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Discussion paper

THE IMPACT OF PUBLIC GUARANTEES ON BANK RISK TAKING: EVIDENCE FROM A NATURAL EXPERIMENT

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The Impact of Public Guarantees on Bank Risk Taking: Evidence From a Natural Experiment *

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Abstract

In 2001, government guarantees for savings banks in Germany were removed following a law suit. We use this natural experiment to examine the effect of government guarantees on bank risk taking, using a large data set of matched bank/borrower information. The results suggest that banks whose government guarantee was removed reduced credit risk by cutting off the riskiest borrowers from credit. At the same time, the banks also increased interest rates on their remaining borrowers. The effects are economically large: the Z-Score of average borrowers increased by 7% and the average loan size declined by 13%. Remaining borrowers paid 57 basis points higher interest rates, despite their higher quality. Using a difference-in-differences approach we show that the effect is larger for banks that ex ante benefited more from the guarantee. We show that both the credit quality of new customers improved (screening) and that the loans of existing riskier borrowers were less likely to be renewed (monitoring), after the removal of public guarantees. Public guarantees seem to be associated with substantial moral hazard effects.

JEL Classification: G21, G28, G32
Key words: banking, public guarantees, credit risk, moral hazard

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1 Introduction

In this paper we empirically analyze the impact of government guarantees on the risk taking of banks in the context of a natural experiment. Until the year 2000 the German savings banks and federal state banks ("Landesbanken") were protected by government guarantees.[1] In July 2001 the European Union, based on the outcome of a lawsuit at the European Court of Justice, ordered that the guarantees must be discontinued in two steps during 2001 to 2005.[2] Using a unique panel data set consisting of matched balance sheet information for all German savings banks and their commercial loan customers for 1996 to 2006, we estimate the effect the removal had on credit risk, loan volumes, and interest rates of savings banks. Taking advantage of this natural experiment we are able to identify the effect of government guarantees on banks' credit portfolio choices and risk taking.

We find that the removal of government guarantees resulted in a significant reduction in credit risk. Credit risk decreased significantly more in banks, for which the value of guarantees was higher ex ante. Savings banks shifted their portfolios towards safer borrowers by dropping existing borrowers with higher credit risk and by tightening their lending standards for new borrowers. Total credit volumes and loan sizes were reduced. Despite the reduction in credit risk, savings banks increased loan interest rates on the remaining customers. The results are particularly striking, if one recognizes that the risk of banks' customers declined, even though the German economy suffered an economic downturn in 2002/2003, i.e. right after the removal of guarantees (Figure 2). Hence, in an environment of deteriorating quality of loan applicants, the quality of those that were granted a loan by savings banks improved significantly. Subsequently, the market share of savings banks in the lending business to non-financials fell from 22% to 21% after the removal (Figure 3).

Public guarantees in the wake of the financial crisis of 2007/2008 have been wide-

[1] We provide more detail on the institutional structure of German savings banks in section 2.

[2] Several major newspapers commented on the court decision. See for example Financial Times "Solution to Five-year Battle Welcomed by Private Sector" and Wall Street Journal "Germany to End State Guarantees for Public Banks", both on 18 July, 2001.

spread. Most countries either nationalized banks (e.g., U.S.: Indy Mac, Fannie Mae, Freddy Mac; UK: Bradford Bingley, Northern Rock, RBS, HBOS, Lloyds; Germany: IKB, Hypo Real Estate; Belgium/Netherlands: Dexia, Fortis), provided blanked guarantees for the banking system (e.g., Germany, Italy) or both. Evidence on the likely effect of such intervention on bank risk taking is scarce, as in most cases guarantees are granted in the midst of a crisis, in which case the effects of the guarantees on the portfolio risk of banks are confounded by the effects of the crisis itself on portfolio risk of banks. To disentangle the two is very difficult in such a setting. In this paper we do not consider the introduction of government guarantees, but rather their removal. Further, the removal was not prompted by a financial event, but exogenously imposed by a court decision. The period under consideration in this paper, 1996 to 2006, was a period without major financial system incidence in Germany and hence is particularly well suited to identify the effects of behavioral changes in response to changes in the safety net.[3]

Theory would tell us that there are two effects of public guarantees on bank risk taking that work in opposite directions. On the one hand, government guarantees may reduce market discipline because creditors anticipate their bank's bail-out and therefore have lower incentives to monitor the bank's risk-taking or to demand risk premia for higher observed risk-taking (Flannery, 1998; Sironi, 2003; Gropp et al., 2006). This tends to increase the protected banks' risk-taking. The effect is similar to the well-known moral hazard effect discussed in the deposit insurance literature (see e.g., Merton (1977) or more recently Ruckes (2004)). If depositors are protected by a guarantee, they will punish their bank less for risk-taking, reducing market discipline. On the other hand, government guarantees also affect banks' risk-taking through their effect on banks' margins and charter values. Keeley (1990) was the first to argue that higher charter values decrease the incentives for risk-taking, because the threat of losing future rents acts as a deterrent. Government bail-out guarantees result in higher charter values for protected banks who benefit from lower refinancing costs. Hence, government guarantees may alternatively be

[3]This is not to say that there were no financial incidents at all; rather the effects of the Russian default (1998), LTCM (1998), or the 9/11 terrorist attacks in 2001 on German savings banks were very mild (Hackethal and Schmidt, 2005).

viewed as an implicit subsidy to the banks and through their future value decrease bank risk taking.

Ultimately, as argued by Cordella and Yeyati (2003) and by Hakenes and Schnabel (2009), the net effect of government bail-out guarantees on the risk-taking of banks is ambiguous and depends on the relative importance of the two channels. Which dominates is an empirical matter.[4]

Empirically, the literature tends to conclude that banks increase their risk-taking in the presence of government guarantees, but the evidence is far from unambiguous. For example, Hovakimian and Kane (2000) show evidence for higher risk-taking of banks in the presence of deposit insurance. Large banks – which may be perceived to be "too big to fail" – have been shown to follow riskier strategies than smaller banks (Boyd and Runkle, 1993; Boyd and Gertler, 1994; Gropp et al., 2009). The findings on the relationship between bank size and failure probabilities are mixed. De Nicoló (2001) and De Nicoló et al. (2004) document higher probabilities of failure for larger banks. In contrast, De Nicoló and Loukoianova (2007) find that public banks do not appear to follow riskier strategies than private banks. Finally, Sapienza (2004) shows that public banks charge lower interest rates for given riskiness of loans, which is consistent with the results presented in this paper.

The effect of government bail-out guarantees on overall banking system stability are also mixed in the literature. Demirgüç-Kunt and Detragiache (2002) present evidence for a negative effect of deposit insurance on banking stability, pointing towards a destabilizing effect of guarantees. Similarly, some papers find a negative relationship between bank stability and government ownership (Caprio and Martínez Pería, 2000) or bank concentration (De Nicoló et al., 2004). However, there also exist papers that are consistent with no or even a stabilizing effect of government guarantees. Barth et al. (2004) show that government ownership has no robust impact on bank fragility, once one controls for banking regulation and supervisory practices. Beck et al. (2006) find that systemic banking

[4]The presence of government guarantees may not only affect the risk-taking of protected banks, but also – through competition – that of the protected banks' competitors (Gropp et al., 2009).

crises are less likely in countries with more concentrated banking sectors.

Most of these papers rely on cross-country or cross-sectional variation in public guarantees to identify their effect. In contrast, in this paper we are able to take advantage of a unique natural experiment within one country for a homogeneous set of relatively small banks. We view the small size of the banks in our sample (mean total assets of Euro 1.9 billion, see section 5.6) as an advantage. If public guarantees were removed for a set of very large banks, these banks may remain "too big to fail" and therefore still be subject to an implicit government guarantee, rather than an explicit one (Gropp et al., 2009). Further, we can use the link between banks and their customers to obtain a precise measure of bank risk taking and are not forced to rely on bank accounting measures such as problem loans.

The reminder of the paper is organized as follows. Section two gives some institutional background on German savings banks and describes the events surrounding the loss of government guarantees. A description of the data set can be found in section three. Section four presents our empirical strategy and section five discusses the empirical results. Section six concludes.

2 Institutional background

The German banking market is almost evenly split between three types of banks: savings and federal state banks (the focus of this paper), credit cooperatives ("Volks- und Raiffeisenbanken"), and commercial banks.[5] It is characterized by a low level of concentration with around 450 different savings banks, more than 1,000 credit cooperatives, and around 300 privately owned commercial banks.

Taken as a group, savings banks in Germany have more than Euro 1 trillion in total assets and 22,000 branches. German savings banks focus on traditional banking business with virtually no off-balance sheet operations. Their main financing source are customer deposits, which they transform into loans to households and small and medium

[5] For an in depth description of the German banking market see Hackethal (2004).

sized enterprises.[6] Savings banks are owned by the local government of the community they operate in. One important difference between commercial banks and savings banks is that savings banks in Germany are obliged by law to serve the "common good" of their community by providing households and local firms with easy access to credit. They do not compete with each other, as a regional separation applies: each savings bank uniquely serves its local market (similar to the geographic banking restrictions that existed up to the 1990s in the U.S.). Each savings bank is affiliated with one federal state bank ("Landesbank") and each federal state bank is affiliated with a state ("Bundesland") or group of states. The affiliated savings banks own each a part of their federal state bank. The federal state banks act as regional clearing houses for liquidity and facilitate the transfer of liquidity from savings banks with excess liquidity to those with liquidity shortfalls. In addition, the federal state banks secure market funding through the issuance of bonds.

Until the year 2000, both the German savings banks and federal state banks were protected by government guarantees ("Gewaehrtraegerhaftung"). As a consequence their bonds were generally rated triple A or slightly below. As German savings banks compete with commercial banks for retail and commercial customers, commercial banks in Germany alleged that the government guarantees resulted in a significant competitive advantage for savings banks. Prompted by these allegations, the European Union filed a lawsuit against the government guarantees at the European Court of Justice in April 2000. The subsequent court decision in July 2001 resulted in the removal of guarantees for savings banks and federal state banks in two steps: during a transition period from July 18, 2001 to July 18, 2005, newly contracted obligations (such as bonds or commercial paper) continue to be secured by government guarantees if their maturity is shorter than December 31, 2015. In a second step, starting from July 18, 2005 all newly contracted obligations will no longer be covered. Obligations contracted before July 18, 2001 are grandfathered. This implies that our sample largely covers the transition period between the full existence of

[6] Savings banks also issue some covered bonds and certificates of deposits that have characteristics similar to subordinated debt (Hackethal, 2004).

the guarantees (until 2001) and their complete removal (2005). Hence, we check the extent to which the expectation of their complete removal affected bank behavior.[7]

3 Data

3.1 Main data sources

We use a proprietary data set provided by the German Savings Banks Association for the years 1996 to 2006 which symmetrically spans the removal of government guarantees in 2001. The data set provides annual balance sheets and income statements of all commercial loan customers of all 457 German savings banks affiliated with the German Savings Banks Association.[8] It includes data of around 87,702 customers after excluding missing values and requiring at least two consecutive observations in order to be able to use lagged variables in the empirical analysis. In total there are 230,562 observations in the data set. Hence, there are around 2.6 annual observations per customer on average. The borrowers are largely small and medium sized enterprises with an average of Euro 1.6 million in total assets. They strongly rely on bank loans as the mean loan ratio is 51%.

To control for savings bank characteristics, we also use annual balance sheets for the 457 savings banks. The savings bank data is also from the German Savings Banks Association. By using this proprietary data set, the sample size is much larger than by using public sources such as Bankscope. In order to ensure some degree of anonymity of customers, the matching of borrowers to savings banks is possible only aggregated in groups of 5-12 savings banks. In total, there are 65 savings bank groups. Hence, while we have precise information on the individual customer, we only know that the customer banked with any one of the group. We thus link the customer characteristics to the average of the group of savings banks, rather than to an individual savings bank.

[7] Technically, the "Gewaehrtraegerhaftung" and the "Anstaltslast" were abolished. The "Anstaltslast" describes the obligation of the government to provide all state-owned enterprises with "sufficient resources to carry out their tasks". In that sense the savings banks considered in this paper could technically not become insolvent before 2001. In the change in legislation of 2001 it explicitly stipulates that federal state banks and savings banks from then on have the "ability to become insolvent".

[8] There are seven savings banks that are not full members in the savings banks association. They are not covered in the data set.

A. Dependent variables

Table 1 provides the definitions and data sources of all variables we use. As a measure for the credit risk at the borrower level we use the Z-Score (Altman, 1968) calibrated to the German banking market (Engelmann et al., 2003):[9]

$$Z\ Score = 0.717 * Working\ capital/Assets + 0.847 * Retained\ earnings/Assets +$$
$$3.107 * Net\ profits/Assets + 0.420 * Net\ worth/Liabilities + 0.998 * Sales/Assets$$

A higher $Z\ Score$ indicates a lower risk associated with the borrower. It is important to emphasize that we calculate the Z-Score based on borrower data. We do not rely on internal credit risk indicators of the savings banks themselves. The internal assessment may be problematic, as savings banks may have incentives to review their internal ratings of borrowers after the removal of government guarantees.

Loan size are the borrower's liabilities towards the savings bank. As savings banks are prohibited from competing with each other, borrowers in a certain region get loans only from their local savings bank. In case a borrower has several loans outstanding at the reporting date, our proxy for loan size is the total loan volume outstanding to the customer.

We approximate borrower level interest rates from the borrowers' balance sheets as interest expenses over total loan volume. The loan volume of borrowers may, however, also contain loans from the savings banks' competitors. Hence, we only include data from commercial borrowers with more than 50% share of total loan volumes from savings banks.[10] *Interest rate spread* is then calculated as the difference between the savings banks loan interest rate and the risk-free rate. We use the annual return of five-year German government bonds as the risk-free rate (taken from the German central bank) since the term to maturity of the average loan is between four and five years (information taken from savings banks' balance sheets).

[9] We replace $EBIT$ by $Net\ profits$ due to better data availability.

[10] Results remain qualitatively the same if we use an alternative cutoff value of 100% (section 5.1).

B. Independent variables

In the baseline analysis, the central variable of interest is *NoStateG* which is a dummy variable distinguishing between the period when savings banks enjoyed a public guarantee (1996 to 2000) and the period when they did not (2001 to 2006). We set the post 2001 period equal to one. Hence, the dummy divides the period of observation into two parts of almost equal size and measures whether bank behavior changed after the removal of public guarantees in 2001.

As we can link borrowers to groups of savings banks, we use a number of bank group level variables to control for bank group level heterogeneity. For example, we use the savings bank groups' total assets, *Total bank assets*, to control for a variety of theories related to bank size. Demsetz and Strahan (1997), among others, emphasize that larger banks can more easily diversify. In our setting, this implies that larger banks are able to lend to individually riskier borrowers without increasing overall portfolio risk. In the specification with *Z Score* as the dependent variable, diversification would imply a negative coefficient for *Total bank assets*. Similarly, Acharya et al. (2006), using a data set of individual loan customers, show that diversification tends to result in higher risk at the individual loan level. They argue that this increase in risk at the individual loan level stems from a decline in monitoring by larger banks. Monitoring declines, because agency problems within banks (between management and loan officers) may increase with bank size (Stein, 2002; Goetz, 2010).

At the same time, large banks may enjoy economies of scale in lending (see for example Berger and Mester (1997)). In a competitive environment, these cost savings may be passed on to borrowers in the form of lower interest rates. Hence, this would suggest a negative coefficient of *Total bank assets* in the *Interest rate spread* specification. Finally, Berger et al. (2005) show that larger banks tend to lend to larger borrowers. If larger borrowers ultimately obtain larger loans, we would expect a positive coefficient of *Total bank assets* in the *Loan size* specification.

We control for the regional level of competition (Boyd and De Nicoló, 2005), *Direct*

competition, by using the ratio of branches of direct competitors (commercial banks and cooperative banks) to savings banks branches per group of savings banks and year. The data comes from the Bundesbank.[11] In line with Keeley (1990) and Dick (2006), we expect that banks lend more aggressively in more competitive markets (higher risk, larger volume and lower interest rates). Further, *Number mergers* contains the number of mergers within a group of savings banks per year and controls for potential effects that merged banks tend to weaken bank/firm relationships, which may affect loan conditions (Di Patti and Gobbi, 2007).[12]

Δ *GDP* is the regional change in annual GDP per group of savings banks and controls for demand effects as well as for varying levels of credit risk (Borio et al., 2001). In addition, we use the level of local GDP to control, for instance, for differences in regional economic development. *Indebtedness* is the average debt per capita of the community that the savings bank is located in. With this variable we attempt to control for differences in the financial strength of the savings banks' owners.[13] Both variables come from the federal statistical office of Germany ("Destatis"). We also use 16 sectoral dummies following the two-digit classification of industries by the federal statistical office of Germany. In addition, we employ *Risk-free interest rate*, which is the average daily risk-free interest rate at the national level (Bundesbank data), in order to control for the relationship between interest rates and credit risk as there is a growing body of literature showing that low short-term interest rates may be related to softer lending standards and increased risk taking (Ioannidou et al., 2009; Jiménez et al., 2008).

3.2 Descriptive statistics

Table 2 provides descriptive statistics for the variables that we use. The first three variables will serve as dependent variables in the regressions below. The average Z-Score is 2.5 with a 5% percentile of 0.2 and a 95% percentile of 6.1. On average, borrowers have loans from

[11] The data covers the year 1996-2004. Thus, as the data ends too early, we assume that competition remained unchanged in 2005/2006 and use the 2004 data in these two years.

[12] However, Berger et al. (1998) provide evidence that reduced small business lending is offset by the reactions of other banks.

[13] Recall that all savings banks are at least in part owned by the local community it operates in.

savings banks of Euro 530,000 outstanding. The median amount outstanding is Euro 215,000. The average interest rate spread is 6.7% with a standard deviation of 19.7%.

Total bank assets per group of savings banks are Euro 15.3 billion on average. The 5% percentile is Euro 5.5 million while the 95% percentile is Euro 39.2 billion.[14] On average, the savings banks' federal state banks were downgraded by two and a half rating notches after the removal of state guarantees. The impact of the removal of public guarantees on the assessment of rating agencies was substantial and differed substantially across federal state banks. Some were only downgraded by one and one half notches, while others were downgraded by four notches. In the absence of ratings for savings banks, we use this variation in downgrades combined with the unique association between savings banks and a certain federal state bank later in the paper to identify the effect of guarantees in the cross section (section 5.2). The number of direct competitors is less than one on average, indicating a rather low level of competition. On average, the savings bank groups were involved in 24% of the years with a merger. Local communities the savings banks were operating in were indebted by Euro 1,040 per capita on average. The average growth rate was 0.7% and average daily interest rates were 3% on an annual basis during our sample period.

As a first cut at how the removal of government guarantees affected the banks' risk taking, we present univariate results of the dependent variables in Panel A of Table 3. Looking at the development of the borrowers' Z-Scores we observe a general trend to a reduction of credit risk from 1996/2000 to 2001/2006 as the average Z-Score increased by 0.20 from 2.36 to 2.56 (8.5%), which is significant at the 1% level. Figure 1 further illustrates this point. It shows that savings banks reduced lending to commercial customers with a Z-Score between 1.0 and 3.0 in favor for less risky clients with a higher Z-Score (3.5 and above). It appears that the savings banks tried to reduce largely the proportion of very risky borrowers in their portfolios. In the second row of Panel A, we also see that savings banks reduced loan sizes to individual borrowers by Euro 78,000 or 13.4%. Row

[14] To account for outliers, we winsorize the first four variables on the 0.5%/99.5% level.

three shows that this reduction in customer risk and loan sizes was associated with higher interest rates spreads as, on average, the savings banks increased their interest rate margin by 112 basis points or 18.8%. Both results are significant at the 1 percent level.

4 Empirical strategy

In this paper we are interested in the effect of government guarantees on bank behavior. Recall the two main predictions that we take from the literature. First, if the moral hazard effect of guarantees dominates, we would expect banks to reduce their risk taking after the removal of the guarantees (Flannery, 1998; Sironi, 2003; Gropp et al., 2006). Second, if the charter value effect, that is the implicit subsidy, dominates, we would expect savings banks to increase their risk taking (Keeley, 1990). Changing risk taking due to the removal of government guarantees would then be reflected in decreasing (moral hazard effect) or increasing (charter value effect) lending to riskier borrowers. The predictions for interest rates charged are ambiguous. If the moral hazard effect dominates, we would expect interest rates charged not to decline on the pool of borrowers left after the removal of guarantees, consistent with findings that public firms tend to charge lower interest rates for a given level of riskiness (Sapienza, 2004). If the charter value effect dominates, we would expect interest rates not to increase after the removal. We think the ability to control for the level of interest rates charged is a strength of the paper, because it permits us to control for changes in risk premia charged by banks when examing changes in the risk of borrowers. If any change in the riskiness of banks' customers was associated with a corresponding change in risk premia charged, it would be difficult to draw firm conclusions on the overall risk incurred by banks.

The removal of the guarantees took place in 2001, in the middle of our observation period. One major advantage of our data set is that the removal was exogenously imposed by a court decision and thus creates a unique natural experiment. We first consider whether we can detect any differences in the Z-Scores, loan sizes, and interest rates charged to borrowers before and after 2001, controlling for bank group characteristics and local

economic conditions, and thus identify the effect of the removal by the time series variation only. In particular, we use the three dependent variables $Y(i,t)$ on the borrower level i, $Z\ Score(i,t)$, $Loan\ size(i,t)$, and $Interest\ rate\ spread(i,t)$ in

$$\begin{aligned} Y(i,t) &= \alpha + \beta\ NoStateG(t) \\ &\quad + \gamma_1\ X_1(i,t) + \gamma_2\ X_2(g,t) + \gamma_3\ X_3(t) + \varepsilon(i,t) \end{aligned} \tag{1}$$

where the variable of interest is $NoStateG(t)$. It is a dummy variable distinguishing between 1996 to 2000 (equals zero) and 2001 to 2006 (equals one). The vector $X_1(i,t)$ includes the control variables (and a full set of two-digit industry dummies) which are on the borrower level, $X_2(g,t)$ includes the local GDP growth, local GDP level, local banking competition, local merger history, and total savings bank assets which are all on the savings bank group level g, and $X_3(t)$ is the daily risk-free interest rate. As we potentially face a simultaneity problem among our set of variables we lag our independent variables $Z\ Score(i,t-1)$, $Loan\ size(i,t-1)$, $Interest\ rate\ spread(i,t-1)$, and $Total\ bank\ assets(g,t-1)$ by one year and include them as further independent variables (Acharya et al., 2006).[15] We estimate all specifications using OLS with cluster robust standard errors at the savings bank group level, thus allowing for unobserved correlation between observations from the same savings bank group (Froot, 1989).

5 Results

5.1 Baseline results

While we found the univariate results in section 3.2 encouraging, it is possible, for instance, that the effects are due to regional differences across local markets. Hence, in Table 4 we present the baseline results for the three dependent variables $Z\ Score$, $Loan\ size$, and $Interest\ rate\ spread$ using specification (1), controlling for a host of local market

[15] We do not lag *Number mergers* as most mergers are reported at the beginning of the calendar year. In addition, we explore other ways to deal with simultaneity in section 5.4.

characteristics. The variable of interest is $NoStateG$, which takes the value one for the period after the removal of government guarantees (2001 to 2006) and zero before.

Panel A of Table 4 shows pooled OLS regression results. We find that the $NoStateG$ coefficient is positive (lower risk) and significant at any significance level in the first column. The commercial loan customers of savings banks exhibited lower risk in the period after the removal of the government guarantee. The coefficient is 0.17 and thus almost as large as in the univariate analysis. Thus, the average borrower has an 7.3% higher Z-Score after the removal of government guarantees than before. This difference indicates not only a statistically significant but also an economically relevant reduction in credit risk.

In the second column of Panel A we show that $NoStateG$ also enters significantly (1% level) into the regression for loan size. We find that savings banks significantly reduced loan sizes after the removal of government guarantees. The average reduction is economically large at Euro 77,000 or 13%. Further, we find that interest rate spreads charged (column 3 of Panel A) were significantly increased (significant at the 1% level). However, the average increase is 57 basis points or 9.6%, smaller than the 112 basis points in the univariate analysis, suggesting that regional differences matter for interest rate spreads charged. Both findings corroborate our main finding: Savings banks significantly reduced their risk taking after the government guarantees were removed.

Most control variables conform to expectations. We find that larger banks tend to originate larger loans. However, bank size is not related to the level of credit risk and interest rate spread. We further find evidence that savings banks in regions where the federal state bank was downgraded more severely had a lower level of credit risk. We will examine this relationship more closely in a difference-in-differences specification in part A of section 5.2. If the savings banks' communities were more indebted, credit risk was higher. Furthermore, higher competition yields riskier lending but is unrelated to loan size and interest rate spread. If local GDP grew more rapidly, the customers of savings banks tend to exhibit lower risk although this relationship does not enter significantly. Finally, low overall levels of interest rates in the economy result in riskier borrowers, larger loans

and lower interest rate spreads. As in Ioannidou et al. (2009) and Jiménez et al. (2008) a low level of interest rates tends to be related to softer lending standards.

We next present and discuss the results of a series of additional tests to illustrate the robustness of our findings from the baseline regressions. First, we use savings bank group fixed effects. Results are shown in Panel B of Table 4. Our main results remain qualitatively unchanged. The *NoStateG* coefficient still enters significantly (at the 1% level) in all three regressions with the credit risk, the loan size, and the interest rate spread as dependent variables. Results thus seem to be robust to controlling for time-invariant saving bank group characteristics. Second, it seems plausible that savings banks may have expected the law suit to go against them and wanted to extend as many risky loans under the old regime. If so, this may imply that they increased their lending to risky borrowers after the law suit was filed in April 2000 and stopped after the law suit was decided in July 2001. We thus perform a robustness check with the years 2000 and 2001 dropped. The number of observations decreases from 230,562 to 168,006. Unreported results regarding the *NoStateG* coefficient remain qualitatively unchanged. Our findings hence do not seem to be driven by savings banks increasing risk levels shortly before the court decision in combination with a decline in risk levels in 2001. Third, we use a different sample definition. In our analyses we approximate borrower level interest rates from the borrowers' balance sheets. The loan volume of borrowers may, however, also contain loans from the savings banks' competitors. Hence, in the baseline, we only include data from commercial borrowers with more than 50% share of total loan volumes from savings banks. As a robustness check, we require that all loans come from savings banks. When doing this, the number of observations declines to 103,407. Again, the *NoStateG* coefficient enters significantly at the 1% level in the risk and interest rate regressions, while we obtain a significance level of 10% for the loan size regression. Overall, the results turn out to be robust to bank group fixed effects, different sample selection criteria and omitting 2000/2001 from the analysis.

While we feel reasonably confident that the results above indeed are driven by

the removal of guarantees, their identification relies only on time series variation in the behavior of savings banks. Hence, it is possible that all banks reduced their risk taking after 2001. If this were the case, the effect of the removal of government guarantees would be confounded by a general time series trend. We should, however, emphasize that Germany experienced a recession in 2002/2003 (see Figure 2), suggesting an overall decline in the quality of the pool of potential borrowers. Despite this decline in the quality in the pool of potential borrowers, we find an improvement in the quality of the accepted borrowers for the savings banks. We further find that the savings banks' market share in lending to commercial borrowers decreased after the removal of the public guarantees. Figure 3 suggests that savings banks' market share was relatively stable at around 22% before 1999. Then we observe an increase of around 1.5% in the years 1999 and 2000. That might have been an anticipation of the forthcoming regulatory change. In the years 2001 and (to a lesser extend) 2002, we observe a drop to around 20% and after that a stable market share of around 21%. The removal of state guarantees thus corresponds to a lower market share of savings banks. Savings banks changed their lending behavior after the removal of guarantees more than their competitors, which were not affected by the removal of public guarantees.[16] Nevertheless, in the next section we show the results for two attempts at identifying the effect of public guarantees in the cross section as well as the time series.

5.2 Higher ex ante value of guarantees

In this section we identify the effect of the removal of government guarantees using a difference-in-differences approach. We would expect that the effects on the behavior of savings banks should be larger if the value of the government guarantees to the savings banks was larger ex ante. We measure the effect of the ex ante value of guarantees in two ways: One, we use the extent of the downgrade of the federal state bank affiliated with the set of savings banks. And second, we check whether ex ante riskier banks reduced

[16] In section 5.6 we further show evidence that loan volume was reduced at individual savings banks after the removal of public guarantees.

their risk taking more than ex ante safer banks.

A. Downgrade of federal state banks

Table 5 shows that the removal of government guarantees resulted in a downgrade of federal state banks by 2-3 rating notches on average. In the absence of ratings for savings banks and given the institutional structure of the system (see section 2), we use differences in these downgrades to identify the effect of guarantees on the behavior of savings banks. The downgrade of federal state banks may have affected individual savings banks via two main channels: First, in their function as clearing houses for individual savings banks. Savings banks, even though not rated and generally without direct access to international capital markets, were able to refinance at (almost) risk-free terms via the federal savings banks (Wagner, 2002). After the downgrade, refinancing with federal state banks may have become significantly more expensive for individual savings banks. Further, this effect may have been stronger, the larger the downgrade of the associated federal state bank.[17] Second, the equity stake of savings banks in the federal state bank may have been affected. Indeed during the recent crisis, a number of savings banks provided capital to failing federal state banks (e.g., in the state of Baden-Wuerttemberg the savings banks supported a recapitalization of the federal state bank with Euro 1.78 billion).[18]

We hypothesize that the removal of government guarantees may have had stronger effects for savings banks affiliated with federal state banks that were downgraded more severely and where therefore the ex ante value of the guarantee was higher. We first provide univariate statistics using the third column in Panel A of Table 3 to calculate difference-in-differences combining before/after the removal of government guarantees with high/low downgrade magnitude. We find that the increase in Z-Score is higher (0.12) if we observe a large downgrade (0.28) than if we observe a small downgrade (0.16). Credit risk decreased more if the value of the government guarantees was more valuable ex ante. The difference-in-differences is significant at the 10% level and accounts for 60% of the overall decrease

[17] Recall that the regional principle applies: each savings bank is affiliated with one particular federal state bank, see section 2.

[18] Cf. Handelsblatt newspaper article from March 16th, 2009. Puri et al. (2009) examine the effect these bail-outs may have had on savings banks lending policies.

of the Z-Score (0.20). For the loan size, the difference-in-differences is minus Euro 99,000 (significant at the 5% level) and is thus even larger than the overall effect (minus Euro 78,000). Savings banks for which the ex ante value of guarantees was higher increased interest rates by 154 basis points, as opposed to 92 basis points for other savings banks. The difference-in-differences is thus 62 basis points (significant at the 10% level) or 55% of the overall effect (112 basis points).

In line with the descriptive statistics, we estimate a difference-in-differences model, which permits an identification of the effect of the removal of government guarantees in the cross section (ex ante value of guarantees) as well as the time series:

$$\begin{aligned} Y(i,t) = \alpha &+ \beta_1\ NoStateGXHighDowng(g,t) \\ &+ \beta_2\ NoStateGXLowDowng(g,t) + \beta_3\ StateGXLowDowng(g,t) \\ &+ \gamma_1\ X_1(i,t) + \gamma_2\ X_2(g,t) + \gamma_3\ X_3(t) + \varepsilon(i,t). \end{aligned} \tag{2}$$

The key variables are the three interaction terms. We are interested in the change in lending behavior before ($StateG$) and after ($NoStateG$) the removal of government guarantees for the savings bank groups which are tied to federal state banks with a more severe ($HighDowng$) and less severe credit rating downgrade ($LowDowng$). We thus base our inference on β_1 - (β_2 - β_3).

The results in Table 6 show that the reduction in risk, the reduction in loan size, and the increase in interest rate spread were all significantly larger for savings banks that benefited ex ante more strongly from the government guarantee. The difference-in-differences terms enter significantly into the regression for all three dependent variables (at the 5% level for credit risk and interest rate spread, at the 10% level for loan size). Banks, for which the ex ante value of government guarantees was likely to be higher, reduced their risk taking more than other banks.

B. Higher ex ante risk

In this section we identify the value of ex ante guarantees on the basis of risk taking

before the removal of the guarantee. If the guarantee resulted in moral hazard effects, their removal should result in a stronger reaction for those banks that incurred greater risk with the guarantee in place. If the charter value effect dominates, we would not necessarily expect a difference in the reaction of ex ante riskier and ex ante safer banks. We measure the ex ante riskiness of the savings bank as the average Z-Score of their borrowers before the removal of government guarantees. To identify the difference in reaction we define two groups of savings banks: $HighRisk$ stands for savings banks with below average Z-Score before 2001, while $LowRisk$ stand for savings banks with above average Z-Score, respectively.

Panel B in Table 3 presents the univariate results. We observe a stronger increase in the average Z-Score after the removal of government guarantees for ex ante riskier banks (0.29) compared to ex ante less risky banks (0.08). The difference-in-differences is 0.21 (significant at the 1% level). In addition, the decrease of the average loan volume was stronger for riskier (Euro 106,000) than for safer banks (Euro 59,000). The difference-in-differences is negative but not significant. The average interest rate spread was raised more strongly (132 basis points compared to 80 basis points). The resulting difference-in-differences (52 basis points) is statistically significant at the 10% level.

As before, we estimate the following difference-in-differences model, which identifies the effects of the removal of government guarantees in the cross section (level of ex ante risk) and the time series:

$$\begin{aligned} Y(i,t) = \alpha &+ \beta_1\ NoStateGXHighRisk(g,t) \\ &+ \beta_2\ NoStateGXLowRisk(g,t) + \beta_3\ StateGXLowRisk(g,t) \\ &+ \gamma_1\ X_1(i,t) + \gamma_2\ X_2(g,t) + \gamma_3\ X_3(t) + \varepsilon(i,t). \end{aligned} \tag{3}$$

Again, the key variables are the three interaction terms. We are interested in the change in lending behavior before ($StateG$) and after ($NoStateG$) the removal of government guarantees for the savings bank groups with lower ($LowRisk$) and higher

($HighRisk$) ex ante riskiness. We thus base our inference on β_1 - (β_2 - β_3).

The results in Table 7 show that the reduction in risk, the reduction in loan size, and the increase in interest rate spreads were all larger for savings banks which carried a higher credit risk before the removal of state guarantees. The difference-in-differences terms enter significantly into the regression for credit risk (at the 1% level) and interest rate spread (at the 10% level) while the difference-in-differences is negative but does not enter significantly in the case of loan size. Ex ante riskier banks appear to have reduced their risk taking more after the removal of guarantees relative to ex ante safer banks.

5.3 Introduction of risk based regulation and prompt corrective action

We want to be sure that the effects we describe above are indeed due to the removal of guarantees and not due to subsequent changes in the regulatory framework. Each savings bank in Germany is required to contribute to a regional reserve fund. These funds, introduced in the 1970s, are intended to safeguard the liquidity and solvency of each individual bank. In December 2003 (two years after the removal of guarantees) it was announced that the contributions to the reserve fund would be changed from flat contributions to risk based contributions based on the portfolio risk of each savings bank. The volume of the fund was also increased. Finally a risk monitoring system was introduced and intervention rights of the reserve fund were strengthened. The reserve fund can ask savings banks to provide further details on its exposures, it may set up meetings with the board of directors and management of the savings bank and a restructuring of the affected savings bank can be imposed. The reforms, which became effective in 2006, can be viewed as introducing a form of prompt corrective action.

While the implementation of these reforms took place in 2006, the last year of our sample period, we want to make sure that the changes in bank behavior were not due to the expectation of these regulatory changes becoming effective. It is possible that by dividing the time period into 1996 to 2000 and 2001 to 2006, we mistakenly attributed effects that occurred due to the announcement of the introduction of changes in the regulatory

framework in December 2003 to the removal of public guarantees. Hence, in the results reported in Table 8, we divide the sample into three sub-periods:

- 1996/2000: Government guarantees are in place ($StateG$)
- 2001/2003: Guarantees no longer in place, no risk based regulation
- 2004/2006: Guarantees no longer in place, risk based regulation announced ($IntroRW$)

Dividing the sample in this way highlights that we can identify the effect of the removal of government guarantees by considering the change in risk taking in 2001/2003 relative to 1996/2000 ($StateG$). However, we cannot unambiguously attribute any further effects (the coefficient $IntroRW$ for the 2004/2006 period) to either the removal of guarantees or the introduction of regulation, as this period will reflect a combination of both effects. Still, it seems interesting in its own right to check whether after 2003 there were additional effects on bank risk taking. Hence, we estimate:

$$\begin{aligned} Y(i,t) = \alpha + \beta_1 \; StateG(t) + \beta_2 \; IntroRW(t) \\ + \gamma_1 \; X_1(i,t) + \gamma_2 \; X_2(j,t) + \gamma_3 \; X_3(t) + \varepsilon(i,t) \end{aligned} \tag{4}$$

The first variable of interest in the results for this exercise is $StateG$. The results in Table 8 show that savings banks reduced their risk taking in 2001/2003 as $StateG$ is negative in the first column. We further find that the borrowers' loan sizes (column 2) were reduced and the interest rate spreads charged (column 3) were increased significantly. All three coefficients are significant at the 1% level. The effect of the removal of government guarantees on risk taking is robust to controlling for the subsequent introduction of risk based regulation and prompt corrective action.

The results also suggest that savings banks reduced their risk taking further in 2004/2006 ($IntroRW$ is positive and significant at the 1% level), although we do not find a significant effect for loan size and interest rate spreads. Overall, we would interpret the evidence as suggestive that risk based regulation reduced risk taking further, although

we cannot fully distinguish the effect from a potential late adjustment to the removal of government guarantees.

5.4 SUR model

In this section, we use a seemingly unrelated regression (SUR) model to account for the simultaneity of the risk, loan size, and interest rate decisions by banks. In Table 9 we report the results of:

$$\begin{aligned} Z\ Score(i,t) &= \alpha + \beta\ NoStateG(t) + \gamma_1\ X_1(i,t) + \gamma_2\ X_2(j,t) + \gamma_3\ X_3(t) + \varepsilon_1(i,t) \\ Loan\ size(i,t) &= \alpha + \beta\ NoStateG(t) + \gamma_1\ X_1(i,t) + \gamma_2\ X_2(j,t) + \gamma_3\ X_3(t) + \varepsilon_2(i,t) \\ Interest\ rate\ spread(i,t) &= \alpha + \beta\ NoStateG(t) + \gamma_1\ X_1(i,t) + \gamma_2\ X_2(j,t) + \gamma_3\ X_3(t) + \varepsilon_3(i,t) \end{aligned} \tag{5}$$

The model allows for a correlated error structure across the error terms of the three equations. We estimate the model for the baseline specification as well as the two difference-in-differences models and the model, in which we control for the subsequent announcement of a change in regulation.[19] The other control variables are as before except the vector $X_1(i,t)$ which only includes the set of industry dummies.

All results go through as before: Savings banks reduced risk taking, reduced loan size and increased interest rate spreads after the government guarantees were removed (I). The effect is stronger, if the ex ante value of the government guarantees were higher (IIa and IIb). All difference-in-differences terms in the credit risk and interest rate regressions are significant at the 1% level. In the case of the loan size regressions, only the difference-in-differences term of specification IIa enters significantly at the 5% level. Specification (III) is also in line with earlier results. All in all, our results do not seem to suffer from simultaneity problems.

[19] Note that we only show the baseline in specification (5) to save space.

5.5 Screening versus monitoring

Our matched bank/borrower data set provides a direct possibility to investigate whether banks changed their screening or their monitoring policies or both. In order to disentangle screening from monitoring, we create two subsamples of our borrower level data set. One includes only new and the second only existing borrowers. Figure 4 shows how we define the two subsamples. It illustrates four exemplary borrowers of a given bank. First, we exclude all observations for 1995 (denoted in Figure 4 with B), because for 1995 we are unable to distinguish whether the observations refers to an existing or a new borrower. Second, if we observe a borrower in 1995 and 1996 or a subsequent year, we define this observation as "existing" (E). Third, if we observe a borrower for the first time in 1996 or any subsequent year, we classify the borrower as "new", denoted with N in Figure 4. Subsequent observations of this same borrower would then be included in the set of existing borrowers (see borrowers 3 and 4 in the figure).

To examine whether the adjustment in credit quality of the banks primarily came about through changes in screening or changes in monitoring, we compare the changes in Z-Scores for these two subsamples. The results are presented in Table 10. We observe a trend towards higher Z-Scores (corresponding to a reduction in risk) both for new and for existing borrowers after the removal of the guarantees. However, the increase is stronger for new (0.49) than for existing borrowers (0.36). The difference of 0.13 is statistically significant at the 10% level. Overall, we find that banks both dropped riskier existing borrowers (monitoring) and tightened lending standards for new borrowers (screening), with a slightly stronger emphasis on tightening standards for new borrowers.

5.6 Bank level loan volume effects

In the previous sections we observed a reduction of risk taking after the removal of government guarantees. This reduction was larger if the ex ante value of the guarantees was higher and if the savings banks' ex ante risk was higher. We interpreted the results to imply that savings banks cut off the riskiest existing borrowers from credit and tightened

their lending standards for new borrowers. This change in policies should be observable in overall bank loan volumes. We already documented that the aggregate market share of savings banks declined after the removal of guarantees (see Figure 3). In this section we examine whether the changes in loan volumes of individual savings banks are consistent with the aggregate patterns and whether changes are larger for banks for which the ex ante value of the guarantees may have been higher.

In order to construct loan volume figures, we aggregate all loans to commercial borrowers per savings bank in each year. We also use the average level of credit risk (Z-Score) and the average interest spread over all borrowers at a group of savings banks of a given year as control variables. In contrast to the regressions on the borrower level, we use *Total bank assets*, *Number mergers*, and *Downgrade* on the savings bank level as in this specification we do not need to match these variables with borrower level data.

We start with a brief description of the savings bank level data set. For 457 savings banks we have 4,708 bank level observations in 1996 - 2006 after excluding observations with missing values for the variables used in the empirical analysis. Despite their obligation to serve the "common good" (see section 2), the saving banks in our sample are on average relatively profitable: average pre-tax ROE is 12.8%. The average cost to income ratio is 82.1%. Despite the differences in governance, savings banks appear very similar to private commercial banks of comparable size in continental Europe. Pre-tax ROE of commercial banks in Europe is 12.1% in continental Europe and 13.1% in the UK (317 banks, 1996-2004, data is from Bankscope). Similarly, cost to income ratios are 80.1% in continental Europe and 66.8% in the UK. Further descriptive statistics of the variables used below in the regression are reported in Panel A of Table 11. The average aggregate credit volume to commercial borrowers is Euro 544 million. The average savings bank has around Euro 1.9 billion of total assets and seems unlikely to be considered "too big to fail". The other control variables are as in the borrower level data set described in Table 2.[20]

We then run the same regressions as for the borrower level data. We present the

[20] *Number mergers* is much lower as this ratio is now calculated per savings bank instead of per group of savings banks.

results in specifications (I) to (III) in Table 12.[21] Specification (I) uses the dummy variable $NoStateG$ (which equals 0 before 2001 and 1 for the years of 2001 - 2006) to estimate the baseline time series effect. We find that the overall credit volume of savings banks declined significantly (at the 1% level) after the removal of the public guarantees. On average, savings banks reduced their loan volume by Euro 125 million, which corresponds to 22% of the commercial loan volume of the average savings bank. Specification (IIa) applies the difference-in-differences approach from Table 6 and interacts $NoStateG$ with the downgrade severity of the federal state bank. While banks with a likely higher ex ante value of public guarantees reduce their lending to commercial borrowers more than those with a lower value, the difference-in-differences term is not statistically significant. Third, specification (IIb) applies the difference-in-difference approach from Table 7 and interacts $NoStateG$ with the value of the ex ante riskiness of the savings banks. However, the difference-in-differences effect is very small and not significant. Fourth, as in Table 8 we use two dummy variables to indicate the periods 1996-2000 ($StateG$) and 2004-06 ($IntroRW$). 2001-03 is excluded as before. The results are reported in specification (III) of Table 12. We continue to find a significant reduction of the loan volume at the bank level for the period 2001-03 and a further reduction after 2004. Hence, the main results found previously at the borrower level seem to go through when considering overall loan volumes of savings banks, although statistical significance is lower, which we attribute to the much smaller sample size.

6 Conclusion

The results in this paper show that government guarantees are associated with strong moral hazard effects. The approach taken in the paper permits a unique identification of

[21] Univariate results for the effect on credit volumes at the savings bank level in Panel B of Table 11 show on average a reduction in credit volume of Euro 42 million after the removal of government guarantees. This is 7.4% of the average loan volume of savings banks. While the reduction of credit volumes was higher if the ex ante value of the government guarantees was higher (Euro 61 million compared to Euro 37 million) the difference-in-differences (minus Euro 24 million) is negative but not significant. Results are similar for the ex ante risk level of the savings banks (before the removal). High risk savings banks reduced their risk to a larger extend (Euro 63 million) than low risk savings banks (Euro 19 million) did. The difference-in-differences (minus Euro 44 million), however, is again negative but not significant.

the effects of government guarantees on bank risk taking. One, the removal of guarantees was exogenously imposed on the sample banks. The change in the safety net that we examine was unrelated to a financial incident, but rather based on a European court decision. Second, the banks in the sample are small and, therefore, unlikely to be "too big to fail". Hence, we can exclude the possibility that explicit government guarantees were simply replaced by implicit guarantees, which may have similar effects on bank risk taking and also be associated with moral hazard (Gropp et al., 2009). Third, the data permit a link between the balance sheet information of the banks and the balance sheet information of their commercial loan customers. Savings banks largely operate along traditional banking lines with little off-balance sheet operations. Hence, we are able to measure their risk taking comprehensively by examining the Z-Score of their commercial loan customers.

We find that the removal of government guarantees not only significantly decreased the risk taking of banks, but we also show that after the removal of guarantees, banks reduced average loan size and overall lending volume. At the same time, banks increased interest rates for loans on the remaining borrowers. Riskier borrowers were either denied credit or were given a smaller loan. The effects are economically substantial: Z-Scores increased on average by 7%, loan sizes declined by 13%, interest rate spreads increased by 57 basis points, and overall loan volume declined by 22%. We find that these effects tend to be significantly larger for banks, where it is likely that the ex ante value of guarantees was higher. Finally, we show that the savings banks adjusted their risk taking both by dropping existing risky borrowers from their loan books (monitoring) and by tightening their lending standards for new borrowers (screening). The results suggest that some borrowers, generally the riskiest ones, lost access to credit due to the removal of guarantees.

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FIGURE 1: Distribution of Z-Scores before and after the removal of public guarantees

The figure shows the distribution of the Z-Score before (1996-2000) and after (2001-2006) the removal of government guarantees. The Z-Score is defined in Table 1. We use univariate kernel density estimation to derive the figure.

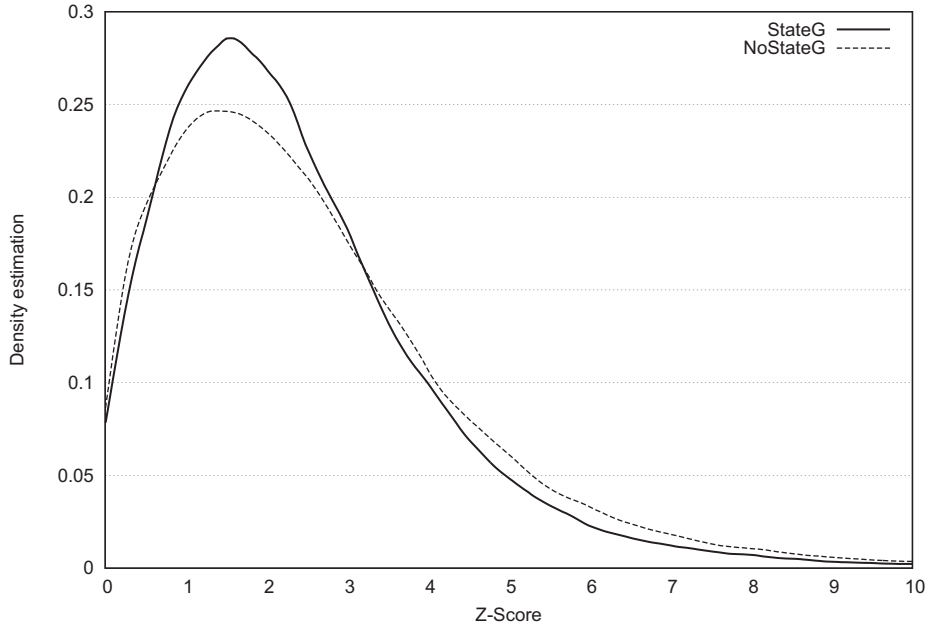

FIGURE 2: Economic developments in Germany

The figure shows annual GDP growth in Germany during our sample period. Data are taken from the federal statistical office of Germany (Destatis).

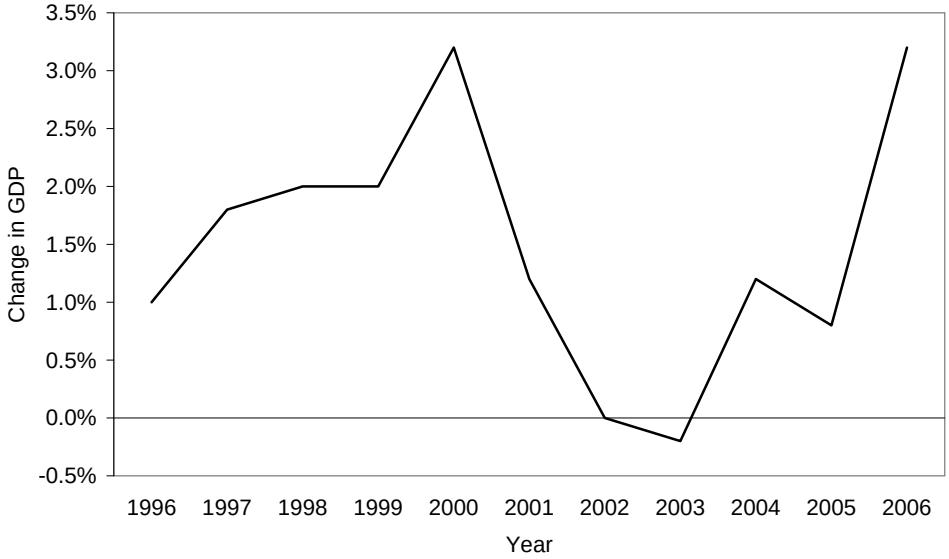

FIGURE 3: Market share of savings banks in Germany

The figure shows the annual loan volume of savings banks as a percentage of the total loan volume to commercial customers in Germany ("market share"). Data are from the Bundesbank and the German Savings Banks Association.

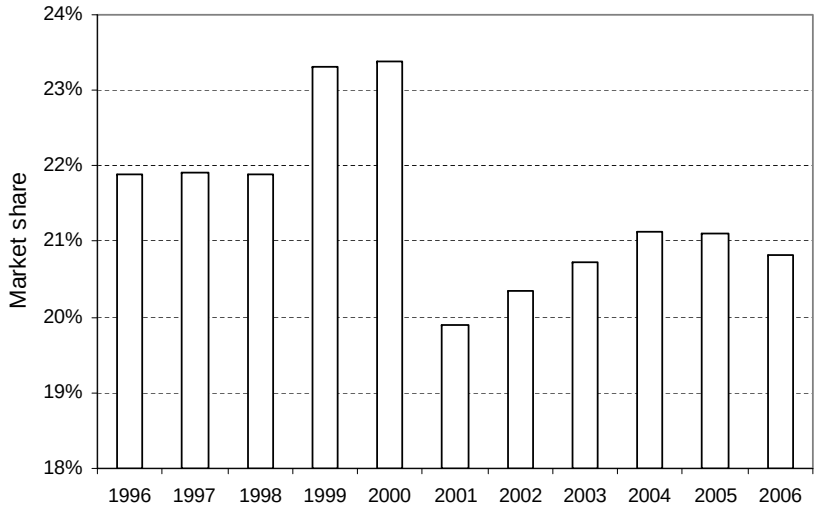

FIGURE 4: Sample selection - Screening versus monitoring

The figure shows how we define the two subsamples of new and existing borrowers used for Table 10. It illustrates four exemplary borrowers of a given bank. All observations for 1995, denoted by B, are excluded. If we observe a borrower in 1995 and 1996 or a subsequent year, we define this observation as "existing" (E). If we observe a borrower for the first time in 1996 or any subsequent year, we classify the borrower as "new", denoted with N. Subsequent observations of this borrower are classified as existing borrower (E).

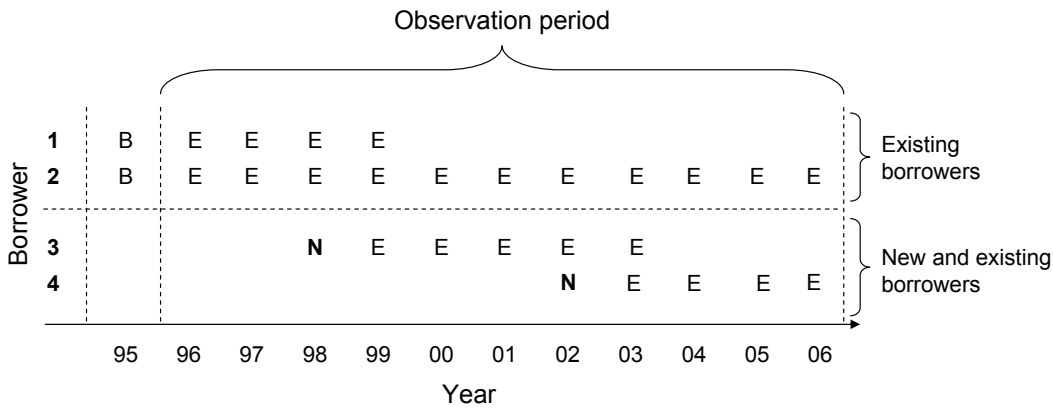

TABLE 1: Definition of dependent and independent variables

The table gives the definitions of all variables used in the empirical analysis. EBIL stands for the proprietary data set of borrowers' balance sheets and income statements. Destatis is the federal statistical office of Germany.

Variable name	Description	Definition/Source
Dependent variables		
Z Score	Altman's Z-Score calibrated to the German banking market (approximation of the credit risk of each individual loan customer), defined by $Z\ Score = 0.717 * Working\ capital/Assets + 0.847 * Retained\ earnings/Assets + 3.107 * Net\ profits/Assets + 0.420 * Net\ worth/Liabilities + 0.998 * Sales/Assets$	EBIL
Loan size	Commercial borrowers liabilities towards the savings bank	EBIL
Interest rate spread	Interest rate spread of commercial borrower (approximated by interest expenses over total loan volumes minus the annual return of five-year German government bonds as the risk-free rate) for customers with at least 50% of credit volumes from savings banks	EBIL, Bundesbank
Independent variables		
Total bank assets	Aggregated total assets of groups of savings banks	Savings banks
Downgrade	Downgrade of federal state bank in numerical rating notches which was due to the removal of state guarantees (cf. Table 5)	S&P's, Moody's
Direct competition	Branches of direct competitors (commercial banks and cooperative banks) to savings banks branches per group of savings banks	Bundesbank
Number mergers	Number of mergers within a group of savings banks per year	Savings banks
Local GDP	Level of local GDP per group of savings banks	Destatis
Δ GDP	Relative change in GDP per group of savings banks	Destatis
Indebtedness	Debt per capita of the community that the savings bank is located in	Destatis
Risk-free interest rate	Average daily risk-free interest rate at the national level	Bundesbank
Industry	Two-digit industry classification of commercial borrower	EBIL
Dummy and interaction variables		
StateG	Dummy variables for removal of government guarantees (before removal of state guarantees)	1 for years 1996 - 2000
NoStateG	Dummy variables for removal of government guarantees (after removal of state guarantees)	1 for years 2001 - 2006
StateGXLowDowng	Dummy variables for interaction of removal of government guarantees with ex ante value of guarantees, approximated by the sharpness of downgrade of the federal state bank	1 for 1996-2000 if Downgrade $\leq$ 2.5
NoStateGXLowDowng		1 for 2001-2006 if Downgrade $\leq$ 2.5
NoStateGXHighDowng		1 for 2001-2006 if Downgrade $>$ 2.5
StateGXLowRisk	Dummy variables for interaction of removal of government guarantees with ex ante riskiness of the savings bank group, measured as the average Z-Score for the years 1996-2000	1 for 1996-2000 if ex ante risk $\leq$ median
NoStateGXLowRisk		1 for 2001-2006 if ex ante risk $\leq$ median
NoStateGXHighRisk		1 for 2001-2006 if ex ante risk $>$ median
IntroRW	Dummy variable for introduction of risk weighted provisions to the savings banks' group-wide reserve funds	1 for 2004-06

TABLE 2: Descriptive statistics

This table shows descriptive statistics of the variables used in the empirical analysis. The definitions of variables are given in Table 1. We provide the number of observations, means, standard deviations, and the 5%, 25%, 50%, 75%, and 95% percentiles.

Variable	Unit	N	Mean	SD	5p	25p	50p	75p	95p
Z Score	-	230,562	2.49	2.12	0.18	1.13	2.11	3.38	6.11
Loan size	EUR mn	230,562	0.530	1.025	0.022	0.092	0.215	0.501	2.064
Interest rate spread	Percent	230,562	6.68	19.65	0.12	2.11	3.53	5.93	17.17
Total bank assets	EUR bn	230,562	15.31	11.69	5.46	9.04	11.59	16.37	39.16
Downgrade	Notches	230,562	2.54	0.95	1.50	2.00	2.00	4.00	4.00
Direct competition	-	230,562	0.90	0.25	0.48	0.75	0.88	1.03	1.36
Number mergers	-	230,562	0.24	0.58	0.00	0.00	0.00	0.00	1.00
Local GDP	EUR bn	230,562	37.02	34.88	9.98	20.47	27.55	37.55	82.80
Δ GDP	Percent	230,562	0.74	1.87	-2.01	-0.35	0.60	1.89	3.33
Indebtedness	EUR thousands	230,562	1.04	0.38	0.62	0.82	0.96	1.17	1.83
Risk-free interest rate	Percent	230,562	2.95	0.75	2.05	2.32	2.84	3.28	4.37

TABLE 3: Univariate analysis

The table shows the results of a univariate analysis of the impact of the removal of government guarantees on credit risk (*Z Score*), loan sizes (in millions of Euros), and interest rate spreads (in percent). The sample includes 230,562 observations. Government guarantees were in place in 1996-2000, and government guarantees were not in place in 2001-06. Panel A: low/high downgrade stands for savings banks for which the respective federal state bank experienced a low/high downgrade (see Table 5). Panel B: High/low ex ante risk stands for savings banks below/above average Z-Score prior to removal of guarantees. The differences in column 3 show a comparison before and after the removal of government guarantees. In column 3, *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively, using univariate OLS with standard errors clustered at the savings bank group level.

Variable		1996-2000	2001-06	Difference
Panel A: Downgrade of federal state banks				
	Overall	2.36	2.56	0.20***
Z Score	Low downgrade	2.37	2.53	0.16***
	High downgrade	2.34	2.62	0.28***
	Overall	0.582	0.504	-0.078***
Loan size	Low downgrade	0.553	0.507	-0.046*
	High downgrade	0.642	0.497	-0.145***
	Overall	5.94	7.06	1.12***
Interest rate spread	Low downgrade	6.22	7.14	0.92***
	High downgrade	5.37	6.90	1.54***
Panel B: Ex ante risk level				
	Overall	2.36	2.56	0.20***
Z Score	Low ex ante risk	2.57	2.65	0.08**
	High ex ante risk	2.17	2.46	0.29***
	Overall	0.582	0.504	-0.078***
Loan size	Low ex ante risk	0.602	0.543	-0.059
	High ex ante risk	0.565	0.459	-0.106***
	Overall	5.94	7.06	1.12***
Interest rate spread	Low ex ante risk	6.53	7.34	0.81***
	High ex ante risk	5.43	6.75	1.32***

TABLE 4: Impact of the removal of government guarantees

The table contains the result of OLS regressions which analyze the impact of removal of government guarantees on credit risk (*Z Score*), loan size, and interest rate spread on the borrower level. Panel A shows the results of pooled OLS regressions while Panel B shows the results using fixed effects on the savings bank group level. *NoStateG* equals 0 before 2001 and 1 for the years of 2001 - 2006. The control variables are all lagged by one year, except the downgrade of the federal state bank, *Downgrade*, the debt per capita per group of savings banks, *Indebtedness*, the absolute level of local GDP, *Local GDP*, as well as the relative change in local GDP, Δ *GDP*, the branches of direct competitors (commercial banks and cooperative banks) to savings banks branches per group of savings banks, *Direct competition*, the number of mergers within the group of savings banks per year, *Number mergers*, and the average daily interest rate in basis points, *Risk-free interest rate*. All specifications include two-digit industry dummies (coefficients omitted from the table). Standard errors are clustered at the savings banks' group level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variables	Z Score	Loan size	Interest rate spread
Panel A: Standard OLS			
NoStateG	0.172***	-0.077***	0.569***
Z Score		-0.084***	0.674***
Loan size	-0.332***		-1.164***
Interest rate spread	0.007***	-0.003***	
Total bank assets	0.004	0.008**	0.027
Downgrade	0.084***	0.021	-0.141
Indebtedness	-0.247***	-0.049	0.026
Local GDP	0.001	-0.002*	0.004
Δ GDP	0.904	0.379	-2.205
Direct competition	-0.219**	0.029	0.131
Number mergers	-0.026*	-0.014*	-0.133
Risk-free interest rate	-0.055***	0.018***	-0.577***
Intercept	2.270***	0.438***	4.125***
Observations	230,562	230,562	230,562
$Adj.R^2$	0.102	0.080	0.014
Panel B: With fixed effects			
NoStateG	0.120***	-0.090***	0.696***
Z Score		-0.085***	0.653***
Loan size	-0.337***		-1.203***
Interest rate spread	0.007***	-0.003***	
Total bank assets	-0.063***	0.023**	-0.083
Indebtedness	-0.039	-0.062**	0.578
Local GDP	0.030***	-0.004	-0.002
Δ GDP	0.178	0.113	-4.584*
Direct competition	-0.236***	-0.040	0.109
Number mergers	-0.019	-0.007	-0.040
Risk-free interest rate	-0.023**	0.017***	-0.561***
Intercept	2.137***	0.447***	5.059***
Number of bank groups	65	65	65
Observations	230,562	230,562	230,562
Within R^2	0.100	0.077	0.013

TABLE 5: Impact of removal of government guarantees on credit ratings of German federal state banks

The table gives Moody's and S&P's rating changes for the German federal state banks before and after the removal of government guarantees. The unguaranteed rating is as of July 19, 2005. In addition it shows the rating downgrade of the rating agencies after the loss of government guarantees of the federal state banks in numerical rating notches. Credit ratings are taken from the rating agencies' websites.

		LBBW	BayernLB	WestLB	NordLB	HSH Nordbank	Helaba	SachsenLB
Moody's	Guaranteed	Aaa	Aaa	Aa2	Aa2	Aa3	Aaa	Aa2
	Unguaranteed	Aa1	Aa2	A1	Aa3	A1	Aa2	A1
	Downgrade	1	2	2	1	1	2	2
S & P	Guaranteed	AA+	AAA	AA-	-	AA-	AA+	AA
	Unguaranteed	A+	A	A-	Aa3	A	A	BBB+
	Downgrade	3	6	3	-	2	2	5
Downgrade intensity		low	high	low	low	low	low	high

TABLE 6: Ex ante value of guarantees: Federal state bank downgrade

The table contains the difference-in-differences result of OLS regressions which analyze the impact of removal of government guarantees in dependence on the ex ante value of guarantees for the following variables: credit risk (*Z Score*), loan size, and interest rate spread on the borrower level. We approximate the ex ante value of guarantees by the severity of the federal state bank downgrade. The control variables are defined as in Table 4. Wald tests for the difference-in-differences terms are reported at the bottom of the table. All specifications include two-digit industry dummies (not reported). Standard errors are clustered at the savings banks' group level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variables	Z Score	Loan size	Interest rate spread
(1) NoStateGXHighDowng	0.250***	-0.129***	0.931***
(2) NoStateGXLowDowng	0.064	-0.141***	1.042***
(3) StateGXLowDowng	-0.071	-0.090*	0.658*
Z Score		-0.084***	0.673***
Loan size	-0.332***		-1.162***
Interest rate spread	0.007***	-0.003***	
Total bank assets	0.005	0.007**	0.030
Indebtedness	-0.233***	-0.046	0.021
Local GDP	0.001	-0.002*	0.003
Δ GDP	0.893	0.419	-2.365
Direct competition	-0.172*	0.037	0.092
Number mergers	-0.022	-0.015*	-0.128
Risk-free interest rate	-0.056***	0.018***	-0.577***
Intercept	2.463***	0.540***	3.371***
Difference (1)	0.250***	-0.129***	0.931***
Difference (2)-(3)	0.135***	-0.051**	0.384***
Difference-in-differences (1)-[(2)-(3)]	0.115**	-0.078*	0.547**
Observations	230,562	230,562	230,562
$Adj.R^2$	0.102	0.080	0.014

TABLE 7: Ex ante value of guarantees: Ex ante risk of savings banks

The table contains the difference-in-differences result of OLS regressions which analyze the impact of removal of government guarantees in dependence on the ex ante value of guarantees for the following variables: credit risk (*Z Score*), loan size, and interest rate spread on the borrower level. We approximate the ex ante value of guarantees by the ex ante risk taking of savings banks. The control variables are defined as in Table 4. Wald tests for the difference-in-differences terms are reported at the bottom of the table. All specifications include two-digit industry dummies (not reported). Standard errors are clustered at the savings banks' group level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variables	Z Score	Loan size	Interest rate spread
(1) NoStateGXHighRisk	0.257***	-0.093***	0.743***
(2) NoStateGXLowRisk	0.456***	-0.017	1.136***
(3) StateGXLowRisk	0.382***	0.045	0.767**
Z Score		-0.085***	0.666***
Loan size	-0.334***		-1.170***
Interest rate spread	0.007***	-0.003***	
Total bank assets	-0.009**	0.005	0.001
Downgrade	0.069***	0.017	-0.171
Indebtedness	-0.165***	-0.025	0.188
Local GDP	0.005***	-0.001	0.011
Δ GDP	0.837	0.363	-2.341
Direct competition	-0.076	0.067	0.415
Number mergers	-0.008	-0.011	-0.098
Risk-free interest rate	-0.057***	0.018***	-0.581***
Intercept	1.959***	0.378***	3.521***
Difference (1)	0.257***	-0.093***	0.743***
Difference (2)-(3)	0.073**	-0.062*	0.369**
Difference-in-differences (1)-[(2)-(3)]	0.184***	-0.031	0.374*
Observations	230,562	230,562	230,562
$Adj.R^2$	0.105	0.081	0.014

TABLE 8: The introduction of risk based regulation and prompt corrective action

The table contains the result of OLS regressions which analyze the introduction of risk weighted provisions for the group-wide reserve funds in the year 2004 on credit risk ($Z\ Score$), loan size, and interest rate spread on the borrower level. We use two dummy variables which indicate the periods 1996-2000 ($StateG$) and 2004-06 ($IntroRW$) and exclude as reference category the period 2001-03. The control variables are defined as in Table 4. All specifications include two-digit industry dummies (not reported). Standard errors are clustered at the savings banks' group level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variables	Z Score	Loan size	Interest rate spread
StateG	-0.105***	0.082***	-0.631***
IntroRW	0.205***	0.014	-0.189
Z Score		-0.084***	0.675***
Loan size	-0.333***		-1.164***
Interest rate spread	0.007***	-0.003***	
Total bank assets	0.005	0.008**	0.026
Downgrade	0.082***	0.021	-0.139
Indebtedness	-0.239***	-0.048	0.019
Local GDP	0.001	-0.002*	0.004
Δ GDP	0.071	0.321	-1.436
Direct competition	-0.172**	0.032	0.088
Number mergers	-0.004	-0.013	-0.153
Risk-free interest rate	0.009	0.023***	-0.636***
Intercept	2.104***	0.338***	5.004***
Observations	230,562	230,562	230,562
$Adj.R^2$	0.103	0.080	0.014

TABLE 9: SUR specification

The table shows the result of seemingly unrelated regression (SUR) models which simultaneously estimate the impact of the removal of government guarantees on credit risk (*Z Score*), loan size, and interest rate spreads of commercial borrowers. Results for credit risk are shown in Panel A, for loan size in Panel B, and for interest rate spread in Panel C. In specification (I) *NoStateG* equals 0 before 2001 and 1 for the years of 2001 - 2006 to identify the effect of the removal of government guarantees, specification (IIa) uses the difference in the sharpness of downgrade of the respective federal state banks by combining before/after the removal of government guarantees with high/low downgrade magnitude, specification (IIb) uses the difference in the ex ante riskiness of savings banks by combining before/after the removal of government guarantees with high/low ex ante risk using the average Z-Score before the removal, specification (III) uses two dummy variables for the periods 1996-2000 (*StateG*) and 2004-06 (*IntroRW*) to analyze the introduction of risk weighted provisions for the group-wide reserve funds in 2004. The control variables are defined as in Table 4 except the two left-hand side variables that were used in the other two regressions in Tables 4 and 6-8. Wald tests for the difference-in-differences terms are reported at the bottom of the table. All specifications include two-digit industry dummies (not reported). Standard errors are clustered at the savings banks' group level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variables	(I) Baseline	(IIa) Downgrade magnitude	(IIb) Ex ante risk of savings banks	(III) Risk based regulation
Panel A: Z-Score regressions				
NoStateG	0.174***			
(1a) NoStateGXHighDowng		0.275***		
(2a) NoStateGXLowDowng		0.088		
(3a) StateGXLowDowng		-0.038		
(1b) NoStateGXHighRisk			0.271***	
(2b) NoStateGXLowRisk			0.446***	
(3b) StateGXLowRisk			0.395***	
StateG				-0.107***
IntroRW				0.205***
Total bank assets	0.003	0.004	-0.010**	0.004
Downgrade	0.080***		0.064***	0.079***
Indebtedness	-0.228***	-0.212***	-0.153***	-0.219***
Local GDP	0.001	0.001	0.005***	0.001
Δ GDP	0.773	0.754	0.702	-0.061
Direct competition	-0.232***	-0.185**	-0.096	-0.185**
Number mergers	-0.023	-0.020	-0.006	-0.002
Risk-free interest rate	-0.058***	-0.059***	-0.059***	0.006
Intercept	2.457***	2.621***	2.153***	2.299***
Difference (1)		0.275***	0.271***	
Difference (2)-(3)		0.126***	0.051	
Difference-in-differences (1)-[(2)-(3)]		0.149***	0.220***	

TABLE 9 continued

Independent variables	(I)	(IIa)	(IIb)	(III)
	Baseline	Downgrade magnitude	Ex ante risk of savings banks	Risk based regulation
Panel B: Loan size regressions				
NoStateG	-0.092***			
(1a) NoStateGXHighDowng		-0.154***		
(2a) NoStateGXLowDowng		-0.153***		
(3a) StateGXLowDowng		-0.093*		
(1b) NoStateGXHighRisk			-0.115***	
(2b) NoStateGXLowRisk			-0.057	
(3b) StateGXLowRisk			0.011	
StateG				0.091***
IntroRW				-0.001
Total bank assets	0.008**	0.007**	0.006*	0.008**
Downgrade	0.016		0.013	0.016
Indebtedness	-0.028	-0.026	-0.012	-0.028
Local GDP	-0.002**	-0.002**	-0.002	-0.002**
Δ GDP	0.356	0.401	0.346	0.360
Direct competition	0.050	0.056	0.075	0.050
Number mergers	-0.012	-0.013	-0.011	-0.012
Risk-free interest rate	0.026***	0.026***	0.026***	0.026***
Intercept	0.320***	0.417***	0.288***	0.230***
Difference (1)		-0.154***	-0.115***	
Difference (2)-(3)		-0.060***	-0.068*	
Difference-in-differences (1)-[(2)-(3)]		-0.094**	-0.047	
Panel C: Interest rate spread regressions				
NoStateG	0.617***			
(1a) NoStateGXHighDowng		1.114***		
(2a) NoStateGXLowDowng		1.092***		
(3a) StateGXLowDowng		0.724*		
(1b) NoStateGXHighRisk			0.898***	
(2b) NoStateGXLowRisk			1.303***	
(3b) StateGXLowRisk			1.037***	
StateG				-0.668***
IntroRW				-0.156
Total bank assets	0.027	0.031	-0.005	0.026
Downgrade	-0.094		-0.133	-0.093
Indebtedness	-0.022	-0.014	0.160	-0.029
Local GDP	0.005	0.004	0.015	0.006
Δ GDP	-3.074	-3.255	-3.251	-2.439
Direct competition	-0.057	-0.060	0.280	-0.093
Number mergers	-0.131	-0.122	-0.086	-0.148
Risk-free interest rate	-0.580***	-0.581***	-0.583***	-0.629***
Intercept	6.667***	5.932***	5.892***	7.538***
Difference (1)		1.114***	0.898***	
Difference (2)-(3)		0.369***	0.266	
Difference-in-differences (1)-[(2)-(3)]		0.745***	0.631***	
Observations	230,562	230,562	230,562	230,562

TABLE 10: Screening versus monitoring

The table shows the average Z-Scores per year for newly approved borrowers (first column) and existing borrowers (second column). We require at least three observations per borrower and thus use a different sample compared to Tables 2 to 9. The sample selection process is illustrated in Figure 4. The results are broken down into two regimes. Panel A displays the years before while Panel B shows the years after the removal of government guarantees. We test the differences between the average Z-Scores before (1) and after the removal (2) by using univariate OLS with standard errors clustered at the savings bank group level. The last line reports the p value of the corresponding Wald test. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively.

	Average Z-Score	
Year	New borrowers	Existing borrowers
Panel A: Before the removal of guarantees		
1996	2.94	2.80
1997	3.04	2.80
1998	3.07	2.77
1999	3.19	2.79
2000	3.21	2.83
(1) Average	3.09	2.80
Panel B: After the removal of guarantees		
2001	3.33	2.90
2002	3.24	2.95
2003	3.39	3.06
2004	3.47	3.22
2005	3.75	3.28
2006	3.96	3.48
(2) Average	3.59	3.15
Difference (2) - (1)	0.49***	0.36***
t statistic	(6.27)	(11.16)
Difference-in-differences	0.13*	
p value, Wald test	(0.056)	

TABLE 11: Descriptive statistics and univariate analysis on the bank level

Panel A shows descriptive statistics at the savings bank level of all variables used for the regression analyses of the bank loan volume (section 5.5). The definitions of variables are given in Table 1. In contrast to the regressions on the borrower level, we use the average Z-Score and the average interest spread over all borrowers at a group of savings banks of a given year. We further use *Total bank assets*, *Number mergers*, and *Downgrade* on the savings bank level as we do not need to match these variables with borrower level data. Panel B shows the results of a univariate analysis of the impact of the removal of government guarantees on bank loan volumes (in billions of Euros). The number of observations is 4,708. The averages are calculated for the two phases of the removal of government guarantees: government guarantees in place (1996-2000) and discontinued government guarantees (2001-06). In the first line, the results are broken down into different values of ex ante guarantees using our first proxy: low/high downgrade stands for savings banks for which the respective federal state bank experienced a low/high downgrade (see the last line in Table 5). In the second line, the results are broken down into different values of ex ante guarantees using our second proxy: low/high ex ante risk stands for different levels of ex ante riskiness of the savings banks before the removal of guarantees. The third column shows the comparisons of bank loan volume before and after the removal of government guarantees. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively, using univariate OLS with standard errors clustered at the savings bank level.

Panel A: Descriptive statistics

Variable	Unit	N	Mean	SD	5p	25p	50p	75p	95p
Bank loan volumes	EUR bn	4,708	0.54	0.89	0.05	0.15	0.30	0.62	1.79
Z Score	-	4,708	3.06	0.41	2.46	2.77	3.02	3.32	3.77
Interest rate spread	Percent	4,708	3.45	0.67	2.23	2.99	3.47	3.94	4.44
Total bank assets	EUR bn	4,708	1.88	2.51	0.25	0.67	1.18	2.18	5.46
Downgrade	Notches	4,708	2.29	1.06	1.00	1.50	2.00	2.50	4.00
Indebtedness	EUR thousands	4,708	1.07	0.36	0.64	0.86	1.00	1.19	1.80
Local GDP	EUR bn	4,708	28.76	29.34	7.88	12.88	22.67	30.45	74.03
Δ GDP	Percent	4,708	0.77	1.98	-2.16	-0.34	0.64	1.94	3.45
Direct competition	-	4,708	0.86	0.27	0.45	0.67	0.84	1.00	1.36
Number mergers	-	4,708	0.03	0.18	0.00	0.00	0.00	0.00	0.00
Risk-free interest rate	Percent	4,708	3.06	0.72	2.05	2.32	3.18	3.41	4.37

Panel B: Univariate analysis of the bank loan level

Regime		1996-2000	2001-06	Difference
Downgrade of federal state banks	Overall	0.567	0.525	-0.042*
	Low downgrade	0.583	0.546	-0.037
	High downgrade	0.515	0.455	-0.061***
Ex ante risk level	Overall	0.567	0.525	-0.042*
	Low ex ante risk	0.649	0.631	-0.019
	High ex ante risk	0.482	0.418	-0.063***

TABLE 12: Impact of removal of government guarantees on bank loan volumes

The table contains the result of OLS regressions which analyze the impact of removal of government guarantees on loan volumes on the bank level. In specification (I) *NoStateG* equals 0 before 2001 and 1 for the years of 2001 - 2006. Specification (IIa) uses the difference in the rating downgrade magnitude of the respective federal state banks. Specification (IIb) uses the difference in the ex ante riskiness of savings banks. Specification (III) uses two dummy variables for the periods 1996-2000 (*StateG*) and 2004-06 (*IntroRW*). *Z Score*, *Interest rate spread*, and *Total bank assets* are lagged by one year. *Z Score* and *Interest rate spread* are on the savings bank group level. We use *Total bank assets*, *Number mergers*, and *Downgrade* on the savings bank level as we do not need to match these variables with borrower level data. The other control variables are defined as in Table 4. Wald tests for the difference-in-differences terms are reported at the bottom of the table. Standard errors are clustered at the savings bank level. *,**,*** indicate significance at the 10%, 5% and 1% level, respectively.

Independent variables	(I) Baseline	(IIa) Downgrade magnitude	(IIb) Ex ante risk of savings banks	(III) Risk based regulation
NoStateG	-0.125***			
(1a) NoStateGXHighDowng		-0.112***		
(2a) NoStateGXLowDowng		-0.024		
(3a) StateGXLowDowng		0.108***		
(1b) NoStateGXHighRisk			-0.125***	
(2b) NoStateGXLowRisk			-0.139***	
(3b) StateGXLowRisk			-0.009	
StateG				0.112***
IntroRW				-0.034***
Z Score	0.070***	0.075***	0.080***	0.072***
Interest rate spread	-0.019**	-0.030***	-0.019**	-0.011
Total bank assets	0.349***	0.349***	0.349***	0.349***
Downgrade	-0.017*		-0.017**	-0.017*
Indebtedness	-0.082*	-0.076	-0.083**	-0.081*
Local GDP	0.0004*	0.0003	0.0004*	0.0004
Δ GDP	-0.294	-0.158	-0.292	-0.210
Direct competition	0.054*	0.072**	0.055**	0.053*
Number mergers	-0.088**	-0.086**	-0.087**	-0.090**
Risk-free interest rate	0.005	-0.001	0.006	-0.0001
Intercept	-0.119*	-0.217***	-0.146**	-0.248***
Difference (1)		-0.112***	-0.125***	
Difference (2)-(3)		-0.131***	-0.130***	
Difference-in-differences (1)-[(2)-(3)]		0.020	-0.005	
Observations	4,708	4,708	4,708	4,708
$Adj.R^2$	0.914	0.915	0.914	0.914