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Accounting for distress in bank mergers

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Abstract

The inability of most bank merger studies to control for hidden bailouts may lead to biased results. In this study, we employ a unique data set of approximately 1,000 mergers to analyze the determinants of bank mergers. We use data on the regulatory intervention history to distinguish between distressed and non-distressed mergers. We find that, among merging banks, distressed banks had the worst profiles and acquirers perform somewhat better than targets. However, both distressed and non-distressed mergers have worse CAMEL profiles than our control group. In fact, non-distressed mergers may be motivated by the desire to forestall serious future financial distress and prevent regulatory intervention.

Keywords: Mergers, bailout, X-efficiency, multinomial logit

JEL classification: G21, G34, G14

Non-technical summary

The wave of consolidation in the German banking sector has led to a constant reduction in the number of credit institutions over a considerable number of years. In fact, a significant number of these mergers involves either distressed targets or, less frequently, distressed acquirers. It appears that mergers at times also serve the objective to prevent banks from failure. Particularly among savings and cooperative banks, problem institutions are normally not dissolved but, instead, are merged with a neighboring institution in the same banking group. An analysis of the factors determining mergers in the banking sector must take account of this fact to avoid reaching the wrong conclusions.

The present study is the first merger analysis in Germany that is based on Bundesbank data on mergers and distressed banks in the industry. These data make it possible to distinguish between distressed and non-distressed mergers. The banks can be divided into six categories. Both acquiring institutions and acquired institutions are subdivided into banks with problems and banks without problems. A further category comprises institutions which have been intensively scrutinized by the supervisory authority but which have remained in existence without being the subject of a merger. In addition, institutions which, in the observation period, were neither classified as problem cases nor became the subject of a merger have been included as a control group.

Using this classification, we model the wave of consolidation as a stochastic process involving the six possible situations in which an institution may find itself. The various probabilities are estimated using a multi-nominal logit model based on the institution-specific data. This form of modelling enables us to subject the different financial profiles of the institutions to an econometric analysis.

Our results show that most mergers involve institutions with a comparatively poor financial profile. This is precisely what one would expect in the case of institutions which have been reported as problem cases to the supervisory authority. What is surprising, however, is that the institutions taken over in non-distressed mergers are often also in a comparatively precarious state. In many cases the principal aim of such mergers therefore seems to be to prevent problem cases arising at all or to correct such cases in the face of failure. In both problem and no problem mergers we find that it is largely size and capitalization that determines if a bank is more likely to become an acquirer.

Nichttechnische Zusammenfassung

Die Konsolidierungswelle im deutschen Bankensektor hat dazu geführt, dass die Zahl der Kreditinstitute seit Jahren beständig zurückgeht. Eine signifikante Anzahl dieser Fusionen betrifft dabei entweder problembehaftete übernommene und, seltener, übernehmende Banken. Es scheint, dass eine Reihe von Fusionen somit der Vermeidung von Insolvenzen dient. Insbesondere im Sparkassen- und Genossenschaftssektor werden problembehaftete Institute in der Regel nicht aufgelöst, sondern gehen mit einem benachbarten Institut aus der gleichen Institutsgruppe zusammen. Eine Analyse der Bestimmungsgründe für Fusionen im Bankensektor muss dieser Tatsache Rechnung tragen, um nicht zu falschen Schlussfolgerungen zu gelangen.

Die vorliegende Arbeit ist die erste Analyse von Fusionen im deutschen Bankensektor auf der Grundlage von Bundesbankdaten zu Fusionen und Problemfällen. Diese Daten erlauben es, zwischen problembehafteten und nicht-problembehafteten Fusionen zu unterscheiden. Insbesondere lassen sich die Banken in sechs Kategorien einteilen. Die ersten vier Kategorien bilden übernehmende und übernommene Institute, jeweils untergliedert in problembehaftete und nicht-problembehaftete Banken. Eine weitere Gruppe bilden Institute, die von der Aufsicht einer intensiven Beobachtung unterzogen wurden, die aber weiterbestehen, ohne dass es in der Folgezeit zu einer Fusion gekommen ist. Als Vergleichsgruppe werden ferner diejenigen Institute herangezogen, die in dem Beobachtungszeitraum weder als Problemfall klassifiziert wurden noch fusioniert haben.

Aufbauend auf dieser Kategorisierung modellieren wir die Konsolidierungswelle als stochastischen Prozess über die sechs möglichen Zustände eines Instituts. Die jeweiligen Eintrittswahrscheinlichkeiten werden dabei mit Hilfe eines multinominalen Logitmodells aus den institutspezifischen Daten geschätzt. Diese Art der Modellierung erlaubt es uns, die unterschiedlichen Finanzprofile der Institute einer ökonometrischen Analyse zugänglich zu machen.

Unsere Resultate zeigen, dass Fusionen vor allem unter Einbezug von Instituten mit vergleichsweise schlechtem Finanzprofil stattfinden. Für Institute, die der Aufsicht als problembehaftet gemeldet wurden, deckt sich dieses Ergebnis mit den Erwartungen. Überraschend ist dagegen, dass auch bei nicht-problembehafteten Fusionen die übernommenen Institute vielfach vergleichsweise schwächere Finanzprofile aufweisen. Das Ziel solcher Fusionen scheint demnach unter anderem in der Prävention oder der Bereinigung von Problemfällen im Vorfeld eines drohenden Ausfalls zu liegen. Wir zeigen außerdem, dass vor allem Größe und Kapitalisierung der Bank darüber entscheiden, ob sie in der Fusion die Rolle des übernehmenden Instituts einnimmt.

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Accounting for Distress in Bank Mergers [1]

1 Introduction

In banking, outright failures are extremely rare. [2] Instead, distressed banks are frequently expected to be merged out. Regulatory discretion and potential financial instability due to loss of public confidence ensure that information about distressed mergers is rarely available. As a result, most bank merger studies are unable to control for the existence of hidden bailouts. This shortfall may lead to serious selection bias. For example, it may explain why previous studies find that merging banks underperform compared to the rest of the market.

In this study we use a unique confidential data set provided by the German Bundesbank. The data consist of detailed information on approximately 1,000 mergers of cooperative banks and savings banks in the period 1995-2001. [3] During this period, bailouts accounted for about 10 percent of bank mergers. We use undisclosed information on the regulatory intervention history to distinguish between distressed and non-distressed mergers. Rather than defining distress ourselves, we make use of the Bundesbank data to distinguish distressed mergers from voluntary mergers, thereby reducing an important dependency problem that exists in the literature (Wheelock and Wilson, 2000). As a result, we can gain a much better understanding of bank merger motives. [4]

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[3] Between 1989 and 2001 the number of German banks declined from 4,193 to 2,423 due to an unprecedented merger wave among cooperative and savings banks. While no commercial banks failed during this period, a substantial number of German bank mergers were attributable to bailouts of distressed institutions by regulatory authorities (Elsass, 2004).

[4] According to Berger (2003) and Goddard et al. (2001), a variety of potential merger motives exist, including the improvement of efficiency, diversification of earnings and risk, growth through acquisition, realization of economies of scale or scope, or increase in market power.

If banks cherry pick top performing targets, we expect to find that economies of scale, market power, or managerial incentives motivate mergers. On the other hand, the efficient management hypothesis (e.g., see Roll, 1986) proposes that acquiring banks replace poorly performing target bank management by more skilled executives. Berger (1997) and Berger, Demsetz, and Strahan (1999) find that managerial efficiency tends to improve after bank mergers. However, few studies examine efficiency as an *ex ante* determinant of mergers. In this study we use measures of X-efficiency derived from stochastic frontier analyses to investigate the role of cost and profit efficiency as a merger motive. Also, we employ a variety of covariates to capture the financial profiles of merging banks.

We find that among merging banks, distressed banks had the worst profiles and acquirers performed somewhat better than targets. However, both distressed and non-distressed mergers had worse CAMEL profiles than our control group. Thus, cherry picking high performing targets is not supported by our empirical evidence. In fact, non-distressed mergers may be motivated by the desire to forestall serious future financial distress and prevent regulatory intervention. An important implication of our results is that the inability to account for hidden bailouts is indeed a salient error in the bank merger literature.

Our paper continues as follows. First, in section 2 we review the relevant literature on bank mergers with a particular focus on potential path dependency problems of failures and acquisitions. In section 3, we describe our methodology and data. We define five different merger events and a set of explanatory covariates that characterize the financial profile of banks. Next, in section 4 we present our empirical results. We start by quantifying the effects of changes in banks' financial profiles on the respective probabilities that they will be involved in a particular type of merger. We then report evidence on the importance of accounting for various groups of banks that participated in the merger wave. We conclude in section 5.

2 Literature

Closely related to the present study, Wheelock and Wilson (2000) compare characteristics of U.S. banks (greater than $50 million in assets) that exited via failure versus those that exited through acquisition in the years 1984-1993. They apply a competing-risks framework to these alternative forms of exit and estimate separate, independent models for failure and acquisition using a Cox (1972) proportional-hazard approach. They point out that it is possible that these exit paths are dependent on one another, as impending failure could motivate an acquisition. To partially account for this potential dependency, they include the ratio of equity to total assets in their acquisition model. In-

deed, they find that this variable is significant and that failure risk helps to explain some acquisitions. They employ two classes of independent variables: (1) different components of CAMEL ratings (i.e., capital, asset quality, management quality, and liquidity), and (2) bank traits including size, holding company and branching status, and age. They measure management quality with efficiency scores derived from cross-sectional translog cost functions and nonparametric Shepard (1970) input and output distance functions. In their study, distress can lead to outright failure or exit via a merger. Failed banks are defined as either banks closed by the FDIC or banks with tier 1 capital ratios less than two percent (i.e., critically undercapitalized under bank regulatory laws).[5] Their results indicate that banks most likely to fail tend to have lower operating efficiency and weaker financial condition. By contrast, acquired banks tend to have higher managerial efficiency and can be characterized by stronger financial profiles than other banks. Also, smaller banks and banks in branch banking states are more likely to be acquired than other banks. The authors conclude that managerially inefficient and financially weak banks are more (less) likely to exit via failure (acquisition). Hence, these two types of exit are quite different from one another.[6]

Importantly, other empirical studies by Hannan and Rhoades (1987), O'Keefe (1996), Thompson (1997), Hadlock, Houston, and Ryngaert (1999), Worthington (2004), and Vander Vennet (2003) report results that are contrary to those of Wheelock and Wilson. In general, they find that target banks have a worse financial profile than acquirers. One possible explanation for these different results is that Wheelock and Wilson carefully control for both failed and financially distressed banks in their sampling procedures. Alternatively, different results may be explained by sample differences in terms of country, period, and types of banks under investigation.

Hannan and Rhoades (1987) hypothesize that poorly managed banks are more likely to exit than other banks due to the market for corporate control. For the period 1971-1982, they estimate a multinomial logit model for 1,046 Texas banks and 201 mergers. They include measures of bank performance and bank market characteristics and distinguish between three categories: (1) no acquisition, (2) acquisition within one geographic market, and (3) acquisition between two markets. While none of the profit, loan activity, or size variables

[5] This capital ratio is computed as total equity capital less goodwill divided by total assets.

[6] A more recent paper by Wheelock and Wilson (2003) investigates the reasons why some banks engage in mergers and other banks do not, including the intensity of merger activity. Focusing on the effects of regulatory supervision on merger activity, they find that banks with higher quality regulatory CAMEL and CRA ratings, lower market concentration, location in an urban market, larger asset size, and higher asset risk tend to increase merger activity among banks. See also Calomiris and Karceski (1998) for research on case studies of merger motivations.

is significant, measures of bank market share, bank growth, market growth, and location in local versus urban areas are. Also, banks with lower capital ratios are more likely to be acquired. Based on their findings, they conclude that there is no support for the notion that the market for corporate control eliminates poorly managed banks.

Extending Hannan and Rhoades, O'Keefe (1996) applies a stepwise logit regression model to identify both targets and acquirers among the population of U.S. commercial and savings banks for the period 1984-1996. Excluding mergers among affiliated bank holding company institutions but including regulatory-assisted mergers, he finds that target banks have significantly lower profits than acquirers, as well as higher expenses on fixed assets and more core deposits. Using proxies for CAMEL rating components, targets tend to have relatively low management quality, low earnings, and low liquidity. Also, targets are smaller in asset size than acquirers.

Thompson (1997) examines the determinants of acquisitions of U.K. building societies in the period 1981-1993. Although building societies are mutually owned, results are similar to those for joint stock companies. The logit model results showed that targets (including those involved in regulatory-assisted mergers) are more likely than other banks to have a smaller asset size, slower asset growth, retained earnings below regulatory requirements, and negative profits. Thompson concludes that building societies with low earnings are likely to be encouraged by regulators to consider acquisition by stronger institutions.

In a related study, Worthington (2004) evaluates the determinants of mergers among mutual credit unions in Australia. He estimates technical and scale efficiency indices using data envelopment analysis (DEA) and employs a multinomial logit model to examine the factors that help explain if a credit union is acquired, acquiring, or not engaged in any merger activity. In addition to cost efficiency, he also uses proxies for CAMEL components. Results show that 50 percent of targets and 60 percent of acquirers are correctly identified by the model. Overall classification accuracy is about 96 percent. Worthington finds that target banks tend to be relatively small in size and have low liquidity. However, cost efficiency measures of managerial ability – that is, scale efficiency (measured by overall technical efficiency divided by pure technical efficiency) and optimal sizes (measured by increasing or decreasing returns-to-scale) – are not significant. Acquirers tend to be larger, more profitable, and scale efficient banks. Thus, managerially efficient credit unions tend to purchase targets that are less efficient.

Hadlock, Houston, and Ryngaert (1999) focus on studying the role of managerial incentives in 287 U.S. bank mergers and acquisitions (M&As) in the period 1982-1992. They find that banks with relatively low levels of manage-

ment ownership are more likely to be acquired. After acquisition, management turnover rates increase. However, profitability (as measured by return on assets) is not a significant determinant in mergers. They conclude that management entrenchment (or resistance) is a determining factor in bank M&A activity.

Relatively few studies of European bank M&As have been published. Vander Vennet (1996) reports evidence on 492 bank M&As among 10 European countries in the period 1988-1993. He is careful to distinguish between four different types of consolidations: (1) cross-border takeovers; (2) domestic acquisitions in which more than 50 percent of the voting control is obtained by the acquirer but the two institutions remain independent legal entities; (3) domestic mergers among equal-sized banks; (4) domestic mergers of large and small banks in which the latter are absorbed by the former to form a single, larger bank. Takeovers of failed banks are excluded from the analyses. Based on univariate statistical tests, he finds that targets are less profitable and cost efficient (as measured by the deviation of bank total costs from a translog cost frontier) than acquirers in cross-border takeovers. In the case of domestic acquisitions, acquirers are larger, more profitable, and input-efficient, but targets are not significantly different from a control group of banks. For domestic mergers of equals, both target and acquirer banks suffer declines in profits and operational efficiency prior to the merger event (with a reversal in these trends afterwards). Finally, for domestic mergers of unequal-sized banks, pre-merger performance is similar among targets and acquirers. Interestingly, when targets have inferior performance prior to M&As, acquirers are unable to improve their performance after consolidation. Thus, the evidence appears to be mixed. Whether underperforming banks are more likely to be targets depends on the type of consolidation.

Closely related to our work, Lang and Welzel (1999) examine the cost efficiency implications of mergers among German cooperative banks in Bavaria (i.e., about 25 percent of the total cooperative bank population). They sample 283 mergers between 1989 and 1997 and estimate a translog cost frontier to measure cost X-efficiency. When they calculate ex ante and ex post merger efficiency differences among acquired and acquirer banks, they find that acquiring banks are less efficient than acquired banks in 47 percent of the mergers. In only 70 out of 283 mergers, the acquired bank is less efficient than the acquiring banks. In these cases ex post efficiency of the acquired banks generally does not improve. They infer that the cost efficiency motive for mergers is not strongly supported by the empirical evidence – that is, acquired banks are not selected by acquiring banks with the intention of improving their operating efficiency and thereby increasing profitability of the combined entity. Instead, regulatory and other considerations have historically been important factors motivating cooperative bank mergers, including prohibition of mergers with other banks outside the region, restriction to only cooperative bank deals,

and even the retirement of senior managers. These non-economic motivations have tended to diminish the role of financial performance in merger decisions among German cooperative banks.

Focarelli, Panetta, and Salleo (2002) investigate bank M&As in Italy for the period 1985-1996. They run a multinomial logit to identify which financial characteristics distinguish bidders and targets from banks that do not engage in M&As. They find that targets are less profitable and have higher labor costs, both of which suggest low performance compared to other banks. Acquired banks are characterized by relatively low profitability, low costs of funds, and many bad loans. An interesting finding is that mergers are associated with expansion of financial services, whereas acquisitions are related to improving the quality of the loan portfolio. Ex post analyses of bank performance confirms that mergers and acquisitions are quite different forms of exit with separate motives and outcomes.

Vander Vennet (2003) examines the determinants and effects of 62 cross-border deals in Europe during the period 1990-2001. Using a control group of 800 other banks, he uses a multinomial logit model to discriminate between acquiring, acquired, and control banks but does not distinguish between failing or distressed banks from other banks in the former two groups. Although the fit of the model is relatively low, with a pseudo R^2 of only 20 percent, results clearly indicate that acquiring buyers have lower (higher) cost (profit) ratios than acquired banks. Thus, acquired banks tend to be underperformers relative to acquiring banks. In further analyses he compares cost and profit efficiency scores of these two bank groups prior to M&A deals. Following Lang and Welzel (1996), he uses a translog functional form to estimate X-efficiency. Ranked efficiency scores of acquired banks are significantly lower than those of acquiring banks, especially with respect to profit efficiency. Tests of pre- versus post-M&A cost and profit efficiency reveal that profit efficiency of acquired banks rises to the control (peer) group level after the acquisition.

A number of studies have compared the efficiency of banks involved in M&A deals with simple measures of efficiency and performance. For 135 U.S. bank takeovers, Cheng, Gup, and Wall (1989) report that profit ratios of target banks are higher than those of acquirer banks, although mean differences are insignificant. Berger and Humphrey (1992) study mega mergers involving banks exceeding $1 billion in assets and find that bidder banks are on average more X-efficient (relative to a translog stochastic frontier) than target banks. In a study of U.S. commercial bank mergers, Rhoades (1993) finds that bidder banks have significantly lower noninterest expense to assets ratios than target banks. Fixler and Zieschang (1993) note that 160 acquiring banks have higher productivity (measured by an aggregate output index of efficiency) than a control sample of less than 2,000 banks. Vander Vennet (1996) observes that target banks have lower financial performance than acquirers that do not

improve after M&As. And, Avkiran (1999) finds that mean efficiency scores (estimated using data envelopment analysis, or DEA, techniques) of acquired Australian trading banks are lower than those of acquiring banks. [7]

In sum, with the notable exception of Wheelock and Wilson, previous studies of depository institution acquisitions generally find that targets are either low performing or no different from other banks. Potentially, the result of Wheelock and Wilson differ due to the fact that they control for regulatory-assisted mergers in their sampling procedures. In the present study we explicitly control for German cooperative and savings bank mergers where at least one bank is deemed distressed by regulatory authorities. These banks are subject to regulatory intervention by the Bundesbank. Unlike previous studies, we are interested in comparing the determinants of two types of target bank exit: regulatory arranged (distressed) mergers and voluntary (non-distressed) mergers. Extending work by Wheelock and Wilson (2000), we do not exclude failed or distressed banks from our analysis. To our knowledge no other studies have examined bank exit due to regulatory intervention. The confidential regulatory information provided by the Bundesbank enables us to obtain a sample of merger targets in which failure is not imminent. Rather than calibrating the definition of distress within the framework of our analysis, we are thereby able to make use of the ex ante definitions used by the Bundesbank. In addition, we can benefit from the confidential information gathered by bank examiners. Consequently, we significantly reduce dependency problems when we predict the likelihood of different types of (non-)merger events.

3 Methodology and data

To test whether regulatory assisted (distressed) mergers are fundamentally different from unassisted mergers, we measure the influences of financial profiles on the probability of being involved in a particular type of merger. The empirical model allows prediction of multiple events.

3.1 Empirical specification

We assume that banks can experience five distinctly separate events during the merger wave. We further assume that the chances of being involved in an event in a given year can be explained by two classes of explanatory covariates. The first class coincides with a bank's financial profile. The second class considers macroeconomic conditions and other bank characteristics. We predict events

[7] See also studies by Rose (1987, 1988) and Hunter and Wall (1989).

$Y = i$ with a common covariate vector x. We have annual observations for our covariates. And we consider it important to allow for the possibility that the different merger events are not entirely independent. This consideration is further validated by Wheelock and Wilson (2000), who also find that failure risk helps explain acquisitions, when they include the ratio of equity to total assets in their acquisition model as a rough proxy. Finally, we consider it useful to allow for the possible existence of serial acquirers. Therefore, we use a multinomial logit model.

As a result, our modelling approach differs from Wheelock and Wilson (2000), who use a Cox proportional hazard model. We consider several additional problems with applying this model in our analysis. First, the time dimension in our panel is limited. For the current sample, the maximum number of periods (years) until a merger is seven. We can extend this somewhat, but at the considerable cost of losing many observations for our covariates. Alternatively, we considered measuring merger events on a monthly basis. However, this would create additional problems. We would still have annual observations for most of our covariates. And we may seriously increase measurement problems regarding merger events. [8]

For a number of $i = 0, .., J$ groups, our model is given by Greene (2003) as: [9]

$$p(Y = j) = \frac{e^{\beta_j x}}{1 + \left(\sum_{k=1}^{5} e^{\beta_j x}\right)} \ , \ p(Y = 0) = \frac{1}{1 + \left(\sum_{k=1}^{5} e^{\beta_j x}\right)} \text{ for } j = 1, ..., 5. \quad (1)$$

We normalize by measuring the relative influence of an identical set of covariates x for five different events with respect to a common reference group of no events, where an event is either an assisted (distressed) or unassisted merger. Estimated parameters per group, β_j, yield the effect of covariates x on the logged ratio of probabilities relative to this reference group, i.e., $ln\ (p_j/p_0) = \beta_j x$.

[8] As an example, consider the fact that distressed and non-distressed mergers may exhibit - different - seasonal patterns.

[9] Other bank merger studies that employ the multinomial logit are Focarelli et al. (2002), Worthington (2004), and Hannan and Rhoades (1987). An important assumption is that relative probabilities in the multinomial logit model are independent from each other, the so-called independence of irrelevant alternatives (IIA) assumption. To test for IIA, Greene (2003) suggests to specify a nested logit model where alternative events are grouped on different levels. According to Hausmann and McFadden (1984), it is then possible to test the IIA directly, because excluding an irrelevant class of events will not lead to consistent estimates. However, we do not specificy a nested logit model as it requires that the choices at a given level are mutually exclusive. This is clearly not the case in our study, and we therefore follow the bank merger literature and use the multinomial logit model.

Estimation requires independence of the observations. In fact, it is unlikely that in our panel setting the observations fulfill this requirement. We therefore relax the independence assumption and utilize a robust estimate of the variance of β (Huber, 1967; and White, 1980a, 1980b). This procedure leaves estimated coefficients unchanged but provides robust standard errors of estimated coefficients. [10]

We report relative risk ratios (RRR), which measure the change of the probability of being in group j relative to the probability of being in the reference group for a one-unit change in the underlying variable$x$. [11] The RRR for a one-unit change in covariate x from value a to value $a+1$ is as follows: [12]

$$RRR_j(a,b) = \frac{p(y=j|x=a)/p(y=0|x=a)}{p(y=j|x=a+1)/p(y=0|x=a+1)} = e^{\beta_j}. \qquad (2)$$

For example, an RRR_j of one is analogous to a zero coefficient. A change in the variable does not affect the probability of being in group j relative to the probability of being in the reference group. [13] Likewise, an RRR_j above one indicates an increase of the probability ratio as x increases, and an RRR_j below one implies a declining relative risk to be in group j as x increases. [14]

3.2 Merger events

For the purpose of our study, it is crucial that we carefully distinguish between distressed and non-distressed merger events. We define a distressed bank as a bank which is in danger of ceasing to exist as a going concern without outside intervention. In order to identify situations of distress we adopt a set of criteria covering any intervention on the part of the supervisory authority, the auditor

[10] While occasionally (fixed effect) panel estimators for multinomial logit models have been applied in the literature (Boersch-Supan and Pollakowski, 1990), we are not aware of any applications to bank merger analyses. Hosmer and Lemeshow (2000) suggest a comparison of cross-sectional and panel estimations for binary logit models. In three out of five binary logit estimations, the estimated variance component is tested to be insignificant. We therefore report cross-sectional estimations with robust standard errors.

[11] References for a more in-depth discussion are provided in Hosmer and Lemeshow (2000).

[12] Reported relative risk ratios are therefore exponentiated coefficients. For example, an RRR of two implies that a one-unit change in the covariate doubles the probability of being in the event group. All $RRRs$ are available upon request.

[13] In section 4, we report tests for the null hypothesis that a single RRR_j is equal to one.

[14] For ease of exposition, we refer to the probability relative to the reference group.

or the deposit guarantee scheme, and excessive losses. [15]

We subdivide our group of distressed banks into those that (i) were distressed targets (DT), (ii) distressed acquirers (DA), or (iii) continued to exist without any additional event (intervention only, I). [16] We suspect that those banks engaging in mergers without any prior intervention are fundamentally different and, therefore, must be modeled as separate events. [17] These banks are designated as voluntary targets (T) and voluntary acquirers (A). We estimate the likelihood of belonging to one of these groups relative to the same reference group consisting of all bank observations where none of the above events occurred. [18] This control group consists of banks that are neither distressed nor involved in a merger (O).

Table 1
Annual pattern of events

Year	DT	DA	T	A	I	O	Total
1995	2	3	84	89	24	3,022	3,224
1996	6	7	89	80	40	2,954	3,176
1997	13	8	80	83	35	2,873	3,092
1998	27	18	132	135	24	2,652	2,988
1999	32	18	194	176	20	2,389	2,829
2000	32	28	223	200	16	2,095	2,594
2001	29	40	167	145	43	1,919	2,343
Total	141	122	969	908	202	17,904	20,246

DT = distressed target; DA = distressed acquirer; T = (non-distressed) target; A = (non-distressed) acquirer; I = intervention only; O = the control group.

Amel et al. (2004) point out that merger waves are a dynamic process. In fact,

[15] Excessive losses are losses amounting to 25% of liable capital or a negative operating result in excess of 25% of liable capital. Distressed events result from a disclosure of facts pursuant to section 29(3) of the Banking Act (BA), moratoriums pursuant to section 46a of the BA and capital preservation measures (including as a result of restructuring caused by mergers).

[16] We also estimated the model excluding interventions without subsequent merger. Results were not affected for the most part.

[17] In line with other failure studies, we also defined distress as capitalization ratios close to regulatory minimum values. However, only a handful of banks had equity ratios close to regulatory thresholds.

[18] Thus, we also include pre-event observations of banks that ultimately experience an event in the control group. Excluding these bank observations did not change our results.

in our sample period a number of banks experienced multiple events. Some banks that acquired another institute subsequently experienced regulatory intervention and later became the target in an arranged or assisted merger. In our analysis these banks are grouped as A, then I, and finally as DT. By allowing one bank to experience multiple events, we acknowledge these dynamics. [19] Table 1 gives the number of yearly observations for our reference and respective event groups. Here we see the increasing momentum of the merger wave between 1998 and 2001. Notice that distressed mergers account for about 15 percent of total mergers in the sample period.

3.3 Explanatory variables

Our database on distressed versus non-distressed bank merger contains information on the date of a takeover, identity of the acquiring and target institutions, and date of intervention. All mergers have in common that the target ceases to exist and no ex post data on the target are available. [20]

We calculate CAMEL covariates per bank and year. The data are collected mainly from balance sheets and profit and loss accounts that are reported annually to the supervision department of the Deutsche Bundesbank. With the exception of two banks, no financial data are available for target banks in the year of the merger. [21] For the risk-related covariates, we draw from annual audit reports compiled by the Bundesbank, in addition to reports submitted by banks pursuant to the Principle I requirements of the 1988 Basle Accord. Monthly balance sheet reports are a further source to compute intra-annual asset growth.

We collect regional macroeconomic covariates that control for the geographical demarcations within the two banking sectors from DeStatis Regional, a database supplied by the Land Office for Data Processing and Statistics of North Rhine-Westphalia. This database provides annual numbers per Bundesland on

[19] Of course, intervention may or may not lead to a merger. In most cases, the time that elapses between an intervention and a merger is very short. In fact, for approximately two thirds of our distressed mergers, the intervention and later merger occur in the same year. The average time between interventions and either DA or DT is around 1.4 years. Only if a merger occurs more than four years after intervention, do we no longer classify it as distressed (but as voluntary). However, changing the time until "rehabilitation" has little or no affect on the results.

[20] It should be noted that no transactions involving acquisition of minority stakes or maintenance of the target bank as a separate institute exist among German savings and cooperative banks. This is not surprising in view of their public and mutual ownership, as well as tightly integrated networks.

[21] This data restriction further explains using lagged financial profiles.

population, GDP, and insolvency ratios. Both savings and cooperative banks are allowed to operate only in the region to which they are assigned (Greve, 2002; Hackethal, 2004).

As mentioned above, we account for both financial profiles of banks as well as the economic conditions under which banks operate. Like previous studies, we use the CAMEL taxonomy as a way to define covariates that constitute a bank's financial profile. [22] As a result, the financial profile employed in this study consists of nine key financial ratios that capture (i) **C**apital adequacy (coded c_i), (ii) **A**sset quality (a_i), (iii) **M**anagement ability (m_i), (iv) **E**arnings level (e_i), and (v) **L**iquidity management (l_i). [23] Furthermore, we employ three variables to capture macroeconomic and bank characteristics, as well as year and bank type dummies. All covariates are included with a one year lag. [24] Table 2 reports the mean values of these variables.

We expect improvements in any financial ratio to reduce relative probabilities on distressed events (i.e., result in an RRR below one). For non-distressed events such inferences are less clear, as they depend on whether targets are acquired due to underperformance or cherry picking of profitable banks. As discussed in the introduction, this issue is unresolved in the literature. Based on financial performance comparisons in Table 2, we expect that targets are acquired due to poor financial profiles, such that improving financial ratios increase the relative probability to become an acquirer.

We measure the capitalization of a bank by the ratio of total capital reserves to

[22] CAMEL profiles consists of a list of (financial) indicators used by the U.S. Federal Reserve Bank to rate banks. Examples of studies employing CAMEL covariates are Stuhr and Van Wicklen (1974), Sinkey (1975), Korobrow, Stuhr, and Martin (1977), Whalen and Thomson (1988), Wheelock and Wilson (2000), and Gilbert et al. (1999).

[23] The universe of financial ratios that are potential candidates for study is far larger than our final selection. Piloff and Santomero (1998) point out the importance of acknowledging the lack of a theoretical model in this respect. They argue that rationalization of mergers is frequently subject to different perspectives by interested parties. For example, bankers consistently motivate mergers by citing scale economies. But empirical evidence fails to confirm this motivation. Given the lack of theoretical guidance, we follow the selection approach outlined in Hosmer and Lemeshow (2000). In brief, we collected a long list of about 200 ratios, for which we inspect descriptive and graphical evidence that indicates discriminatory power. We examine each variable's univariate explanatory power in binomial logit analysis for each event. Based on this information criterion, we organized a short list of variables into CAMEL categories. We then employed this reduced covariate vector in a multivariate logit per event category using stepwise regression. From this further reduced vector we chose a set of final covariates based on their economic meaningfulness.

[24] We also tested longer lags, but one-year lags yielded stronger discriminatory power.

Table 2
Mean of covariates per event group

Variable	Code	DT	DA	T	A	I	O
Capital reserve ratio	c_1	2.6	2.9	3.5	3.4	2.8	3.5
Security share	a_1	25.3	30.3	42.1	38.1	32.3	43.2
Net loan loss provision	a_2	1.7	1.1	0.6	0.7	1.2	0.7
Share of latent risk loans	a_3	14.4	12.9	10.2	10.6	16.1	10.8
Asset growth	a_4	0.8	6.8	3.1	7.0	4.7	7.6
Profit efficiency	m_1	64.5	67.2	69.6	74.1	70.0	74.8
Cost efficiency	m_2	78.1	75.8	80.5	80.2	78.5	81.6
Return on RWA	e_1	5.5	5.7	6.5	6.2	5.7	6.4
Cash and inter-bank assets	l_1	8.0	6.6	6.8	5.9	6.7	5.9
GDP per capita	GDP	15.7	15.5	15.6	15.5	15.1	15.3
Insolvency ratio	INS	87.8	96.5	78.7	78.3	88.4	78
Risk-weighted assets	RWA	146	534	106	275	281	275

Notes: all variables measured in percentages with a one-year lag unless noted otherwise; 1) in thousands of Euros; measured in the event year; 2) in millions of Euros.

total assets, c_1.[25] The mean capitalization ratio is relatively low for the groups DT, I, and DA, and relatively high for the groups T, A and O. Reserves provide an important buffer for banks to absorb (for example) a sudden drop in the market value of securities or other non-traded assets (Hughes and Mester, 1993). An increase in this buffer may reduce the probability of belonging to a distressed group or becoming a voluntary target, unless cherry picking occurs, which would have the opposite effect. Likewise, we expect that higher capitalization leads to an increased probability of voluntarily acquiring another bank.

To capture the influence of asset quality on mergers, we construct four ratios. Our first covariate is the ratio of securities to risk-weighted assets, a_1. Presumably, banks with higher proportions of securities have higher asset diversification and lower overall asset risk. Table 2 indicates that all banks involved in events (but especially distressed banks) have shares of securities that are on average below that of the control group. For this reason we expect

[25] Our univariate and stepwise variable selection process favored the use of gross total assets as a denominator compared to risk-weighted assets, Basle equity ratios, or total equity. We capture the influence of risk in the asset quality category discussed shortly.

that an increase in a_1 leads to lower probabilities of distressed events. Also, the probability of becoming a non-distressed target (acquirer) is likely to be smaller (larger) after an increase in a_1.

To proxy credit risk in the loan portfolio, we employ two ratios. First, we use the ratio of net loan loss provisions to total customer credits, a_2. This ratio captures actual credit losses suffered during the pre-event period. Banks involved in voluntary mergers as well as non-merging banks have low and approximately equal mean levels of net loan loss provision. For distressed acquirers and banks receiving regulatory attention, this variable is substantially higher, while it is highest for distressed targets. Higher losses increase the likelihood of distress and voluntary targets but are expected to decrease the probability of acquiring another bank. The second credit risk covariate, a_3, is the ratio of loans with higher latent risks according to the Bundesbank audit reports relative to total audited loans. This variable is a stock variable and therefore captures the long-run risk profile of the bank when granting credit. In terms of mean levels, a similar dichotomy holds. Non-distressed banks as well as non-merging banks have a low share of latent risk loans, whereas the other groups have a relatively high share. Banks that are subject to regulatory attention (I) have the highest share of latent risk loans. Our expectations with regard to a_3 are the same as for a_2.

Our final asset quality covariate is annual asset growth, a_4. This variable captures the risk of either expanding business activities too rapidly (to manage growth prudently) or too slowly (to keep pace with competitive pressures). Sample mean growth rates shown in Table 2 for all categories are below the mean of non-merging banks, especially both groups of targets and banks receiving intervention only. Hence, we expect that increases in this covariate lead to lower probabilities of becoming involved in distressed and non-distressed events.

To proxy for managerial skill, many studies employ key performance indicators, such as cost-income ratios (e.g., see Rhoades, 1993). We argue that such covariates are an inferior proxy for two reasons. First, these measures are prone to accounting rule-induced distortions. For example, we know that cost income ratios of savings banks are systematically below average due to funding advantages associated with government ownership. Second, these ratios might reflect market circumstances, rather than managerial skill. If, for example, an idiosyncratic shock hits a region, cost-income ratios will rise. Clearly, such a ratio does not proxy for management quality. As an alternative, we employ profit and cost efficiency estimates, m_1 and m_2. These measures are derived from a bank production model using stochastic frontier analysis.[26] In this model observed costs (profits) can differ from estimated best-practice cost

[26] The appendix provides technical details.

(profits) for two reasons: (i) deviations can be attributable to random noise (e.g., measurement error); and (ii) deviations can result from systematically employing sub-optimal combinations of input quantities to produce outputs, thereby leading the bank to incur too high costs (too low profits). The latter deviations are due to inefficiency and proxy (lack of) managerial skill. [27] Note that two banks exhibiting identical returns on equity can be different in terms of employing in- and outputs in the correct proportion to realize that profit. [28] From Table 2, we observe that acquiring banks and banks in the control group both exhibit high profit and cost efficiency, while distressed banks have low profit and cost efficiency. Banks in the voluntary target group have on average relatively low profit efficiency but high cost efficiency. We expect that an increase in efficiency is associated with a lower probability of distress. Regarding non-distressed events, decreased (increased) efficiency is expected to correspond to a higher probability of being a target (acquirer).

To measure earnings we use operating return over risk-weighted assets, e_1. This covariate measures profitability on a risk-adjusted basis. Again, distressed banks have low earnings ratios, non-distressed banks have relatively high earnings ratios. We expect that higher earnings decrease the chances of distress. Likewise, we expect an increase of earnings to render a bank more (less) likely to be an acquirer (target).

The final CAMEL covariate refers to the liquidity position of a given bank. We use the ratio equal to the sum of cash and inter-bank assets to risk-weighted assets, l_1. [29] Liquidity is a buffer, and can help absorb sudden cash-outflows. Mean liquidity in distressed target banks is very high, while in acquiring banks and non-merging banks it is quite low. Mean liquidity of the other groups falls in between. However, excessive cash holdings imply poor returns as these assets normally have low yields. Thus, the effect of an increase in liquidity depends on the level of liquidity holdings.

Table 2 indicates that distressed and non-distressed targets exhibit higher average liquidity than non-merging banks. Hence, we expect an increase of liquidity to result in a higher probability of being involved in a distressed event and becoming a non-distressed target. Likewise, we expect that the probability of acquiring another bank is lower.

[27] For a comprehensive discussion of alternative frontier models, we refer the reader to Kumbhakar and Lovell (2000).

[28] Put differently, the inefficient bank might have realized higher returns with the observed input-output combination at its disposal.

[29] A preferable alternative would have been the Principle II liquidity ratio that is reported for each bank in the supervision departments audit report (Deutsche Bundesbank, 2002). Unfortunately, data for this ratio were not available before 1998.

In addition to bank-specific financial profiles, Porath (2004) emphasizes the importance of macroeconomic conditions on bank performance. Our first macroeconomic variable captures the private sector by GDP per capita, *GDP*. The variation in mean levels of GDP per capita across groups is low. We expect that distress is less likely under good economic conditions. Higher income fosters demand for financial products. Also, outstanding assets (e.g. customer loans) are at lower risk of failing. To capture the effect of economic conditions in the business sector on bank merger probability, we also include the percentage of insolvent non-financial firms, *INS*. Mean levels of insolvency ratios are high for all distressed banks, and relatively low for the non-distressed banks. As the commercial customer base of banks suffers from adverse economic conditions, we expect that banks will be increasingly exposed to distress. [30]

A number of studies on bank mergers (Worthington, 2004; Wheelock and Wilson, 2000; Cole and Gunther, 1995; DeYoung, 2003) find that larger banks are less likely to be taken over. To account for differences in size, we include the log of risk-weighted total assets, RWA, as a final bank characteristic. The most important observation with regard to differences in mean levels of risk-weighted assets is not between distressed and non-distressed banks, but between targets and acquirers. The average size of target banks is substantially lower than that of all other banks. [31]

4 Results

We begin this section by assessing the appropriateness of our choice of covariates. Next, we provide results for the multinomial logit model. Finally, we test for differences between distressed and non-distressed events and between acquirers and targets, respectively.

4.1 Explanatory power

Hosmer and Lemeshow (2000) suggest various approaches for evaluating the explanatory power of logit models. Since the primary interest of this study is

[30] The principle of the so-called *Hausbank* approach together with relationship lending is confirmed by Elsass and Krahnen (2004). They find that savings and cooperative banks "... develop an informationally intense relationship with their customers, and that these special relationships are common among mid-sized firms."

[31] We also include indicator variables for the respective year and banking group to control for systematic differences between the two groups in terms of size, business focus, and sheer number of banks (and events).

to identify a financial profile that discriminates between distressed and non-distressed merger events, we wish to find the set of covariates that categorizes observations with highest possible accuracy.[32] Given that we estimate a continuous probability that events fall into discrete categories, the discriminatory power of our model depends on the cutoff probability level beyond which predicted values are assigned to a specific group.

To evaluate the discriminatory power of the model over a range of cutoff levels, we employ the area under the Receiver Operating Characteristics (ROC) curve. The area under the ROC curve (AUR) measures the percentage of correctly classified events (sensitivity) versus one minus the percentage of correctly classified non-events (specificity). According to Hosmer and Lemeshow, AUR values between 0.6 and 0.7 are acceptable, values between 0.7 and 0.8 are good, and higher values are outstanding.[33]

Table 3
Area under the ROC curve for event groups

Control Group	Event	DT	DA	T	A	I
DA	AUR	0.916***				
	N	(263)				
T	AUR	0.887***	0.899***			
	N	(1,110)	(1,091)			
A	AUR	0.964***	0.834***	0.855***		
	N	(1,049)	(1,030)	(1,877)		
I	AUR	0.830***	0.826***	0.864***	0.866***	
	N	(343)	(324)	(1,171)	(1,110)	
O	AUR	0.943***	0.924***	0.772***	0.810***	0.892***
	N	(7,832)	(7,813)	(8,660)	(8,599)	(7,893)

Notes: AUR = Area under the ROC curve; *** = significant at the 1% level; number of observations between brackets.

Table 3 depicts AUR values for various multivariate, binomial logit models.[34] We use the entire vector of CAMEL and other covariates for each possible combination of event and reference group. Columns coincide with event groups and rows with the respective control group. Estimations for distressed acquirers

[32] For example, a prediction model requires careful calibration of the model and out of sample testing.
[33] Note that perfect discrimination is not possible as it would prohibit estimation.
[34] Assessing the fit of a multinomial model by means of single variable logit analysis is consistent with Begg and Gray (1984) and Hosmer and Lemeshow (2000).

(DA), voluntary targets (T), voluntary acquirers (A), and intervention only (I) control groups exclude non-event observations. AUR values between 0.826 and 0.964 indicate that our model is well suited to differentiate distressed targets from distressed acquirers, voluntary mergers, and interventions, respectively. Also note that the standard errors of the AUR values are fairly low. From this evidence we infer that the chances of becoming a distressed target is explained quite well by the covariates. At the bottom of Table 3, we also provide results from a single logit model predicting distressed targets relative to a reference group of strictly non-merging banks.[35] The AUR value of 0.943 is in line with other information criteria (e.g., a pseudo R^2 of 0.447) and supports the explanatory power of the model.[36]

We obtain similar results when modeling distressed acquirers as an event group. Depending on the choice of a reference group, AUR values (in column DA) range between 0.826 and 0.924 and again have low standard errors. Hence, the ability of our covariates to identify distressed acquirers is fairly strong.

For the two voluntary merger events, T and A, the explanatory power of our model is slightly lower. Nonetheless, AUR values ranging from 0.772 and 0.864 support the inference that the covariates can explain different merger events.[37] Lastly, we find AUR values close to 0.9 for interventions without a later merger, which means that the covariates explain these events fairly accurately despite a relatively low number of observations.

4.2 Degrees of difference

In this section we discuss the multinomial logit model results. In Table 4 we report *RRR* scores for each event. The reference group consists of bank

[35] Note that, unlike the multinomial model, this model excludes non-event observations that later merge from the control group.

[36] Hosmer and Lemeshow (2000) caution not to rely entirely on R^2. The assessment of a model's goodness-of-fit should examine how well the choice of covariates can predict an event to occur and the ability of the model to correctly classify an observation as event or non-event.

[37] We also estimated our model with single covariates, and found that only four out of twelve covariates exhibit AUR values as high as 0.6. These results are available upon request. We further test whether the difference of financial ratios' means is significant. Given the non-normality of financial ratios, we use a Kruskall-Wallis test (1952a, 1952b) and find for each variable that at least one difference between groups is significantly different from zero.

observations without any event. [38] Since we are interested in whether the entire financial profile for each group significantly predicts the type of event, for each group we test the null hypothesis that all coefficients are simultaneously equal to zero. Reported Wald test statistics yield significant financial profiles for all groups. Recall that the reported RRR measures the change in the probability of membership in one group relative to the probability of not merging at all for a one-unit change of the variable.

Table 4
Relative risk ratios for event groups

Variable	Code	DT	DA	T	A	I
Capital reserve ratio	c_1	0.386^{***}	0.679^{***}	0.866^{***}	1.012	0.599^{***}
Security share	a_1	0.965^{***}	0.985^{***}	0.994^{***}	0.997^{**}	0.991
Net loan loss provision	a_2	1.599^{***}	1.386^{***}	1.116^{***}	0.967	1.533^{***}
Share of latent risk loans	a_3	1.046^{***}	1.014	1.012^{***}	0.997	1.039^{***}
Asset growth	a_4	0.944^{***}	0.994	0.959^{***}	0.992^{***}	0.982^{***}
Profit efficiency	m_1	0.981^{***}	0.985^{***}	0.984^{***}	1.000	0.991^{*}
Cost efficiency	m_2	0.962^{**}	0.932^{***}	1.001	0.990^{*}	0.958^{***}
Return on RWA	e_1	0.712^{***}	0.831^{*}	1.057	1.158^{***}	0.631^{***}
Cash and inter-bank assets	l_1	1.058^{***}	1.007	1.022^{**}	0.975^{**}	1.016
GDP per capita	GDP	1.005	0.611^{***}	0.753^{***}	0.629^{***}	0.827
Insolvency ratio	INS	1.008	0.997	0.992^{***}	0.987^{***}	1.005
Risk-weighted assets	RWA	0.376^{***}	1.652^{***}	0.523^{***}	1.885^{***}	0.823^{***}
Wald χ^2(df = 19)		404	308.9	743.5	645	313.6

Total number of observations = 20,246; pseudo R^2 = 0.133; Wald χ^2= 2,218.1; pseudo loglikelihood = -8.858; ***/**/* = significant at 1/5/10% level.

Unless otherwise indicated, all variables are measured in percentages. For example, an RRR of 1.6 for net loan loss provisions of distressed targets implies that a one percentage point increase in this variable leads to a 60% higher probability of becoming a distressed target relative to not merging at all. We compare each covariate's influence as captured by RRR across the event groups.

We hypothesized that an increase of c_1 leads to lower probabilities for all distressed events and non-distressed targets and implies a higher probability

[38] Parameters of indicator variables are generally significant. To conserve space these results are not reported but are available upon request.

of becoming an acquirer. Our results generally confirm this hypothesis. In addition, the sensitivity to changes in capitalization is highest for the group of distressed targets, followed by the intervention group and distressed acquirers. In four out of five cases, the RRR score is significantly different from one, with the correct sign. The modest sensitivity for the group of voluntary targets does not support the existence of a strong cherry picking effect. While the RRR for the group of non-distressed acquirer is in line with expectations, it is not significantly different from one.

Next we consider asset quality. With respect to the security share, a_1, we hypothesized earlier an increase to yield lower probabilities for distressed events and voluntary targets. Also, we expected a higher probability for acquisitions to occur as a consequence of such a change. Table 4 shows that the estimated $RRRs$ for the security share variable are between 0.96 and 0.99. Estimates are significant for all groups except for those banks that receive intervention without subsequent merger activities. The magnitude of the sensitivity shows that this effect is quantitatively unimportant. Contrary to our expectation, the probability of becoming a voluntary acquirer is negatively influenced by the security share. A tentative explanation of the result that higher security shares lower the probability of being involved in any merger may be that especially larger banks tend to hold high security shares and remain independent. This requires further research.

According to Greve (2002), cooperative (and savings) banks have traditionally focused on providing credit finance to small commercial and private borrowers. Increasing competition has reduced interest margins and rendered these activities unattractive (Molyneux et al., 1996). The monthly reports of the Deutsche Bundesbank (2003) confirm this development. We suspect that the growing need to generate income from alternative sources caused some banks to expand their securities trading activities. The impact of an increase in the share of securities is identical across all merger events in terms of direction, which may reflect this trend.

An increase in the net loan loss provision, a_2, is expected to increase the probability of becoming distressed and becoming a target, while it is expected to decrease the probability of becoming an acquirer. This is confirmed by significant RRRs above one for all groups except non-distressed acquirers. We find no significant effect of loan loss provision changes on the likelihood of becoming an acquirer. An increase by one percentage point of a_2 results in a 150% increase in the probability of being involved in a distressed event. Thus, this measure is among the more important determinants of mergers in Germany. High sensitivities of increasing a_2 for distressed events are in line with common practice in the literature that defines distress on the basis of this indicator. Significantly higher mean loan loss provisions (see Table 2) tend to trigger regulatory attention. Non-distressed targets may be motivated to merge by

their respective head organization in order to avoid further regulatory attention. The necessity for increased write-offs could indicate adverse conditions (e.g., a harvest in a particular region lost due to flood).[39] The insignificant RRR for acquirers implies that net loan loss provisions for these banks are not substantially different from those of non-merging banks. Consequently, this observation does not support the notion that acquirers are financially healthier banks compared to the non-merging bank population.

We expect a higher share of latent risk loans a_3 to increase the probability of becoming distressed and voluntary targets and to decrease the probability of acquiring another bank. The RRR is insignificant for both distressed and non-distressed acquirers. The sensitivity for the remaining groups is substantially lower compared to RRR for a_2. We therefore conclude that latent risk loans, a_3, are a less important indicator of distressed events than loan loss provisions, a_2. Again, no evidence in favor of cherry picking is found.

We expect higher asset growth rates, a_4 to imply lower probabilities of being involved in distressed events. In addition, we expect higher growth rates to decrease the probability of being a voluntary target and increase the probability of being a voluntary acquirer. Table 4 shows that RRR estimates for annual growth of total assets, a_4, are below one for both distressed and voluntary mergers. This implies that an increase in the growth rate leads to a lower likelihood of merging. With the exception of distressed acquirers, all $RRRs$ are significantly different from one. As found previously, the sensitivity to changes in growth is largest for group DT but the difference from group T is small. The evidence indicates that savings and cooperative banks prefer internal growth strategies. Only if internal growth is too slow is an acquisition considered as a means of growing in line with non-distressed competitors. In sum, we infer that banks that experience below average growth are more likely to merge. Exceptionally low growth is associated with becoming a target in a merger.

Decreasing cost and profit efficiency are expected to lead to higher probabilities of becoming involved in a distressed event and becoming a target. This is in line with the efficient management hypothesis, which states that owners will ultimately replace managers that employ scarce resources inefficiently with more competent personnel (e.g., see Roll, 1986).

In Table 4, we see that estimates of the RRRs for profit and cost efficiency, m_1 and m_2, are significantly below one for all distressed events. This supports the hypothesis that higher efficiency decreases the chances of experiencing a distressed event. Cost efficiency RRRs are lower than profit efficiency RRRs among distressed banks. Moreover, the estimated RRR for non-distressed targets significantly less than one suggests that profit efficiency influences the

[39] This happened in 1997 and subsequently in 2002 when the rivers Oder and Elbe flooded a number of new Bundeslaender.

probability of falling into group T. The sensitivity is relatively small at an RRR of 0.984 but is identical to that of distressed mergers.

Together, the results for m_1 and m_2 lend some support for the efficient management hypothesis, despite the absence of an equity-based market for corporate control. The fact that lower efficiency increases the probability of becoming a voluntary target suggest that non-distressed institutions merge to forestall regulatory intervention. In this regard, while local savings and cooperative banks are not legally required to comply with their respective head organizations, our results suggest that they likely play a role in the merger process. [40]

We expect that increased earnings lead to a lower probability of distress and takeover and a higher probability of acquiring another bank. Our estimates for RRRs for earnings, e_1, are consistent with these expectations. Sensitivity is highest for interventions only, followed by distressed targets, and distressed acquirers. In fact, this covariate discriminates quite well between all event groups, with the exception of non-distressed targets. For both non-distressed events we find that higher earnings increase the probability of merging.

We expect that increases of cash and inter-bank assets, l_1, increase the probability of becoming involved in a distressed merger or becoming a voluntary target. Assuming that acquirers are capable of better cash-management, we expect the opposite effect for this group. The RRR is significant for all non-distressed events and for distressed targets. The direction of the effect is consistent with our hypotheses, but small in magnitude.

We have few priors as to whether distressed and non-distressed mergers are more or less likely to occur in relatively wealthy areas. Our results show that the RRR of state GDP per capita is significantly below one for both non-distressed events and for distressed acquirers. In adition, the magnitude of these RRRs suggests that this covariate is an important determinant of merger activity. Perhaps this variable captures the different stages in the consolidation process in the wealthy western states and the relatively poor eastern states.

We expect higher insolvency ratios to increase the probability of distressed events and to decrease the probability of voluntary mergers. Our results indicate that insolvencies only have significant effect on the probability of being involved in a non-distressed merger. Only insignificant effects are found for distressed events.

[40] Siebert (2004) and others have argued that corporate governance in Germany follows principles of co-determination and consensus rather than reliance on market mechanisms. Wengerer and Kaserer (1998) point out that this corporate governance system may shield bank managers from the threat of being replaced by a more efficient management. Our evidence does not support these arguments.

Our last covariate measures the size of the banking firm. We hypothesize that large firms are more likely to become acquirers than targets. The *RRR* scores are large and significant for all groups and discriminates especially well between targets and acquirers. More specifically, an increase in size by one million euros implies a bank is almost twice as likely to become an acquirer. By contrast, chances of becoming a target are almost halved. This relation is identical in direction for both distressed and non-distressed events. Thus, both in distressed and non-distressed transactions, sheer size is an important determinant of whether a merging bank is a surviving (acquiring) or ceasing (acquired) institution.

Our multinomial logit model results can be summarized as follows. Financial profiles can explain merger events with high accuracy. Distressed events are different from non-distressed events, and acquirers are different from targets. However, differences between groups are reflected to a greater extent in the magnitude of effects rather than their direction. [41] The covariates that show the largest absolute and relatively sensitivities and thus are most important in explaining different events and discriminating between groups, are capitalization net loan loss provision, earnings and size.

4.3 Significance of differences

Given that the differences between estimated *RRR*s are relatively small, a natural question is whether sensitivities differ significantly between groups. While the tests conducted so far reject the hypothesis that respective groups' profiles are jointly equal to zero, it remains unclear if single covariate and entire profile effects are different between groups. We tackle this issue by examining whether single covariates and entire financial profiles differ significantly between distressed and non-distressed mergers, as well as between acquirers and targets. [42]

To this end, we report four different tests. First, we test whether each covariate's *RRR* is equal for the distressed and non-distressed targets. Second, we test whether the *RRR* for each single covariate is equal for distressed and non-distressed acquirers. Third, we test whether the *RRR* for each single covariate is equal for distressed targets and distressed acquirers. Fourth, we test whether the *RRR* for each single covariate is equal for voluntary targets and

[41] In this respect, our results nicely complement Oshinsky and Olin (2005), who report similar findings when comparing recovery, mergers and continuation.

[42] We also tested all possible combinations between groups that are presented in Table 1 (i.e., nine combinations). In tests of equality between DT versus I and DA versus I, five out of twelve covariates are significantly different. Results are available upon request.

Table 5
Significance of differences between event groups

Null hypotheses	Code	DT=T	DA=A	DT=DA	T=A
Capital reserve ratio	c_1	0.000	0.002	0.001	0.000
Security share	a_1	0.000	0.013	0.013	0.403
Net loan loss provision	a_2	0.001	0.000	0.151	0.002
Asset growth	a_3	0.325	0.709	0.002	0.000
Latent risk loan share	a_4	0.002	0.122	0.023	0.010
Profit efficiency	m_1	0.611	0.010	0.640	0.000
Cost efficiency	m_2	0.014	0.001	0.164	0.146
Return on risk weighted assets	e_1	0.000	0.002	0.268	0.054
Cash and inter-bank assets	l_1	0.070	0.258	0.119	0.001
GDP per capita	GDP	0.183	0.856	0.057	0.031
Insolvency ratio	INS	0.008	0.036	0.104	0.071
Risk-weighted assets	RWA	0.004	0.158	0.000	0.000
All CAMEL variables equal		0.000	0.000	0.000	0.000

p-values of Wald tests for null hypothesis that RRRs are equal.

voluntary acquirers.[43] Table 5 reports the p values of Wald tests for these four hypotheses.

We start by comparing distressed and non-distressed mergers. Regarding targets, most RRRs are significantly different from each other at the 1% level. The difference in liquidity, however, is significant only at the 10% confidence level. The variables asset growth, profit efficiency, and GDP per capita are no different for targets merging with and without distress. Overall, the last row indicates that the $RRRs$ of distressed targets are significantly different from those of non-distressed targets. These results demonstrate the importance of differentiating between merger targets on the basis of distress.

Turning to the results for acquirers, five out of twelve covariates have RRRs that are not significantly different between distressed and non-distressed acquirers. In addition to the previously identified three covariates, the share of loans with higher latent risks and bank size are no different between the

[43] We also tested whether distressed mergers are different from non-distressed mergers (abstracting from whether a bank was target or acquirer). Our results stay qualitatively the same. These results are available upon request.

two groups. The fact that the remaining seven covariates differ significantly between the two groups explains why the hypothesis of joint equality of all parameters is rejected. We infer that non-distressed acquirers have significantly stronger financial profiles than distressed acquirers.

Next, we compare acquirers and targets. In Table 5 we report tests of whether the $RRRs$ of (distressed) targets and acquirers are equal. The p-values of Wald tests for each covariate and the all CAMEL covariates are provided there. In general, half of the covariates' effects differ significantly between distressed targets and acquirers. The estimated $RRRs$ for net loan loss provision, the two efficiency measures, return on RWA, liquidity and the insolvency ratio do not differ significantly. On the other hand, we find that capitalization ratios, security shares, asset growth, latent risk loan share and size are significantly different between the two groups.

The importance of accounting for different financial profiles is more pronounced among non-distressed mergers. In Table 5, all but two covariates are significantly different between voluntary targets and acquirers. The last row shows that all covariates are also jointly significantly different. We infer that voluntary targets have financial profiles that are more like distressed banks than like other non-distressed banks.

Overall, the conclusion must be that focussing only on distressed versus non-distressed banks is insufficient in a merger analysis. In addition, targets and acquirers have significantly different financial profiles and sensitivities to explanatory variables.

5 Conclusion

This paper investigates the possible bias that exists in studies of bank merger determinants when not appropriately controlling for the existence of hidden bailouts. We distinguish between five possible events, including distressed targets and acquirers, non-distressed targets and acquirers, and banks subject to only regulatory intervention. After specifying a vector of bank-specific and environmental covariates, we estimate a multinomial logit model in order to predict the probability of becoming a (distressed) target, a (distressed) acquirer, or a bank that experiences intervention but continues to exist.

We find some evidence that supports the efficient management hypothesis. By implication, regulatory authorities and head organizations of cooperative and savings banks appear to play important roles in the disposition of distressed German bank mergers. Despite sharing below average profiles, merging banks that are targets are different from acquirers. The probability of entering a

specific group is largely determined by sheer size and to a lesser extent by capitalization. In general, larger banks that experienced intervention later became an acquirer (rather than target) in subsequent mergers. Hence, size is the crucial factor that determines the role a merging bank assumes in the merger.

More importantly, both distressed and non-distressed merging banks have lower capital reserve ratios than non-merging banks, lower exposure to securities business, higher credit risk as measured by net loan loss provisioning, and below average efficiency. Sensitivities to changes in these covariates are normally of a lesser magnitude for voluntary mergers, but the direction of covariates' impact on distressed and non-distressed events is identical for nine out of twelve covariates. Even for voluntary acquirers, we find only limited evidence that improving financial profiles increases the probability of belonging to this group.

Our results provide evidence that merger events in general are more likely to occur among banks that exhibit relatively bad financial profiles. For distressed mergers this finding is consistent with expectations. However, we also find that non-distressed mergers involve underperforming banks, which may mean that voluntary mergers are motivated by pre-emptive distress resolution considerations, rather than cherry picking of top performing banks. It also confirms the findings of Rhodes-Kropf and Robinson (2004), who find that mergers typically pair together firms that perform similarly, compared to the market.

We conclude from these findings that the recent consolidation in German banking is associated with underperforming target and acquirer institutions perhaps seeking to avoid potential future financial distress. Given that a considerable portion of non-distressed mergers may have been motivated by the intention to avoid more severe problems, we consider an analysis of the success of both distressed and non-distressed mergers an important topic for future research.

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Appendix: Measurement of managerial skill

We employ stochastic frontier analysis (SFA) to measure X-efficiency relative to cost and profit frontiers.[44] According to Leibenstein (1966), X-efficiency measures the amount of waste incurred due to sub-optimal management choices. We therefore use cost and profit efficiency to proxy for managerial skill. To conserve space we only overview the cost model.[45] We assume that banks minimize costs, operate in perfect markets,[46] and produce inputs and outputs per the intermediation approach[47].

We define three outputs y_m subject to fixed prices. Banks choose input quantities given factor costs. We specify three inputs purchased at prices t_i. For bank k input-output combinations are produced at observed costs C_k.[48] Following Hughes and Mester (1993), we specify equity capital z to account for different risk profiles of banks. Output quantities and input prices are obtained from Bundesbank accounts for cooperative and savings banks for the years 1993 to 2003. Descriptive statistics are in Table 6.

Output quantities are year-end stocks. We calculate input prices as factor payments divided by input quantities. The price of fixed assets equals depreciation over fixed assets, the price of labor equals personnel expenses over number of full time equivalent employees, and the price of borrowed funds equals interest expense over total borrowed funds, respectively.

Following Lang and Welzel (1966), we use a translog functional form including a time trend variables. The cost frontier is written as:[49]

$$\ln TOC_k(w,y,z) = a_0 + \sum_{i=1}^{I} a_i \ln x_{ikt} + \tfrac{1}{2}\sum_{i=1}^{I}\sum_{j=1}^{J} a_{ij} \ln x_{ikt} \ln x_{jkt} + \varepsilon_k \qquad (3)$$

Here x consists of outputs y, input prices w, control variables z and a time

[44] SFA was developed by Aigner, Lovell and Schmidt (1977), Meeusen and van der Broek (1977), and Battesse and Corra (1977). Studies applying it to study the ex-post effects of merger include Kohers et al. (2000) and Akhavein et al. (1997).

[45] Since the profit model is analogous, we use footnotes to review methodological differences.

[46] For the profit model we follow the alternative profit approach proposed by Humphrey and Pulley (1997). In brief, banks continue to face perfect input markets, but on the output side they are allowed limited price discretion as reflected by an additional pricing opportunity constraint in the maximization problem.

[47] For a discussion of bank production, see Freixas and Rochet (1997).

[48] In the alternative profit approach the dependent variable is profits before tax, or PBT_k.

[49] We use maximum likelihood estimation to obtain both parameter estimates for equation (3) and the error components. We impose homogeneity of degree one in input prices and symmetry, following Lang and Welzel (1996).

Table 6
Descriptive statistics for variables employed in SFA analysis

Variable		Mean	Std. Dev.	Min.	Max.
y1*	Interbank loans	49.9	146.5	0.001	4,360
y2*	Customer loans	286.9	743.9	0.670	22,600
y3*	Securities	118.3	293.3	0.003	6,570
w1**	Price of fixed assets	16.5	110.5	0.744	14,062
w2***	Price of labor	49.7	107.7	0.377	18,400
w3**	Price of borrowed funds	3.8	0.8	0.952	8.2
z*	Equity	21.4	53.4	0.175	2,060
TOC*	Total operating cost	28.0	66.3	0.175	1,873
PBT*	Profit before tax	5.2	13.4	-35.91	417
TA*	Total assets	486.1	1,191	3.721	32,700

* measured in millions of Euros; ** measured in percentages; ***measured in thousands of Euros; N=30,374.

trend t. The composed error ε_k consists of random noise component, v, and a systematic inefficiency component labeled u. Following Stevenson (1980), we assume that the random component v is i.i.d. $N(0, \sigma_v)$. For the inefficiency part we assume that u is i.i.d. $N|(\mu, \sigma_u)|$. As cost inefficient banks operate above the efficient frontier the latter term is added to random deviations, resulting in a composed error of the form $\varepsilon_k = v_k + u_k$.

After estimation of the cost and profit frontier we use the approach suggested by Jondrow et al. (1982) to derive firm-specific efficiency estimates. We obtain firm-specific efficiency estimates as the expected value of inefficiency conditional on total error. Like Coelli et al. (1998), we calculate efficiency scores by using:

$$TE_k = [\exp(-\hat{u}_k)] .$$

The estimated cost and profit efficiency scores are referred to as CAMEL covariates m_1 and m_2, respectively.

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