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ECONOMIC PAPERS

Tobias Körner

Board Accountability and Risk Taking in Banking

Evidence from a Quasi-Experiment

Ruhr Graduate School in Economics

#313

Imprint

Ruhr Economic Papers

Published by

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

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Ruhr Economic Papers #313

Responsible Editor: Christoph M. Schmidt

ISSN 1864-4872 (online) – ISBN 978-3-86788-359-7

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Bibliografische Informationen der Deutschen Nationalbibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über: *http://dnb.d-nb.de* abrufbar.

http://dx.doi.org/10.4419/86788359
ISSN 1864-4872 (online)
ISBN 978-3-86788-359-7

Tobias Körner[1]

Board Accountability and Risk Taking in Banking – Evidence from a Quasi-Experiment

Abstract

In this paper, a law reform is evaluated that aimed at improving the corporate governance of German savings banks by tightening accountability and legal liability of outside directors. The causal effect of this reform on bank risk is identified by difference-in-differences and triple differences strategies. The estimation results show that savings banks subject to the reform increased capital and liquidity ratios. Hence, they have become less vulnerable to unexpected losses and liquidity shocks. This indicates that the low occurrence of outside director litigation reflects incentive effects of current liability regimes.

JEL Classification: G21, G38, K20

Keywords: Corporate governance; outside directors; legal liability; bank risk

January 2012

1 RGS Econ. – I thank Thomas K. Bauer, Daniel Baumgarten, Alfredo R. Paloyo, Christoph M. Schmidt and Isabel Schnabel for their valuable comments and suggestions. I also benefited from comments by participants of the RGS Workshop at RWI Essen, the Brown Bag Seminar at the University of Mainz, the RGS Doctoral Conference in Economics 2011 in Dortmund, the Annual Congress of the European Economic Association 2011 in Oslo and the Annual Congress of the Verein für Socialpolitik 2011 in Frankfurt. Financial support from the Leibniz Association through RGS Econ and from FAZIT Foundation is gratefully acknowledged. *– All correspondence to: Tobias Körner, RGS Econ, c/o RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, E-Mail: tobias.koerner@rwi-essen.de.*

1 Introduction

The failure of boards has been identified by policy makers and policy advisors as critical when it comes to explaining the severe problems and near-collapses of many banking and financial firms in the liquidity and banking crisis of 2007/2008. For example, the OECD views inappropriate risk management and misaligned incentive-based pay as the result of poor board decisions (OECD, 2009). In his report for the UK government, Walker (2009, p. 6) argues that 'massively different outcomes [of banking firms] can only be fully explained in terms of differences in the way they were run [...], a matter of their boards'. At the same time, governance through boards is not only viewed as the source of the problems but also as a promising solution. Therefore, the Basel Committee emphasizes the vital interest of banking supervisors in sound corporate governance practices and the ultimate responsibility of boards in implementing and exercising such practices (Bank for International Settlements, 2010).

However, there is much less consensus about how improvements in board-level governance can be achieved; in particular, it is unclear which kind of mechanisms should be in place to incentivize board members to act as qualified advisors and diligent monitors. Based on the notion that the actual legal devices lack financial bite, policy advisors in Germany have proposed to strengthen accountability and personal liability of supervisory board members (Hellwig, 2010; Wissenschaftlicher Beirat, 2010).[1] In the aftermath of the banking crisis, this proposal is gaining increasing support by the fact that yet not a single supervisory board member has been made personally liable for condoning business models that eventually endangered the mere existence of the financial institutions entrusted to them by shareholders. This is all the more remarkable, as legal scholars repeatedly made the point that German corporate law requires the managing directors to take legal action against supervisory board members (see, e.g., Lutter, 2009). Although this might seem quite paradoxical in the case of bank failure, managing directors would have to sue their own supervisory boards for not preventing them from taking excessive risks. This is simply not happening.

Conjectures that legal devices do not expose supervisory board members to significant liability risks and thus do not provide meaningful incentives also apply to other countries.

[1] As a first step into this direction German legislative bodies in November 2010 passed a law that extends the limitation period for damage claims of banks against directors for breaches of duty from five to ten years (Bundesrat Drucksache 681/10).

In a comparative legal study including Common Law (UK, Australia and Canada) and Civil Law countries (Germany, France and Japan), Black and Cheffins (2006) document that legal liability rarely leads to payments of outside directors. According to the authors this reflects a combination of different factors, most prominently procedural considerations, that in practice reduce actual liability risks substantially.[2] Even for the U.S., which is commonly viewed as the toughest legal environment an outside director can be exposed to, Black, Cheffins and Klausner (2006) conclude that actual liability risks are low, thanks to indemnification, liability insurance and settlement incentives. Consequently, in its conclusions about corporate governance responses to shortcomings revealed by the recent financial crisis, the OECD recommends to keep board member liability 'on the policy agenda since it is not clear that effective arrangements are yet in place' (OECD, 2010, p. 17).

In light of these conjectures and recent moves towards policy reform, it seems imperative to gain a better understanding on how the actual rules and mechanisms governing the liability of outside directors affect their behavior and ultimately feed into outcomes at the bank level. It is the ultimate motive of policy reform to alter the incentive structure of outside directors in order to induce more prudent behavior. Therefore, it is desirable to assess the prospects of such reforms. Existing evidence on liability regimes is mostly anecdotal and inconclusive about incentive effects. In particular, counting the number of cases that led to out-of-pocket liability of outside directors (see, e.g., Black and Cheffins, 2006) reveals little about incentives: a low number of cases is equally consistent with strong incentive effects (supervisory board members chose high effort levels to avoid liability) and practical irrelevance (liability risks are practically non-existent).

This paper seeks to contribute to the understanding of existing liability regimes by providing for the first time systematic evidence on the relationship between outside director liability and risk taking of banks. Specifically, this paper evaluates a law reform concerning German savings banks, which form the retail basis of a large financial network ('Sparkassen-Finanzgruppe'). The aggregated balance sheet of this network exceeds the business volume of Europe's largest banking groups. Since savings banks are not only governed by nation-wide laws but also by laws of the federal states, reforms of federal state laws can give rise to a quasi-experimental setting. In particular, I argue that the

[2]Similar conclusions are reached for Korea, which is treated in a separate study (Black, Cheffins and Klausner, 2005).

2004 reform of the savings banks law of Lower Saxony can be interpreted as an exogenous increase in the probability of outside directors to be held accountable and to be made personally liable for breaches of duty. Comparing the outcomes of savings banks situated in Lower Saxony with outcomes of savings banks in other federal states, I seek to learn about the causal impact of board accountability on risk taking of banks.

Given the existing conjectures about the ineffectiveness of legal liability rules, the results seem surprising: the difference-in-differences estimates indicate that savings banks in the reform state increased their capital ratios due to the reform. The increase is statistically significant; in economic terms, it is small to moderate. For instance, the equity ratio increased by roughly 0.13 percentage points, which amounts to about 2.5 percent of the pre-reform average. Furthermore, the estimation results on liquidity-risk proxies as measures of bank risk point into the same direction. Hence, savings banks in the reform state have become more resilient against insolvency and liquidity risks. Including cooperative banks as an additional control group not affected by the law reform and employing a triple-differences estimator confirms these conclusions. Thus, the results suggest that tightening accountability of boards and increasing nominal liability of outside directors can alter bank risk, even though actual liability risks might have remained small.

The economic literature on outside director incentives mainly focuses on monetary rewards (e.g., Yermack, 2004; Adams and Ferreira, 2008), performance sensitivity of director compensation (e.g., Perry, 1999; Yermack, 2004) and reputation concerns (e.g., Fich and Shivdasani, 2007; Fahlenbrach, Low and Stulz, 2010), whereas little attention is paid to legal liability of outside directors. The reason might be that outside directors are believed to be widely protected against out-of-pocket liability by indemnification arrangements and liability insurance. Among the few exceptions of studies dealing with legal liability as a potential source of incentives are Laux (2010) and Bradley and Chen (2011). In his theoretical contribution, Laux (2010) argues that outside directors face two different options when confronted with tightened liability risks from accounting manipulation. Apart from exerting more effort in monitoring the management, they can change management pay towards less performance sensitivity, reducing the incentives of managers to engage in accounting manipulation. Tightened liability tends to lead outside directors to exercise more board oversight if the marginal costs of monitoring are low. This suggests that the impact of tightened liability depends on the complexity of a firm's business operations.

Bradley and Chen (2011) examine empirically whether limited liability provisions and indemnification influence risk taking and thus the cost of debt of U.S. publicly traded firms. They hypothesize that these arrangements largely insulate both managing and outside directors from shareholder litigation. Hence, directors are not punished for overly conservative business strategies. These are generally preferred by directors because they are concerned about their private benefits from control and their firm-specific human capital. Consistent with this argument, Bradley and Chen (2011) find that firms that provide more director protection appear to be less risky and enjoy lower costs of debt.

More generally, this paper contributes to the empirical literature on the relationship between governance through boards and risk taking of banks. Only recently it has been fully acknowledged that the specific nature of banks requires a separate treatment with regard to corporate governance in general (Adams, 2010; Laeven and Levine, 2009) and board-level governance in particular. Recent evidence indicates that board characteristics are related to bank risk.

Using a sample of publicly listed U.S. bank holding companies, Pathan (2009) documents that larger boards, more independent boards, and more powerful CEOs are associated with less bank risk as measured by several risk proxies based on stock returns. This is consistent with the hypothesis that smaller boards are better suited to push the management to pursue the objectives of shareholders, which ultimately leads to more risky business strategies. In turn, a more powerful CEO (a CEO that is internally hired) might be able to accomplish his preferred level of low risk taking. In this regard, the results on board independence appear contradictory. Independence of directors also might reflect independence from shareholders and thus a stronger emphasis on regulatory compliance.

Adams (2009) and Beltratti and Stulz (2010) focus on bank governance and banking outcomes during the recent banking and liquidity crisis. After establishing that board characteristics commonly viewed as crucial for sound corporate governance significantly differ for U.S. banks and non-financial firms, Adams (2009) compares banks that received assistance from the U.S. Trouble Asset Relief Programm (TARP) with banks that did not.[3] She finds that TARP banks tend to have larger and more independent boards. Moreover, directors of TARP banks hold more directorships in other companies. Thus, provided that in banking independence might be associated with a lack of industry-specific financial expertise, a tentative conclusion is that TARP banks are worse governed.

[3]Due to data constraints the sample is restricted to publicly listed bank holding companies.

Beltratti and Stulz (2010) examine the stock market performance of banks during the liquidity and banking crisis. Their sample consists of large publicly listed banks in 20 countries. Specifically, they relate crisis performance to various measures of corporate governance, external governance and banks' balance sheet characteristics. Two results stand out: First, among the various governance variables, an indicator measuring the shareholder friendliness of boards appears to be most robust. The more shareholder friendly are their boards, the lower are the stock returns of banks during the crisis. Second, pre-crisis stock returns are clearly negatively associated with crisis performance. This is consistent with the view that boards pushed banks to engage in business strategies that were valued highly by shareholders before the crisis and that turned out to be a source of weakness during the financial turmoil.

The remainder of this paper is organized as follows. Section 2 outlines the institutional background and gives an overview of the law reform under study. Section 3 introduces the empirical approach and describes the data. Section 4 presents the results. Section 5 concludes.

2 Institutional Background

2.1 Savings Banks in Germany

The aim of this paper is to generate evidence on the causal relationship between board accountability and risk taking of banks by evaluating a policy reform concerning German savings banks. Therefore, to get a sense of the subjects under study, this section discusses briefly the relevant characteristics of savings banks and outlines the 2004 savings banks reform in Lower Saxony in some detail.[4]

Savings banks are regionally operating public-law banks with a strong retail focus.[5] Generally, they engage in any kind of banking business. However, traditional banking activities

[4]For a more detailed overview of savings banks and their role within the German banking system, see Hackethal (2004).

[5]A few savings banks historically have been organized as private-law banks. Among 431 savings banks as of year-end 2009 six savings banks were chartered as private-law stock corporations.

- taking deposits and extending loans - still form the main pillar of their business model.[6] The typical savings bank predominantly extends loans to individuals and to small- and medium-sized firms. Funding largely relies on deposits and, to some extent, on interbank loans. Funding on capital markets plays only a minor role.

Laws governing the external legal matters of banking firms, including their contractual relationships to borrowers and debtors, equally apply to all banks, no matter whether they are chartered under public or private law, or in which federal state they are chartered. The same is true for any legislation concerning the regulation and supervision of banks and banking activities. In contrast, the internal legal matters are governed by legal form-specific organization laws, and, in the case of public-law savings banks, these laws differ between federal states. In fact, most federal states have enacted state-specific savings banks laws.[7]

As organization laws specific to public-law savings banks, these laws dictate the charter of a savings bank, define the relationship between the banks and their owners, and outline the cornerstones of corporate governance. The state-specific laws generally have in common that savings banks can only be chartered by one or several municipalities. Private investors are not allowed to acquire equity in savings banks. Savings banks have to fulfill a public mandate. In this regard, they are supposed to support the chartering municipalities and to serve people and firms within the municipal territory. Furthermore, they are only allowed to conduct business within this territory, thereby being insulated from competition from other savings banks.

As with German banks chartered under private law, it is mandatory for savings banks to have a two-tier board that comprises managing directors (*Vorstand*) and a supervisory board (*Verwaltungsrat*). Managing directors are appointed by the supervisory board. The appointment has to be approved by the federal banking supervision authority (BaFin) that examines the managers' professional capacities. The supervisory board consists of outside directors, and, according to co-determination, to at least one third of bank employees.[8] The supervisory board members are appointed by the municipal parliaments. Many of

[6] As of year-end 2007, the mean customer loans-to-assets ratio of savings banks in the sample was about 59 percent, and the mean deposits-to-assets ratio was about 66 percent. See Table 4.

[7] The only exception is Hamburg where the only savings bank is a private-law stock corporation.

[8] The terms 'supervisory board' and 'outside directors' are used interchangeably throughout the paper.

them are members of the parliaments themselves, and often they are closely associated with the governing parties.

2.2 Savings Banks Reform in Lower Saxony: Overview

The government of Lower Saxony justified the law reform of 2004 with three major reform goals.[9] First, to confirm the public mandate of savings banks; second, to clarify the question of ownership of savings banks; third, to improve corporate governance by adapting the recommendations of the German Corporate Governance Code.[10]

Giving savings banks a public mandate justifies entrepreneurial activities of the state in the financial sector, which - in absence of such a mandate - could hardly be reconciled with the German constitution. In this regard, the savings banks law of Lower Saxony explicitly emphasizes the area-wide provision of financial services to private households and firms, in particular small- and medium-sized firms. Moreover, savings banks are supposed to maintain and enforce competition in the local banking markets. Finally and more generally, savings banks shall support the chartering municipalities in fulfilling the obligations owed to the public. In defining the public mandate, the new savings banks law of Lower Saxony almost literally contains the formulations of the old savings banks law. Furthermore, legal provisions were introduced that aim at avoiding outright liquidation of savings banks, and thus at ensuring the continued provision of financial services even in sparsely populated areas. Hence, as claimed by the government of Lower Saxony, the new law confirms and, to some extent, strengthens the public mandate.

With regard to ownership, rules have been incorporated into the new savings banks law that render private ownership of savings banks impossible. To address recurring public debates about privatization and opening of savings banks to private investors, the new law confirms that savings banks belong to the municipalities, and no private entity or person can acquire interest in them. Additionally, as a response to attempts to circumvent the

[9] See Niedersächsischer Landtag [State Parliament of Lower Saxony], Drucksache 15/1220. This section partially draws on Berger (2006), pp. 24, who gives a detailed overview of the reform.

[10] The German Corporate Governance Code aims at strengthening trust of investors in the corporate governance of German listed stock corporations. It contains corporate governance rules of the German Stock Corporation Act (Aktiengesetz) and recommendations of best practices for 'good' corporate governance. These recommendations are not binding. However, management and supervisory boards are obliged once a year to confirm compliance with recommendations, or to explain the reasons for non-compliance.

no-privatization dogma by means of assets deals, the new law ensures that distressed savings banks are not allowed to sell operating assets as long as liquidation has not been approved by public authorities. Hence, with regard to ownership, the law reform is meant to preserve the status quo.

2.3 Improving Corporate Governance of Savings Banks

Finally, the third reform goal was to improve corporate governance. I argue that in contrast to the other two major goals, the new legislation brought actual and substantive changes, and these changes mainly affected the accountability and liability of board members.

As before, savings banks are required to have a managing board and a supervisory board. However, the new law clearly defines tasks and competencies of managing and outside directors, and, more importantly, it strictly separates their responsibilities. Before the reform, outside directors determined the general business policies of savings banks. Now, this is left to the managing directors; they take the initiative, and their proposals have to be approved by the supervisory board. In contrast, to avoid conflicts of interests, managing directors are not members of the credit committee anymore, which is now formed by members of the supervisory board only. The primary responsibilities of outside directors have been shifted to monitoring managers. To fulfill their duties as monitors, outside directors have been given stronger rights to acquire information from the managing directors. Hence, their role has been adapted to the role of supervisory boards of stock corporations.

Furthermore, the law reform introduced rules to foster transparency in decision making. For example, the maximum number of supervisory board members has been reduced from 21 to 18. More importantly, board members are not allowed to appoint substitute members any more, which reduced overall board sizes substantially. Borrowing from the German Corporate Governance Code, the new law contains explicit rules for the frequency of board meetings and decision making, and it requires board members to develop rules of internal procedure.

All these changes have one objective: to foster board accountability. The new rules clearly state what boards are expected to do and how to do it, and they make it easier to attribute

to board members what has been done. Consequently, the new rules make it easier to identify a breach of duty.

Consistent with more accountability, the law reform goes one step further, and for the first time incorporates liability rules for outside directors into savings banks law. These rules explicitly state that outside directors are obliged to pay compensation for damages to the savings bank that arise from a breach of duty. Before the law reform, it has been widely assumed that - if at all - outside directors are liable only for gross negligence or willful intent (Berger, 2000). The principal reason for this is that, due to the nature of savings banks as public-law entities, the status of outside directors has been considered as similar to the status of civil servants. These people generally enjoy the privilege of low liability standards.[11] After the law reform, with explicit liability rules borrowed from stock corporation law, outside directors are not treated differently than outside directors of private-law corporations anymore. In particular, they can be held liable in any case of negligence.

Two minor elements of the law reform have to be noted, since in principle they could affect the outcome variables of the subsequent empirical analysis, too. First, due to the reform savings banks now have more discretion in conducting banking business. The old legislation explicitly listed the banking activities savings banks were allowed to do. Activities not listed could either not be conducted at all or only after approval by municipal authorities. The rationale for this was to limit risks of savings banks, since municipalities were exposed to bank risks through extensive explicit public guarantees.[12] After the 2001 agreement between the European Commission and the German government to abolish public guarantees, the business constraints for savings banks became obsolete. Consequently, the new law allows savings banks to conduct any kind of banking business in line with the federal banking act and territorial restrictions.

Second, rules regarding the distribution of profits were changed. As before, the supervisory board decides which amount of profits will be retained to build up bank capital and which

[11] Lutter (1991, pp. 126) holds a different view. He argues that the privileged status applies only in those federal states where laws concerning the status of civil servants are explicitly referenced in the savings banks law. He acknowledges, however, that this is against the commonly held view in the savings banks literature.

[12] Public guarantees required the chartering municipalities to maintain the business operations of savings banks under any circumstances and thus rendered defaults of savings banks impossible (*Anstaltslast*). Moreover, the chartering municipalities were directly liable to the creditors of savings banks (*Gewährträgerhaftung*).

amount will be paid out as dividends to the chartering municipality. However, the boards have been given more degrees of freedom, since under certain conditions both amounts are not limited anymore.

To sum up, the new savings banks law of Lower Saxony is first and foremost an attempt to improve corporate governance of savings banks. To achieve this, responsibilities between managing and directors were clearly separated, and outside directors were incentivized by tightening personal liability. Other main reform elements reflect the current legal status of savings banks and are meant to preserve the status quo, in particular with regard to ownership. Hence, the law reform can be interpreted as an exogenous increase in the probability of outside directors to be held accountable and to be held personally liable for breaches of duty.

3 Empirical Approach

3.1 Identification

To identify the effect of the law reform on risk taking of savings banks, I employ a difference-in-differences strategy. I compare outcomes of savings banks in Lower Saxony before and after the law reform with outcomes of savings banks in other federal states over the same time horizon. Formally, I seek to identify the quantity

$$\mathrm{E}[y_{1i} - y_{0i} | s = \text{Lower Saxony}, t = \text{after reform}], \tag{1}$$

where y_1 denotes potential risk taking with the law reform and y_0 without, which is unobservable; s denotes the federal state, and t indexes time.

The standard difference-in-differences assumptions are

$$\mathrm{E}[y_{0i} | s, t] = \gamma_s + \lambda_t \tag{2}$$

$$\mathrm{E}[y_{1i} | s, t] = \mathrm{E}[y_{0i} | s, t] + \delta, \tag{3}$$

that is, the mean outcome without law reform can be written as the sum of a state-specific component γ_s that does not vary over time, and a time effect λ_t that does not vary across states. Furthermore, the reform effect is just to add a constant δ.

Given these assumptions, the estimand is identified by taking double differences:

$$\begin{aligned}\delta = {} & \mathrm{E}[y_{1i}|s = \text{Lower Saxony}, t = \text{after reform}] - \mathrm{E}[y_{0i}|s = \text{Lower Saxony}, t = \text{before}] \\ & - \big[\mathrm{E}[y_{0i}|s = \text{comparison}, t = \text{after reform}] - \mathrm{E}[y_{0i}|s = \text{comparison}, t = \text{before}]\big].\end{aligned} \tag{4}$$

Clearly, assumption (2) is critical: it excludes interactions between state and year effects. This implies that there should be no other factors besides the law reform that affected risk taking of savings banks in Lower Saxony and in other federal states in different ways. Put differently, in absence of the reform, the difference in mean outcomes between savings banks in Lower Saxony and other federal states should have remained constant. This assumption cannot be tested. However, to account for observable time-varying factors that might confound the reform effect, I include a large set of control variables that reflect economic conditions in the federal states and other determinants of bank risk.

Instead of replacing the population means of (4) by sample analogues, I estimate a regression model. Enriched by bank-fixed effects γ_i and a vector of state-level controls $\mathbf{x}_{st}$, the regression equation is

$$y_{ist} = \gamma_i + \lambda_t + \delta \cdot d_{st} + \boldsymbol{\beta}'\mathbf{x}_{st} + \epsilon_{ist}, \tag{5}$$

where d_{st} indicates savings banks in Lower Saxony in 2005 or later years.

3.2 Data and Variables

3.2.1 Measures of Bank Risk

To measure risk taking of savings banks, I primarily focus on capital ratios. As will be explained below, this is a natural choice, since outside directors are directly involved in determining these ratios. In addition, I also consider some crude measures of liquidity risk. All risk variables are calculated on the basis of unconsolidated annual balance sheet data provided by Bureau van Dijk's Bankscope database. The period under study begins in 2002, one year after the agreement between the European Commission and the German government on the guarantees of public sector banks. It ends in 2007, just before the financial and banking crisis peaked. Bankscope covers all savings banks in Lower Saxony and almost all savings banks in the rest of Germany. On average, roughly 10

banks per year are missing. I exclude private-law savings banks from the sample since these banks differ from public-law savings banks with regard to governance structures.[13] The estimation sample contains 2748 bank-year observations in 14 federal states.[14] The number of single banks is 491 in 2002. Due to continued merger activity within the savings bank sector, this number decreases to 434 in 2007. Between 46 (2007) and 50 (2002) savings banks are situated in Lower Saxony.

I examine three types of capital ratios. First, I relate security reserves to total assets.[15] Security reserves are profits retained and accumulated according to the requirements of the savings banks laws of the federal states. They form the most important source of capital for savings banks, since, unlike stock corporations, they cannot raise equity funds in capital markets. Besides, they cannot rely on capital injections from their chronically underfunded owners. Given the role of supervisory boards in deciding over the distribution of profits, it is natural to look at security reserves as an outcome variable. In the years before the reform, average security reserves to total assets of savings banks in Lower Saxony were 5.16 percent (Table 1). After the reform it increased by 0.55 percentage points, suggesting at first sight a relatively strong reform effect. However, the ratio also increased in other federal states, from 4.43 to 4.84 percent. This indicates that a large part of the increase in Lower Saxony might be explained by a trend common to all savings banks.

The second capital ratio, book equity divided by total assets, is also a natural candidate to study. As in determining security reserves, outside directors play a crucial role here, too, since they decide whether to accept capital contributions of 'silent' (i.e. non-controlling) partners (*Stille Einlagen*). Together with security reserves and balance sheet profits, capital contributions form the three typical components of book equity of savings banks. On average, the equity ratio of savings banks in Lower Saxony was 5.35 percent before the reform and 5.9 percent after the reform. Outside Lower Saxony, the ratio started at a considerably lower level, 4.63 percent, and increased by 0.42 percentage points to 5.05 percent.

[13] Including private-law savings banks hardly affects the regression results, though.

[14] Two federal states, Hamburg and Berlin, are not included in the analysis. The only savings bank in Hamburg is a private-law stock corporation (HASPA AG). The only savings banks in Berlin (Berliner Sparkasse) is integrated in Landesbank Berlin AG and does not publish separate financial statements.

[15] Detailed variable definitions are given in the Appendix.

The third capital ratio is the most comprehensive one. In addition to equity it comprises profit participation rights (*Genussrechte*) and subordinated debt. I call this supplemented capital ratio, since these debt instruments can be used to supplement core capital in order to fulfill regulatory capital requirements. Before the reform, the mean ratios in Lower Saxony and other federal states were quite similar (6.51 percent and 6.54 percent, respectively). This shows that state differences in the other two capital ratios do not necessarily reflect differences in insolvency risks. Rather, in building buffers against unexpected losses savings banks outside Lower Saxony on average seem to rely more on supplementary capital components. The supplemented capital ratios increased over time, both for savings banks in Lower Saxony and other federal states. In contrast to the other capital ratios, the increase in Lower Saxony is considerably larger than in the comparison states (0.56 vs. 0.23 percentage points).

Arguably, since the most important component of all capital ratios is (retained) profits, these ratios might capture the impact of the reform on bank profitability rather than on risk taking. Therefore, to underpin the interpretation of the results as risk taking effects, I consider additional risk proxies, namely liquidity ratios (liquid assets divided by total assets) and crude measures of maturity mismatch (liquid assets divided by short-term funding). These give some indications about the vulnerability of savings banks to liquidity shocks. Variable means displayed in Table 1 show substantial differences between Lower Saxony and the other federal states. They are much lower in Lower Saxony in both time periods before and after the reform. Thus, savings banks in Lower Saxony on average seem to be less prepared for liquidity shocks. In Lower Saxony, both variable means slightly increased after the reform, while in the other states they dropped moderately.

Overall, these simple mean comparisons suggest that insolvency and liquidity risks of Lower Saxony savings banks decreased after the reform. However, it remains to be seen whether this first impression can be confirmed, and, in particular, whether it reflects the causal effect of the reform on bank risk.

3.2.2 Assessing Long-Run Trends

As a first step, it is worthwhile to assess the long-run evolution of bank risk in Lower Saxony and other federals states. Although the critical identification assumption cannot be tested, the inspection of outcomes in reform and non-reform states before the reform

Table 1: Variable means of savings banks before and after the reform

Variable	Niedersachsen 2002–2004	Niedersachsen 2005–2007	Other federal states 2002–2004	Other federal states 2005–2007
A. Measures of bank risk				
Security reserves/total assets (%)	5.16	5.71	4.43	4.84
	(0.80)	(0.96)	(1.01)	(1.06)
Book equity/total assets (%)	5.35	5.90	4.63	5.05
	(0.78)	(0.94)	(0.99)	(1.03)
Supplemented capital/total assets (%)	6.51	7.07	6.54	6.77
	(0.89)	(0.90)	(1.66)	(1.67)
Liquid assets/total assets (%)	22.70	22.77	30.12	28.80
	(8.63)	(8.82)	(11.39)	(11.56)
Liquid assets/short term funding (%)	44.17	45.13	56.48	52.88
	(16.44)	(18.26)	(17.75)	(18.16)
B. State-level control variables				
Real GDP growth	0.0023	0.0229	0.0064	0.0202
(first difference of log real GDP)	-	-	(0.0119)	(0.0130)
Log insolvency proceedings	7.999	7.977	7.415	7.204
	-	-	(0.928)	(0.964)
Municipal deficits	–0.175	–0.173	–0.138	–0.143
(in EUR 1,000 per inhabitant)	-	-	(0.203)	(0.265)
Municipal debt	1.028	0.980	1.130	1.107
(in EUR 1,000 per inhabitant)	-	-	(0.259)	(0.264)
Population density	167.65	167.75	338.10	337.05
(inhabitants per km^2)	-	-	(400.22)	(401.63)
Net interest margin	2.72	2.70	2.59	2.42
of cooperative competitors (%)	-	-	(0.31)	(0.36)

Notes: Numbers in parentheses are standard deviations. The number of bank-year observations in Lower Saxony is 148 (141) in 2002-2004 (2005-2007), and 1279 (1189) in other federal states. For liquid assets/total assets the number of observations is 148 (141), and 1269 (1188), respectively. For liquid assets/short-term funding the number of observations is 145 (135), and 1243 (1149), respectively. The number of other federal states is 13. Exact definitions of variables are given in the Appendix.

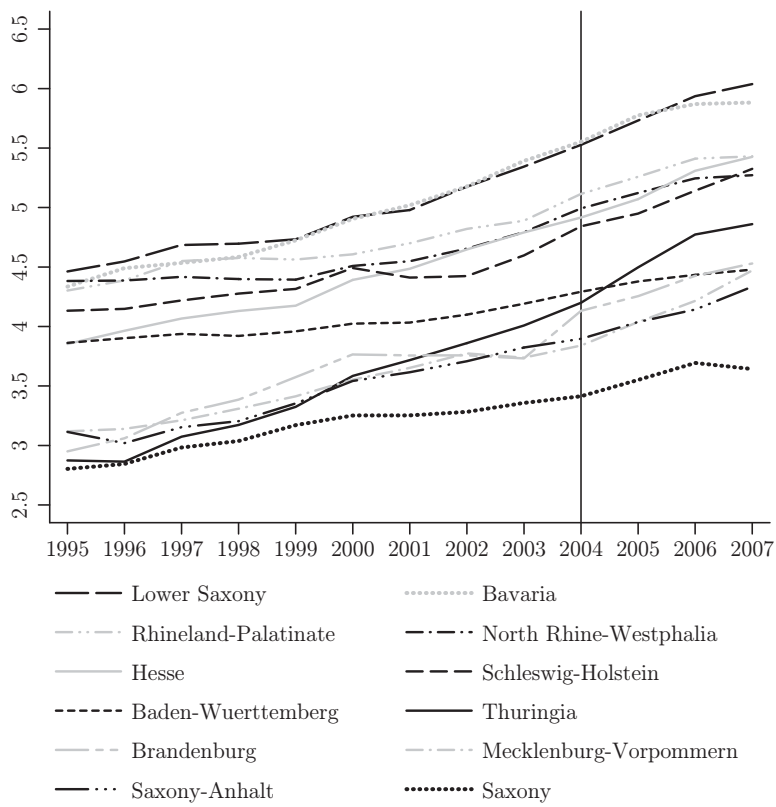
can provide some credibility assessments. Therefore, Figure 1 displays the evolution of equity ratios of savings banks in Lower Saxony and other German federals states from 1995 onwards.

As already seen from Table 1, savings banks in Lower Saxony on average have higher equity ratios than savings banks in most other federal states. This is true in the long run, too. Only savings banks in Bavaria exhibit equity ratios of similar magnitude. In fact, from 1999 to 2005 mean equity ratios in Lower Saxony and Bavaria were almost the same. Moreover, most other West-German states (Rhineland-Palatinate, North Rhine-Westphalia, Hesse, Schleswig-Holstein) show similar growth paths: even if their savings banks hold on average less equity, the differences in mean equity ratios with respect to Lower Saxony seem to be roughly constant over time. Most importantly, this applies to the recent pre-reform years. These years are of particular interest, since they will be included in the regression analysis. One notable exception is Baden-Württemberg where equity ratios grow quite slowly. As a result, long-run trends in Baden-Württemberg and Lower Saxony clearly drift apart.

Figure 1 also documents an east-west gap of equity ratios. Savings banks in East-German states (Thuringia, Brandenburg, Mecklenburg-Vorpommern, Saxony-Anhalt, Saxony) on average have considerably lower equity ratios than savings banks in West-German states. If at all, the gap closes only very slowly. In one case, Saxony, the gap even widens. This indicates that Saxony might be a poor control group. In addition, when looking at recent years before the reform only, the picture becomes less convincing for Brandenburg, Mecklenburg-Vorpommern and Saxony-Anhalt, too. A sharp kink in 2003 (Brandenburg) and a relative decrease in equity ratios compared to Lower Saxony (Mecklenburg-Vorpommern and Saxony-Anhalt) make it doubtful whether the identification assumption holds for these states.

However, the overall impression is that savings banks in Lower Saxony and in most other federal states follow a common trend. Hence, the long-run evolution of equity ratios does not contradict the identification assumption. On the contrary, it provides some confidence that the assumption is fulfilled. Nevertheless, I reran the regressions leaving out the states identified as suspicious by means of Figure 1. The results hardly changed, no matter which combination of Baden-Württemberg and East-German states was left out.

Figure 1: Mean equity ratio of savings banks by federal state



Notes: The figure shows the evolution of federal state means of book equity/total assets of savings banks (in percent). Due to the low number of observations, Bremen (one observation per year) and Saarland (seven observations per year) are not displayed. The exact variable definition is given in the Appendix.

3.2.3 Control Variables at the State Level

In addition to bank- and year-fixed effects, the regression analysis includes a wide range of control variables that are meant to capture factors that potentially confound the reform effect.

First, the regression models include two measures of economic activity in the federal states, the annual growth rate of real GDP and the number of firms that filed for insolvency (in logs). These measures can be expected to be correlated with default probabilities of savings banks' borrowers. For example, one could imagine that borrowers of savings banks in Lower Saxony relative to borrowers in other federal states became more likely to default - for reasons not related to the reform such as a regional economic downturn. Consequently, bank capital in Lower Saxony might have suffered more than in other federal states. This would mask the 'true' effect of the law reform (in this particular example, the difference-in-differences would underestimate the reform effect). Besides, the measures of economic activity to some extent reflect demand for bank loans, which affects the extension of loans by savings banks and, consequently, results in changes of asset risk profiles and business volumes. After the reform, real GDP growth in Lower Saxony was about 2.1 percentage points higher than before the reform, whereas in other federal states the increase in real GDP growth amounted to 1.4 percentage points (Panel B of Table 1). This indicates a more favorable economic development in Lower Saxony. In contrast, the number of insolvency proceedings of firms in Lower Saxony hardly changed, while the average of other federals states decreased by 21 percent. This indicates a disadvantage for Lower Saxony in terms of overall economic activity.

The second set of control variables is motivated by the close associations between the savings banks and the chartering municipalities. Since savings banks serve as Hausbanks to the municipalities, different evolutions of municipalities' credit demand in Lower Saxony and in other federal states might give rise to different evolutions of savings banks' asset allocation and risk profiles. Therefore, variables reflecting the financial situation of municipalities are included in the regression models. Municipal deficits and municipal debt, aggregated at the federal state level and related to the population of the federal states, indicate the financial strength of municipalities, and thus determine their scope for medium- to long term debt finance. Deficits of municipalities reflect the need for short-term finance by bank loans. Moreover, municipalities as owners of the savings banks

benefit from dividend payouts. Thus, controlling for the financial strength of municipalities also accounts for the possibility that weaker municipalities might force savings banks to pay out higher dividends. Municipal deficits in Lower Saxony amounted to EUR –175 per inhabitant before the reform and to EUR –173 after the reform. The average values of the other federal states are EUR –138 and EUR –148, respectively. At the same time, municipalities in Lower Saxony reduced per capita debt from EUR 1,028 to EUR 980, whereas municipalities in other federals states experienced a decrease from EUR 1,130 to EUR 1,107 only. This indicates that municipalities in Lower Saxony have been more successful in limiting deficits and reducing debt.

Finally, the last set of control variables picks up concerns that the competitive environment of savings banks in Lower Saxony might have evolved differently from the situation in other federal states. For instance, eroding market power might induce higher risk taking of banks (e.g., Keeley, 1990). To make sure that it is not competitive effects that hide behind the difference-in-differences estimate, I include two proxies for the competitive environment as control variables.

First, I include the population densities of the federals states. This can be motivated by the substantial reduction of bank branches in Germany during the past decade (Deutsche Bundesbank, 2007). It can be conjectured that branches in the least densely populated areas were the first ones to be closed. Due to their public mandate, their organizational structure and their strong regional focus, savings banks usually are supposed to be more hesitant to close branches than private banks, even in sparsely populated areas. Thus, different evolutions of population densities in the federal states could give rise to different competitive environments, with potential repercussions for the risk taking of savings banks. However, as Table 1 shows, the population density in Lower Saxony hardly changed, and the same is true for the average population density of the other federal states. Hence, it seems unlikely that Lower Saxony was disproportionately affected by branch closures.

Second, I measure competition at the state level by the state average of the net interest margins of cooperative banks. High margins indicate weak competition. Note that I do not include interest margins of savings banks in the regression equation. The reason is that margins of savings banks in Lower Saxony could have been affected by the law reform, too. For instance, savings banks could have reduced risk by providing less risky loans. Consequently, risk premia and margins would have declined. If at the same time

the reform caused savings banks to hold more capital, the result would be a (negative) correlation between margins and capital ratios. Since I am interested in the overall effect of the reform on risk taking of savings banks in Lower Saxony, it seems advisable not to partial out this correlation, but rather to rely on margins of cooperative banks only.

Although there still is the possibility that cooperative banks are indirectly affected by the reform through competition with savings banks, margins of cooperative banks can be expected to capture better non-reform related changes in the competitive environment. The margins of cooperative banks in Lower Saxony remained constant at roughly 2.7 percent. In contrast, average margins in other states declined from about 2.6 percent in the pre-reform years to about 2.4 percent in the post-reform years. This indicates that competitive pressure became weaker outside Lower Saxony and strengthens the case for enriching the regression with competition measures.

4 Regression Results

4.1 Baseline Results

The main regression results are displayed in Table 2. For every risk measure, the difference-in-differences estimate of the reform effect (the coefficient of *Lower Saxony after reform*) is positive. Moreover, it is statistically significant at the 1 percent level in most cases. This indicates that, due to the reform, savings banks in Lower Saxony on average increased capital and liquidity ratios. For instance, the reform led to an average increase in security reserves/total assets by roughly 0.13 percentage points (column (1) of Table 2). This is about 2.5 percent of the pre-reform average of savings banks in Lower Saxony. Thus, with regard to security reserves the reform effect is small but non-negligible. An effect of similar size is estimated for the equity ratio, see column (3). Somewhat larger are the results for the supplemented capital ratio. The difference-in-differences estimate is about 0.27, which is about 4.1 percent of the pre-reform average (column (5)).

A slightly different picture emerges when looking at liquidity-risk proxies. Here, the reform effect appears to be larger. Liquid assets/total assets on average increased by about 1.8 percentage points (column (7) of Table 2), and liquid assets to short-term

Table 2: Difference-in-differences estimates of the reform effect

	Security reserves/ total assets		Book equity/ total assets		Supplemented capital/ total assets		Liquid assets/ total assets		Liquid assets/ short term funding	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lower Saxony after reform	0.126***	0.140***	0.125***	0.152***	0.272***	0.293***	1.775**	2.369***	4.855***	5.540***
	(0.046)	(0.048)	(0.047)	(0.050)	(0.076)	(0.083)	(0.743)	(0.792)	(1.739)	(1.828)
Real GDP growth		−0.545		−0.256		−2.679		−10.309		−8.539
		(0.900)		(0.895)		(1.851)		(12.432)		(25.609)
Log insolvency proceedings		0.063		0.049		0.062		−2.165*		0.651
		(0.089)		(0.093)		(0.207)		(1.307)		(2.587)
Municipal deficits in EUR 1,000 per inhabitant		0.044		0.042		−0.263		0.060		0.178
		(0.110)		(0.108)		(0.211)		(1.468)		(3.117)
Municipal debt in EUR 1,000 per inhabitant		0.273		0.717***		0.267		7.089*		13.524*
		(0.260)		(0.238)		(0.672)		(4.081)		(7.728)
Population density		−0.023**		−0.018*		−0.011		−0.133		−0.466*
		(0.009)		(0.009)		(0.019)		(0.121)		(0.248)
Net interest margin of cooperative competitors		0.014		0.020		0.010		0.810		0.136
		(0.087)		(0.079)		(0.161)		(1.208)		(2.050)
R^2 within	0.49	0.50	0.50	0.50	0.11	0.12	0.17	0.18	0.13	0.14
Observations	2748	2742	2748	2742	2748	2742	2746	2740	2672	2666

Notes: All models include year-fixed effects and bank-fixed effects. Standard errors clustered at the bank level are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent level, respectively.

funding increased by about 4.9 percentage points.[16] In terms of pre-reform averages of savings banks in Lower Saxony, this amounts to roughly 8 percent and 11 percent, respectively.

As can be seen from the even-numbered columns of Table 2, these results are robust to including state-level control variables. The reform effects are estimated even slightly larger. Again, the coefficients of *Lower Saxony after the reform* are statistically significant at the 1 percent level.[17] The coefficients of the control variables are economically small and, an in most cases, not statistically significant. There is some indication, however, for a positive association between municipal debt and the risk ratios. The reason might be that financial weakness of bank owners lowers bail-out expectations, inducing savings banks to behave more precautionary. Furthermore, the risk ratios are negatively associated with the population density. This might indicate higher risk-taking of banks in face of fiercer competition.

The lack of statistical significance with respect to the other control variables does not mean that these variables do not matter for bank risk at all. Rather, federal states face similar developments. For instance, economic cycles in the federal states are strongly correlated. The time variation common to all states is captured already by the year dummies. Thus, only little state-specific variation is left to identify the impact of the overall economic environment on bank risk. In fact, when leaving out year-dummies, the coefficients on control variables increase sharply (in absolute terms) and become statistically significant in the majority of cases (results not displayed).

Overall, the regression results suggest that the savings banks reform in Lower Saxony caused the savings banks in Lower Saxony to increase their capital ratios. Hence, the insolvency risk decreased. The effects are small to moderate. The results on liquidity risk point into the same direction. Savings banks in Lower Saxony increased liquidity ratios, thus becoming less vulnerable to liquidity shocks. Accounting for of a wide range of observable state-specific factors that potentially confound the reform effect does not alter these results.

[16]The number of observations for liquid assets/short-term funding is smaller than for the other ratios because, for some banks, Bankscope does not contain detailed information on the liquidity structure of liabilities.

[17]When including control variables, six time-year observations drop out because no information on municipal deficits in Bremen is provided.

4.2 Reform Lags and Leads

As a next step, instead of including a single dummy variable that indicates savings banks located in Lower Saxony after the reform, I include Lower Saxony-year dummies for every year from 2003 to 2007.[18] This serves two purposes: First, Lower Saxony-specific effects after 2005 allow us to explore whether the reform effect exhibits a lag pattern. Second, including Lower Saxony-specific effects before 2005 serve as a kind of placebo test - when there was no reform, finding a 'reform effect' would raise serious doubts whether the difference-in-differences estimates in Table 2 can really be attributed to the reform.

The results of this exercise are displayed in Table 3. With regard to the post-reform period, the general picture is that the Lower Saxony-specific effects are larger in the second and third year after the reform. In fact, the effects are largest in 2007. In particular, this is true for capital ratios (columns (1) to (3)). Here, the effect for 2007 is substantially larger than the joint effect for all post-reform years displayed in Table 2. For example, security reserves/total assets of savings banks in Lower Saxony 2007 are on average 0.26 percentage points higher than expected on the basis of their former behavior and behavior of savings banks in comparison states (column (1) of Table 3). Similarly, the equity ratio increased by 0.27 percentage points (column (2)). Finally, supplemented capital/total assets (column (3)) increased by about 0.48 percentage points - by no means a small effect given that the pre-reform average of this ratio was 6.5 percent for savings banks in Lower Saxony. The Lower Saxony-specific effects become larger in later years after the reform when looking at the liquid assets ratio, too (column (4)). However, no lag pattern is detected with regard to liquid assets/short-term funding. Here, the coefficient estimates of the Lower Saxony-year dummies after the reform are large and of roughly equal size throughout the whole post-reform period.

Overall, the results indicate that the reform did not immediately decreased risk taking of savings banks in Lower Saxony but with a lag. One explanation is that bank capital cannot be raised arbitrarily. Specifically, to build up capital savings banks rely mostly on retained profits. The amount of profits earned to some extent depends on the overall economic circumstances. These improved substantially in 2006 and 2007, when Germany experienced a boom after the economic downturn at the beginning of the decade and a period of slow recovery in 2004 and 2005. Consequently, the impact of the reform on bank

[18] Due to multicollinearity, the Lower Saxony-2002 dummy is excluded.

Table 3: Difference-in-differences estimates including reform lags and leads

	Security reserves/ total assets (1)	Book equity/ total assets (2)	Supplemented capital/ total assets (3)	Liquid assets/ total assets (4)	Liquid assets/ short term funding (5)
Lower Saxony 2003	0.034	0.044	0.024	1.693***	2.165
	(0.035)	(0.034)	(0.075)	(0.643)	(1.351)
Lower Saxony 2004	0.076*	0.094**	0.080	0.518	−0.131
	(0.041)	(0.044)	(0.090)	(0.750)	(1.611)
Lower Saxony 2005	0.082	0.110*	0.165	3.059***	6.504***
	(0.058)	(0.063)	(0.126)	(0.956)	(2.281)
Lower Saxony 2006	0.196***	0.219***	0.343***	2.987***	6.186***
	(0.062)	(0.066)	(0.112)	(1.019)	(2.374)
Lower Saxony 2007	0.257***	0.271***	0.477***	3.374***	6.085**
	(0.079)	(0.081)	(0.121)	(1.231)	(2.884)
Real GDP growth	0.218	0.428	−1.278	−13.976	−16.646
	(1.048)	(1.045)	(2.188)	(13.281)	(26.605)
Log insolvency proceedings	0.096	0.076	0.129	−2.360*	0.265
	(0.096)	(0.099)	(0.222)	(1.340)	(2.625)
Municipal deficits	0.061	0.061	−0.238	0.322	0.404
in EUR 1,000 per inhabitant	(0.112)	(0.111)	(0.214)	(1.481)	(3.142)
Municipal debt	0.349	0.796***	0.380	7.059*	13.004*
in EUR 1,000 per inhabitant	(0.263)	(0.240)	(0.688)	(4.138)	(7.840)
Population density	−0.026***	−0.021**	−0.018	−0.130	−0.443*
	(0.009)	(0.009)	(0.020)	(0.121)	(0.246)
Net interest margin	−0.027	−0.016	−0.070	0.971	0.532
of cooperative competitors	(0.095)	(0.085)	(0.170)	(1.216)	(2.074)
R^2 within	0.50	0.50	0.12	0.18	0.14
Observations	2742	2742	2742	2740	2666

Notes: All models include year-fixed effects and bank-fixed effects. Standard errors clustered at the bank level are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent level, respectively.

capital became the more visible, the more favorable the conditions for capital accumulation became. Another possibility is that many outside directors did not immediately become aware of the consequences of the reform. As outlined in Section 2, the law reform was comprehensive. Hence, outside directors most likely were trained systematically to become familiar with the new legislation. Naturally, it takes some time until training measures are organized and training is completed.

Finally, some elements of the reform were set into force with some delay. The reason is that the mandate of supervisory board members is synchronized with municipal elections. Consequently, all supervisory board members kept their mandate until the next municipal elections in autumn 2006. Thus, size limits on boards and abandoning of substitutes became effective only at year-end 2006 or even later. For example, following the municipal elections in September 2006, the supervisory board of Sparkasse Hannover, the biggest savings bank in Lower Saxony, was re-established in December 2006. In line with the new savings banks law, the newly formed board consists of 17 members - instead of 55 members (including substitutes) before. Similarly, the board of Sparkasse Burgdorf, one of the smallest savings banks in Lower Saxony, was cut down from 19 to 9 members in March 2007.

As for the placebo test, the regression results displayed in Table 3 show that the coefficient estimates of the Lower Saxony-year dummies before the reform are generally small. Moreover, the dummies are mostly not statistically significant. The only exceptions are the Lower Saxony-specific effects in 2004 on security reserves/total assets and book equity/total assets (columns (1) and (2)) and the Lower Saxony-specific effect in 2003 on the liquid asset ratio (column (4)). However, these effects are still considerably smaller than the post-reform effects. The differences between these effects and post-reform effects are statistically significant. Hence, it seems very unlikely that the post-reform Lower Saxony-specific effects capture just some random fluctuations unrelated to the law reform. Rather, they reflect the causal impact of the law reform on risk taking of savings banks.

4.3 Alternative Identification Strategy

The critical difference-in-differences assumption that there are no state factors that confound the law reform can be relaxed by including an additional control group not subject to the law change. Early examples of this approach are Gruber (1994) and Hamermesh

and Trejo (2000). The idea is that a comparison between non-treated control units in the state where the law change happened and non-treated control units in other states delivers an estimate of the effect of potential confounding factors. This difference is subtracted from the difference-in-differences estimate. Therefore, this approach has been termed 'triple differences'.

Fortunately, there exists another group of banks in Germany that appears to be an appropriate additional control group: cooperative banks. These banks are governed by nationwide laws only, and their business model is quite similar to that of savings banks. They mostly rely on deposit funding, and the asset side is dominated by loans to small- and medium-sized firms and private households (see Table 4). Moreover, like savings banks, they have a strong regional focus and generally do not compete with banks outside their business district.

Formally, the critical difference-in-differences assumption (2) now relaxes to

$$\mathrm{E}[y_{0i}|l, s, t] = \gamma_{ls} + \lambda_{lt} + \theta_{st}, \tag{6}$$

where l indexes the legal form (public savings bank or cooperative bank). Note that, in contrast to the difference-in-differences model, this model does not exclude interactions between state and time: θ_{st} captures all state-time-specific factors common to both legal forms. Besides, λ_{lt} reflects time-varying legal form-specific factors that are constant across states. Thus, unlike difference-in-differences, it is not required that without the law reform mean outcomes of savings banks in Lower Saxony and other federal states would have moved parallel. Finally, γ_{ls} reflects factors specific to all combinations of legal forms and states that do not change over time. The validity of assumption (6) implies that, in absence of the law reform, the difference between the difference in mean outcomes of savings banks in Lower Saxony and savings banks in other states and the difference in mean outcomes of cooperative banks in Lower Saxony and other federal state would have remained constant.

The corresponding regression equation becomes

$$y_{ilst} = \gamma_i + \lambda_{lt} + \theta_{st} + \delta \cdot d_{lst} + \boldsymbol{\beta}' \mathbf{x}_{st} + \epsilon_{ilst}, \tag{7}$$

where d_{lst} indicates savings banks in Lower Saxony after the law reform and δ is the parameter of interest. As before, bank-fixed effects γ_i are included. To account for

Table 4: Variable means of savings banks and cooperative banks

Variable	Savings banks	Cooperative banks
A. Measures of bank risk		
Security reserves/total assets (%)	4.72	4.13
	(1.07)	(1.51)
Book equity/total assets (%)	4.92	5.89
	(1.05)	(1.39)
Supplemented capital/total assets (%)	6.66	6.34
	(1.61)	(1.35)
Liquid assets/total assets (%)	28.77	25.19
	(11.41)	(10.77)
Liquid assets/short term funding (%)	53.69	47.51
	(18.22)	(21.71)
B. Balance sheet structure		
Loans to banks/total assets (%)	9.25	12.60
	(7.05)	(7.50)
Loans to customers/total assets (%)	59.01	59.74
	(12.26)	(11.43)
Securities/total assets (%)	25.62	20.71
	(10.84)	(10.23)
Loans from banks/total assets (%)	21.71	12.84
	(9.66)	(5.80)
Deposits/total assets (%)	66.48	74.76
	(9.65)	(7.95)
Bonds/total assets (%)	3.08	3.67
	(3.33)	(4.53)
Total assets (million EUR)	2027.86	532.14
	(2458.83)	(1197.54)

Notes: Numbers in parentheses are standard deviations. The number of bank-year observations is 2748 (savings banks) and 5621 (cooperative banks), respectively. For liquid assets/total assets the number of observations for savings banks is 2746. For liquid assets/short-term funding the number of observations is 2672 (savings banks) and 4971 (cooperative banks). Differences between group means are significantly different from zero at the 1 percent level throughout. Exact definitions of risk measures are given in the Appendix.

the possibility that savings banks and cooperative banks react differently to changing economic conditions in the federal states, the effect of the state-level controls is allowed to depend on the legal form. This is done by adding interactions between state-level controls and dummy variables indicating the legal form to the vector $\mathbf{x}_{st}$. The balance sheet data for cooperative banks is also taken from Bankscope. In contrast to savings banks, Bankscope does not provide near-full coverage on cooperative banks. The coverage ratio ranges from 57 percent in 2003 (790 out of 1392 cooperative banks) to 85 percent in 2006 (1071 out of 1255); roughly 80 observations per year can be found in Lower Saxony.

The results of this approach are displayed in Table 5. The estimates of the parameter of interest are positive throughout (first row of Table 5). It is statistically significant in 7 out of 10 specifications. Moreover, the magnitude of the estimates is moderate with respect to capital ratios (columns (1)-(6)), whereas it is much larger with respect to liquidity-risk proxies (columns (7)-(10)). Thus, the general impression given by the difference-in-differences results is confirmed. However, the inclusion of cooperative banks does not alter the difference-in-differences results in an unambiguous fashion. Depending on the risk measure, the reform effect is estimated sometimes as larger (in 7 out of 10 specifications) and sometimes as smaller (in the remaining three specifications).

Another observation is that compared to the difference-in-differences results in Table 2, the estimates of the reform effect are altered only moderately with regard to capital ratios and quite drastically with regard to liquidity-risk proxies. This can be seen directly from the second row of Table 5, which displays the coefficient estimates of the dummy variable indicating a bank in Lower Saxony after the reform (*Lower Saxony after reform*). These estimates give an indication of the post-reform Lower Saxony-specific effect that is not related to the reform. The effect is not significantly different from zero in the capital ratio regressions, whereas it is negative, large and statistically significant in the regressions employing liquidity-risk proxies as dependent variable.

A tentative conclusion is that in absence of the law reform capital ratios of banks in Lower Saxony compared to capital ratios of banks outside Lower Saxony would have developed similarly. This supports the critical assumption of the difference-in-differences approach. In contrast, in absence of the reform liquidity-risk proxies would have declined, suggesting that the difference-in-differences assumption is not fulfilled with regard to these outcome variables. We should keep in mind, however, that estimating the non-reform Lower Saxony-specific effects largely relies on the outcomes of cooperative banks in

Table 5: Triple differences estimates of the reform effect

	Security reserves/ total assets		Book equity/ total assets		Supplemented capital/ total assets		Liquid assets/ total assets		Liquid assets/ short term funding	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Savings bank in Lower Saxony after reform	0.137	0.246**	0.062	0.204**	0.106	0.241*	5.181***	5.936***	11.314***	12.561***
	(0.097)	(0.102)	(0.097)	(0.102)	(0.115)	(0.123)	(1.092)	(1.143)	(2.260)	(2.375)
Lower Saxony after reform	−0.011	−0.108	0.063	−0.049	0.165*	0.046	−3.404***	−3.572***	−6.445***	−7.197***
	(0.085)	(0.091)	(0.084)	(0.089)	(0.087)	(0.092)	(0.802)	(0.831)	(1.443)	(1.533)
Savings bank after reform	−0.145***	−0.144***	−0.079***	−0.143***	−0.118***	−0.136***	−1.955***	−1.590***	−4.159***	−2.990***
	(0.030)	(0.034)	(0.028)	(0.033)	(0.045)	(0.046)	(0.333)	(0.361)	(0.718)	(0.773)
Real GDP growth		1.528		−0.159		−0.631		−15.249		−17.385
		(1.049)		(0.774)		(1.040)		(10.908)		(19.927)
Real GDP growth × savings bank		−2.413***		−0.695		−1.112		−12.090		−20.668
		(0.805)		(0.706)		(1.081)		(9.606)		(18.134)
Log insolvency proceedings		0.306**		0.421***		0.218*		−2.582*		0.672
		(0.128)		(0.096)		(0.126)		(1.437)		(2.389)
Log insolvency proceedings × savings bank		−0.129		−0.358***		−0.070		2.146		4.755
		(0.126)		(0.106)		(0.206)		(1.616)		(2.911)
Municipal deficits		−0.403***		−0.336***		−0.602***		−0.409		−0.308
		(0.120)		(0.110)		(0.135)		(1.217)		(2.473)
Municipal deficits × savings bank		0.441***		0.386**		0.371		0.520		−0.147
		(0.163)		(0.154)		(0.248)		(1.889)		(3.866)
Municipal debt		−0.690**		−0.720***		−1.435***		−9.457***		−16.235**
		(0.298)		(0.254)		(0.347)		(3.523)		(6.980)
Municipal debt × savings bank		1.238***		1.428***		1.939***		18.084***		38.909***
		(0.347)		(0.307)		(0.625)		(4.834)		(9.156)
Population density		−0.003		−0.009		−0.004		−0.323**		0.140
		(0.013)		(0.010)		(0.014)		(0.149)		(0.273)
Population density × savings bank		−0.021		−0.007		−0.012		0.215		−0.577
		(0.015)		(0.013)		(0.024)		(0.196)		(0.369)
R^2 within	0.30	0.30	0.36	0.38	0.14	0.15	0.07	0.08	0.05	0.06
Observations	8369	8347	8369	8347	8369	8347	8367	8345	7643	7621

Notes: All models include year-fixed effects and bank-fixed effects. Standard errors clustered at the bank level are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent level, respectively.

Lower Saxony. If, for example, these banks reacted differently to economic developments in Lower Saxony than savings banks, then the coefficient of *Lower Saxony after reform* might be a poor indicator for the non-reform counterfactual outcome of savings banks.

Finally, it should be noted that the coefficient estimates of the dummy for savings banks after the reform (third row of Table 5) are negative, quite large and statistically significant. Hence, in 2005–2007, capital ratios and liquidity-risk proxies of savings banks declined relative to outcomes of cooperative banks. One possible explanation is that the banking groups reacted differently to the economic upturn in 2006 and 2007. This explanation gains support in the regression results on the control variables: the coefficient estimates of most cyclical variables (insolvency proceedings, municipal deficits, municipal debt) are much larger (in absolute terms) than the estimates obtained from the savings banks sample only (Tables 2 and 3). Moreover, the coefficients of the interactions of these variables with the legal form indicator are often statistically significant. This indicates that cooperative banks are more sensitive to changes in the overall economic environment.

The luxury of having two alternative identification strategies available requires a discussion on which of the two strategies might be more credible. On the one hand, from a general point of view, triple differences is preferable since it is less restrictive than difference-in-differences. In particular, it does not exclude interactions between states and years. Hence, the interpretation of the triple differences estimates as causal effect of the reform does not hinge on the assumption of 'common trends' of savings banks in Lower Saxony and other federal states. On the other hand, long-run evolutions of savings banks outcomes in the federal states (Figure 1) are consistent with common trends. Furthermore, triple differences relies on the notion that outcomes of cooperative banks in Lower Saxony - relative to cooperative banks in other federal states - reflect Lower Saxony-specific effects that are unrelated to the reform and that also apply to savings banks in Lower Saxony. This implies that savings and cooperative banks should be quite similar. In particular, both types of banks should react similarly to changes in economic conditions in the federal states. In this respect, the triple differences results raise some concerns.

Luckily, both the difference-in-differences and triple differences results point into the same direction. This is particularly true for the main outcome variables of interest, the capital ratios. Here, both sets of results indicate small to moderate positive reform effects. The results differ more with respect to liquidity-risk proxies. However, both the difference-in-

differences and triple differences estimates indicate a significant increase in these ratios, both in economic and statistical terms.

5 Conclusion

In this paper, a law reform is evaluated that exogenously increased the probability of outside directors of German savings banks to be held accountable and to be held personally liable for breaches of duty. The difference-in-differences analysis shows that savings banks subject to the reform strengthened their capital basis and hold more liquid assets. The results are robust to controlling for a wide range of potential confounders and employing an alternative identification strategy. Hence, savings banks subject to the reform became more resilient against unexpected losses and liquidity shocks. Since the other major elements of the law reform were meant to preserve the status quo, and the minor elements are unlikely to affect bank risk, the results can be interpreted as causal evidence on the impact of tightening board accountability on risk taking of banks.

The law reform under study approximates from below liability rules already in place for companies chartered under private law. These rules are commonly perceived to lack financial bite. Therefore, the dose of the 'treatment' implied by the reform appears to be low. Thus, one might be surprised that the reform caused measurable changes in bank risk at all. One explanation is that it took outside directors some time to fully understand the new legal environment they were exposed to; in the meanwhile, they equated the tightening of nominal liability with an increase in actual liability risks. However, the lag pattern of the reform effects reveals even stronger effects in later post-reform years and thus contradicts this explanation. It rather seems to be the case that outside directors do respond to liability schemes of the current style, although actual liability risks are arguably low. The low occurrence of out-of-pocket payments, as documented by Black and Cheffins (2006), appears to be not only a result of a director-friendly environment but also a result of directors' concerns for accountability and liability. This is in contrast to the conjecture implied by the recent policy debate and the relatively limited attention outside director liability has received in the academic literature.

This study shows that laws designed to improve corporate governance by tightening accountability and liability of outside directors are effective in changing bank risk. Naturally,

the applicability of this result to other types of banks and other countries than Germany depends on a wide range of factors such as the complexity of a bank (see Laux, 2010) and internal and external governance mechanisms already in place. More broadly, the results of this study imply that governance through outside directors matters for bank risk. This is in line with recent empirical evidence on the association between board characteristics and risk taking of banks (Pathan, 2009) and the relevance of such characteristics in explaining differences in banking outcomes during the recent financial crisis (Adams, 2009; Beltratti and Stulz, 2010). Hence, designing board-level governance is a promising approach for future policies that aim at safeguarding financial stability.

Appendix: Variable Description

A. Measures of Bank Risk

Security reserves/total assets Profits retained and accumulated divided by total assets in percent. *Source*: own calculations based on Bankscope.

Book euity/total assets Book equity divided by total assets in percent. Book equity is total assets minus total liabilities. Book equity of public-law savings banks typically consists of security reserves, balance sheet profits and capital contributions of 'silent' (i.e. non-controlling) partners (*Stille Einlagen*). *Source*: own calculations based on Bankscope.

Supplemented capital/total assets The sum of equity, subordinated debt and profit participation rights (*Genussrechte*) divided by total assets in percent. *Source*: own calculations based on Bankscope.

Liquid assets/total assets Liquid assets divided by total assets in percent. Liquid assets are: cash, treasury securities and bills of exchange eligible for advances from central banks, due from banks on demand, bonds and other fixed-income securities eligible for advances from central banks, shares and other non-fixed income securities, recovery claims against public authorities. *Source*: own calculations based on Bankscope.

Liquid assets/short-term funding Liquid assets divided by short-term funding in percent. Short-term funding comprises: due to banks on demand, savings deposits, other customer deposits on demand. *Source*: own calculations based on Bankscope.

B. Control Variables

Real GDP growth Yearly difference in log real GDP of the federal states. *Source*: own calculations based on data obtained from the Federal Statistical Office (Destatis).

Log insolvency proceedings Log of number of firms that filed for insolvency proceedings in each federal state. *Source*: own calculations based on data obtained from the Federal Statistical Office (Destatis).

Municipal deficits Sum of the deficits (income minus expenditure) of municipalities in each federal state in EUR 1,000, divided by the population of the federal states. *Source*: own calculations based on data obtained from the Federal Statistical Office (Destatis).

Municipal debt Sum of the debt of municipalities in each federal state in EUR 1,000, divided by the population of the federal states. *Source*: own calculations based on data obtained from the Federal Statistical Office (Destatis).

Population density Number of inhabitants per km^2 in each federal state. *Source*: own calculations based on data obtained from the Federal Statistical Office (Destatis).

Net interest margin of cooperative competitors Mean net interest margin of cooperative banks in each federal state. Net interest margin is interest income from lending and money market transactions minus interest expenditures divided by total loans. *Source*: own calculations based on Bankscope.

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