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Market discipline across bank governance models – empirical evidence from German depositors

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Non-technical summary

Research Question

Market discipline constitutes a form of self-regulation exercised by purchasers of financial services which is intended to punish the behavior of sellers that impose a cost on buyers for which the buyers have not been compensated. German savers are renowned for preferring safe, long-term investments, thus providing patient capital, whereby bank deposits play an important role. This study examines whether German depositors are really that patient, abstaining from any type of market discipline, and how the financial crisis might have changed this well-established habit.

Contribution

Using a unique data set for German banks provided by the Deutsche Bundesbank, this study takes up the issue of market discipline by German depositors and analyzes empirically whether and in what manner differences in bank governance structures affected depositors' behaviors both before and during the recent financial crisis. A new measure of market discipline is introduced which provides a deeper insight into depositors' behaviors.

Results

This paper does not confirm the supposed passiveness of German depositors, but rather reveals the existence of market discipline and, in this regard, signals a high degree of heterogeneity among German depositors. This heterogeneity acknowledges the impact of governance structure. Depositors of different banking groups differ with respect to the risk indicator that triggers sanctions, the type of sanction chosen and in terms of the impact of the financial crisis. The announcement of a state guarantee for bank deposits following the collapse of Lehman Brothers succeeded in calming depositors of all banking groups but did not remove market discipline entirely. Remaining disciplinary reactions by depositors of different banking groups increased in homogeneity but some differences can still be identified.

Nichttechnische Zusammenfassung

Forschungsfrage

Marktdisziplin beschreibt eine Form von Selbstregulierung, die vom Erwerber von Finanzdienstleistungen ausgeübt wird und das Verhalten von Anbietern bestraft, die den Käufern für nicht erbrachte Leistungen Kosten auferlegen. Deutsche Sparer sind bekannt, sichere, langfristige Investitionen zu präferieren und stellen demzufolge langfristiges Kapital zur Verfügung, wobei Bankeinlagen eine besonders wichtige Rolle zukommt. Die vorliegende Studie untersucht erstens, ob deutsche Einleger tatsächlich das propagierte geduldige Sparverhalten aufweisen und dabei auf jegliche Form der Marktdisziplin(ierung) verzichten und zweitens, inwiefern die Finanzkrise die bestehenden Gewohnheiten verändert hat.

Beitrag

Die vorliegende Studie nutzt einen Datensatz der Deutschen Bundesbank über deutsche Banken, um die Marktdisziplinierung durch deutsche Einleger zu untersuchen und Unterschiede in der Bank Governance und deren Einfluss auf das Sparverhalten vor und während der Finanzkrise empirisch zu analysieren. Zudem wird ein neues Maß für Marktdisziplin eingeführt, welches einen tieferen Einblick in das Verhalten von Einlegern ermöglicht.

Ergebnisse

Dieses Papier widerlegt die Annahme der Passivität deutscher Sparer und offenbart sowohl das Vorliegen von Marktdisziplin als auch einen hohen Grad an Heterogenität zwischen Einlegern. Diese Heterogenität bestätigt den Einfluss von Governance-Strukturen. Einleger verschiedener Bankengruppen unterscheiden sich in Hinblick auf den Risikoindikator, welcher die Sanktionen auslöst, die Art der gewählten Sanktionen sowie den Einfluss der Finanzkrise auf das Sparverhalten. Die Vergabe von staatlichen Einlagegarantien, welche auf die Insolvenz von Lehman Brothers folgten, beruhigte die Einleger, jedoch wurde Marktdisziplin nicht vollständig aufgehoben. Unterschiede zwischen den Reaktionen der Einleger verschiedener Bankengruppen wurden kleiner, können aber noch identifiziert werden.

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Market Discipline Across Bank Governance Models – Empirical Evidence from German Depositors*

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Abstract

German savers are renowned for preferring safe, long-term investments, thus providing patient capital, with bank deposits playing an important role. Using a comprehensive data set for the German banking sector, we examine whether German depositors are really that patient, abstaining from any type of market discipline, and how the financial crisis might have changed a well-established habit. Our empirical investigation reveals the existence of market discipline with a high degree of heterogeneity depending on banks' governance structures. The announcement of a state guarantee for bank deposits following the collapse of Lehman Brothers succeeded in calming depositors of all banking groups but did not remove market discipline entirely. Remaining disciplinary reactions by depositors of different banking groups increase in homogeneity but some differences remain.

Keywords: Market discipline, bank depositor behavior, bank risk taking, deposit rates.
JEL classification: G10, G20, G30.

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1 Introduction

The role of market discipline is receiving increasing attention from researchers and policymakers alike in the light of the recent financial crisis. Market discipline constitutes a form of self-regulation exercised by purchasers of financial services which is meant to punish the behavior of sellers that impose a cost on the buyers for which they have not been compensated (Berger, 1991). In the case of depositors, this could mean their withdrawal of deposits, the shortening of formal and factual maturities or the demanding of higher interest rates. Whereas quite a few empirical investigations into the existence of market discipline exercised by depositors for the US and other countries have been undertaken (e.g., Berger and Turk-Ariss, 2015; Martinez Peria and Schmukler, 2001), to our knowledge, there is no study for Germany that explicitly takes into account the specific features of the German financial system.

The German financial system has a tradition of bank orientation characterized by stable relationships between depositors and their housebanks.[1] A high popularity of bank deposits as a safe long-run investment for household wealth has placed German banks in a very comfortable position in terms of the availability of cheap and stable liquidity. Prior to 1998 when the European directive (94/19/EG: CELEX Nr. 394L0019; 97/9EG: CELEX Nor. 397L0009; 2009/14/EG: CELEX No. 309L0014) became German law, deposit insurance in Germany rested by and large on informal guarantees, even leaving a depositor without any formal and judicially enforceable claim in the event of a bank failure. However, bank runs in Germany have so far been largely missing. All this raises the question whether German depositors do not stand ready to punish their banks for bad behavior and, furthermore, whether the financial crisis has provoked a change in this respect. Evidence on this point is important because insofar as German savers have become more sensitive to signals about banks' financial health, credit institutions would be well-advised to respond by adjusting their strategies appropriately. Undertaking an empirical investigation into the existence of depositors' market discipline in Germany requires to take into account a key feature of the German banking system, namely the parallel existence of different bank governance models, which, in turn, are closely related to the existence of basically three pillars. Whereas in particular large banks belonging to the group of credit banks[2] are organized as stockholding companies, cooperative banks are owned by their members and hence by their depositors. Savings banks and Landesbanken have mixed obligations: on the one hand, they must operate under public law, giving priority to the economic well-being of the region in which they are based, and on the

[1] In Germany, a bank to which depositors have close relationships (for instance the main financial transactions are only conducted with this bank) is called housebank.

[2] We use the terms 'credit banks' and 'commercial banks' interchangeably.

other hand, they are fully liable for their debt. Full liability is a direct consequence of the Brussels Concordance of 2002 which restricts public ownership in these banks to the binding of their objectives to public interests.

The fact that ownership structures have a significant impact on a firm's governance model has been confirmed by a large body of literature,[3] with a firm's objectives as well as its strategies receiving most attention. In addition, in Germany each governance model has created its own deposit insurance system. Hence, it should be expected that any finding of market discipline, as well as its type and extent, will depend largely on the governance model of the chosen housebanks.

In our paper, we take up the issue of market discipline by German depositors and examine whether and in what manner differences in bank governance structures affected depositors' behavior both before and during the recent financial crisis. The following research questions are addressed: First, do private households respond to increased bank risk-taking by investing a smaller proportion of their savings in bank deposits? Second, how did the structure of bank deposits behave over time prior to the financial crisis, during the financial crisis and in its aftermath? Third, do private households demand higher interest rates from riskier banks? Fourth, can any differences be observed between (large) private banks, savings banks, and cooperative banks? In order to answer these questions, an empirical analysis will be conducted applying panel regression techniques to analyze empirically the German banking system using a unique data set combining MFI interest rate statistics, balance sheet statistics, and the supervisory database of the Deutsche Bundesbank .

Our paper aims to contribute to the literature on market discipline by depositors and on the relationship between banks' risk-taking behavior and governance structures. By and large, existing literature concentrates on the role of deposit insurance for market discipline while broadly ignoring the impact of governance models. On the other hand, papers dealing with the impact of governance on risk-taking largely disregard market discipline by depositors.[4] The innovative component of our paper relates to examining the interaction between market discipline, regulation, and bank governance conducting an empirical analysis of the German banking sector.

The remainder of the paper is organized as follows: Section 2 provides a literature review distinguishing between theoretical and empirical research. Section 3 presents the major characteristics of the German banking system relating to depositors' safety and Section 4 describes the applied data set. Section 5 is dedicated to the presentation of the empirical analysis. Section 6 concludes the paper.

[3]For basic contributions see Jensen and Meckling (1976) and Shleifer and Vishny (1997). A more recent survey is provided by Singh and Davidson III (2003).

[4]Hughes and Mester (2012) discuss market discipline in the context of the market for corporate control.

2 Literature Review

Theoretical Research

Following Rochet (2008), Flannery (2001), and Kwast, Covitz, Hancock, Houpt, Adkins, Barger, Bouchard, Connolly, Brady, English, Evanoff, and Wall (1999), the value of market discipline exercised by banks' creditors results from its disciplining management decisions in favor of the choice of lower risk projects (direct effects) and from providing new information to financial supervisors (indirect effects). In the first case, market discipline constitutes a substitute for financial supervision and thus reduces the need for government intervention. In the case mentioned last, it helps to improve financial supervision. At all events, high capabilities of correctly evaluating a bank's overall condition together with sufficient incentives to monitor the bank on the part of creditors is needed. Both conditions appear to be critical in the case of depositors for the following reasons: First, contrary to a standard debt contract in which the creditor only receives a promise to be fully reimbursed, the bank typically guarantees its depositors the safety of their investments. Second, the depositor has the right to terminate the contract prematurely at low cost. These two components of a "standard deposit contract" satisfy a depositor's high degree of aversion against illiquidity and loss. However, in light of financial market incompleteness, the existence of an absolutely safe asset can be ruled out, nor is there any guarantee that the bank can always meet its depositors' demand for liquidity. Rather, in a standard deposit contract all risks are shifted to the bank, leaving bank managers with the task of "producing" the required liquidity and providing safety as well. In theory, the provision of a safe deposit has been shown to be possible if the bank chooses a portfolio for its assets which consists of a high number of independent credit risks (Williamson, 1986; Diamond, 1984).

In practice, this has proved to be rather difficult, irrespective of the advanced screening and monitoring technologies available to banks. Otherwise, we would never have witnessed banking crises as regular, and not just exceptional, events. In conclusion, we may say that a deposit, too, is nothing more than a promise on a future uncertain return, meaning that a risk-averse depositor should have an interest in exercising market discipline (Martinez Peria and Schmukler, 2001). On the other hand, the introduction of deposit insurance schemes in many countries is based on the motivation to assign the protection of the (small) depositor the property of a public good (Dewatripont and Tirole, 1994). By separating the safety of deposits from banks' risk management strategies, depositors were seemingly relieved of any obligation to monitor and punish their bank for bad behavior. Theoretical models expressed a warning to regulators though. Given banks' limited liability and given that deposit insurance premia are only imperfectly

risk-adjusted, bank managers might have an incentive to take excessive risks (Keeley, 1990; Kim and Santomero, 1988). To the extent that risk-shifting is practiced on a large scale in the banking sector, this can expose the existing deposit insurance scheme to serious trouble. All this implies that the degree to which depositors believe in the reliability of the prevailing deposit insurance scheme will have an impact on their readiness to punish banks for excessively risky behaviors. Belief in the reliability of the deposit insurance scheme might not be the only variable determining the extent to which depositors sanction their banks for bad behavior. In addition, bank governance structures might play a role for the following reasons: First, the ruling governance principles have an impact on a bank's risk-taking behavior. Second, depositors might even be given a right to affect the choice of strategies themselves, and third, a bank might be embedded in a comprehensive risk-sharing network, adding to the safety of prevailing deposit insurance schemes. Corporate governance represents the institutional framework which regulates who should be given priority in deciding on a firm's broad policies, ranging from goals, strategies to the supervision of performance (Macey and O'Hara, 2003; Turnbull, 1997). In the academic literature, stockholding companies are at the center of research with a focus on the Anglo-Saxon model according to which of the rules of corporate governance should be directed exclusively at maximizing the shareholder value. This explains why governance and ownership structures are frequently used as synonyms (Laeven and Levine, 2009). Shareholder value maximization is usually justified by the fact that owners dedicate a part or all of their wealth to the firms and, by way of compensation, receive a residual income, the size of which is subject to uncertainty (Shleifer and Vishny, 1997). However, this does not necessarily imply that shareholders are interested in low-risk strategies. Rather, given that firm owners have limited liability for occurring losses and if the firm's creditors suffer from asymmetric information, then the maximization of shareholder value may involve excessive risk-taking, thus harming the firm's creditors. On the other hand, the separation of ownership and control under asymmetric information may set the incumbent risk-averse management incentives to favor low-risk projects. Hence, the relative power of owners compared to managers will determine whose interests are ultimately satisfied (Jensen and Meckling, 1976). In this respect, the degree of ownership concentration gains relevance. Research on corporate governance has a dominant focus on manufacturing firms organized as stockholding companies. A bank differs from a manufacturing firm particularly in terms of its capital structure, its capability to produce liquidity, and in the existence of deposit insurance schemes (Macey and O'Hara, 2003). A bank typically has a low level of equity capital and hence relies more heavily on debt than non-financial firms. This aggravates possible conflicts between bank owners and creditors, with depositors representing a major group. Bank owners might therefore have stronger incentives to take excessive risks as

compared to owners of manufacturing firms. Compared to the theoretical literature on stockholding companies, publications on other governance structures are rather few. In the market for banking services, banks organized as shareholding companies play an important but not exclusive role. Of further importance are cooperative structures (credit unions and mutuals in the US, mutual building societies in the UK, Genossenschaftsbanken in Germany) as well as banks in public ownership. As an important difference to shareholding companies, the owners of credit unions and mutuals belong to the group of depositors, thus removing conflicts between debtholders and owners. Since each member is given one vote in the general assembly, ownership is widely dispersed. By consequence, the separation between ownership and control might even be more pronounced than in shareholding companies (Rasmusen, 1988). This leaves open the crucial question whether the incumbent management is less risk-averse than the ones in shareholding companies. Typically, managers of credit unions receive a fixed salary and therefore cannot benefit from higher profits, hence they should have an interest in low-risk strategies (Valnek, 1999). We may therefore conclude that cooperative banks should have a preference for strategies which are less risky compared to stockholding banks. Research on public versus private ownership is centered on efficiency and profitability and in this respect does not have a particular focus on banks (Shirley and Walsh, 2001). A common conclusion here is that a lack of corporate control through capital markets aggravates conflicts of interest between the maximization of social welfare and the maximization of politicians' private utility function thus leading to inefficiencies and lower profitability than in privately owned firms.

Empirical Research

Empirical investigations into the behavior of US depositors revealed market discipline for uninsured deposits (Hosono, 2004; Calomiris and Wilson, 1998; Ellis and Flannery, 1992; Hannan and Hanweck, 1988; Baer and Brewer, 1986; Goldberg and Hudgins, 1996) as well as for insured deposits (Maechler and McDill, 2006; Park and Peristiani, 1998; Cook and Spellman, 1994; Baer and Brewer, 1986). As is shown in Crabbe and Post (1994), the intensity of punishments turns out to be less severe if deposits are insured. Sanctioning mechanisms encompassed higher interest rates, deposit withdrawals, restructurings towards insured deposits as well as difficulties faced by distressed banks to attract new uninsured deposits. In a comparison between the US, EU and Switzerland, Berger and Turk-Ariss (2015) examine market discipline exercised by uninsured as well as insured depositors. Their findings indicate higher market discipline in the US than in Europe, both prior to the financial crisis and in the aftermath. Their analysis also reveals that government interventions during the financial crisis had a dampening

impact on depositors' reactions to higher bank risk. A weakening effect of government intervention measures in support of the safety of deposits on market discipline is also found by Demirgüç-Kunt, Karacaovali, and Laeven (2005), and Balasubramnian and Cyree (2011). Market discipline for deposits, irrespective of their insurance, is confirmed for Latin American countries like Argentina, Chile, and Mexico, where depositors reacted by both deposit withdrawals and the demanding of higher interest rates to higher bank risk (Martinez Peria and Schmukler, 2001). Murata and Hori (2006) focus on Japanese cooperative banks and find market discipline in particular in anticipation of regulatory changes towards a lower degree of deposit protection. In contrast, (Pop and Pop, 2009) suggest that market discipline may no longer be present after the bailout of *Resona Holdings* in 2003.

Whereas the literature on market discipline takes the perspective of depositors, empirical research on bank governance structures focuses on banks' risk-taking behaviors. Empirical studies for US banks organized as stockholding companies reveal that stockholder-controlled banks, and thus institutions with a low degree of separation between ownership and management, are more inclined to take higher risks than managerially controlled banks. They confirm that the concentration of ownership matters for a bank's risk-taking (Saunders, Strock, and Travlos, 1990). This evidence is supported in an international comparison (Laeven and Levine, 2009) which reveals that stricter capital regulations only dampen the risk-taking of a stockholding bank if ownership is widely dispersed and that deposit insurance schemes increase bank risk only in institutions with concentrated ownership. These empirical results are confirmed by Koehn and Santomero (1980), Buser, Chen, and Kane (1981), and Haw, Ho, Hu, and Wu (2010). Sullivan and Spong (2007) find that bank risk is higher if managers participate in the development of the bank's net worth which they operate. Barry, Lepetit, and Tarazi (2011) find that in Europe the type of owners who have the say in a stockholding bank matters. In particular, a higher equity stake of individuals, families or even banking institutions is correlated with lower bank risk compared to institutions with financial investors and non-financial corporations as principal owners.

Empirical studies on the risk-taking behavior of credit unions and mutuals confirm that they engage in lower risk-taking behavior than stockholding companies (Esty, 1997; Cordell, MacDonald, and Wohar, 1993; Lamm-Tennant and Starks, 1993; Saunders et al., 1990; Verbrugge and Goldstein, 1981). Karels and McClatchey (1998) even find that the introduction of deposit insurance for US credit unions did not lead to higher risk taking but, on the contrary, increased their capitalization. Valnek (1999) finds that UK mutual building societies outperformed stock retail banks in the period 1983-1993 and were less affected by the negative outcomes of higher risk.

For public banks in Europe, Iannotta, Nocera, and Sironi (2007) find a lower loan quality and higher insolvency risk than for mutuals and private banks. In an empirical investigation into the significance of ownership in the Indian banking industry, Sarkar, Sarkar, and Bhaumik (1998) confirm the proposition that in the absence of well-functioning capital markets differences between public and private ownership of banks concerning both their performance and risk vanish. There also exists a study on the German banking system, though with an exclusive focus on profitability (Altunbas, Evans, and Molyneux, 2001). In particular, empirical studies examining market discipline exercised by German depositors across the variety of German bank governance structures are missing. In our paper we want to fill this gap, and in doing so we first provide an introduction into the specifities of the German banking system.

3 Bank Governance Models in Germany

Excessive risk-taking by banks is to a large degree associated with the possibility of externalizing realized losses to third parties. The degree to which this occurs very much depends on the existence of disciplinary forces. In this respect, the Anglo-Saxon countries share a tradition of placing a great deal of emphasis on the disciplinary role of competitive markets. This also explains their preference for shareholding companies, which find themselves continuously re-evaluated by a functioning market of corporate control. This explains why in the US, for example, credit unions and savings banks organized as mutuals have remained small in terms of their market shares. Indeed, cooperative banks are excluded from being able to raise their capital by issuing shares, and typically they are barred from access to ample liquidity at decent interest rates. Hence, the only way for cooperative banks to grow would be to give them permission to cooperate with other banks, thus forming strategic networks. This, however, conflicts with the Anglo-Saxon market paradigm.

Germany has followed a different path by attaching much greater importance to cooperative solutions aimed at avoiding excessive risk-taking by individual institutions or at internalizing possible detrimental effects for depositors. The German banking sector is composed of three banking groups which not only differ in terms of their ownership structures but also in their internal organization and – not unrelated to this – in their deposit insurance schemes. *Commercial banks* are privately owned and in particular in the case of large banks, operate as stockholding companies. The sector of commercial banks is quite heterogeneous regarding the size as well as the range of business of individual institutions. The class of large banks (Großbanken) experienced mergers in the aftermath of the financial crisis as well as nationalization and is now represented

by the Deutsche Bank, the Commerzbank (partly in public ownership), the Deutsche Postbank[5] and the UniCredit Bank. Further classes of commercial banks are regional banks (under private law) and branches of foreign banks. The German *savings banks* see themselves as independent institutions subject to public law. Prior to the Brussels Concordance (2002), they were owned by public municipalities (cities, districts, federal states) which were also fully liable for their savings banks' liabilities. Working under public law now implies that savings banks have to gear their objectives and strategies to promoting the economic welfare of the region in which they are based. By contrast, the owners of *cooperative banks* belong to the group of depositors. The objective pursued by cooperative banks is not primarily the maximization of expected profits but the promotion of their members' well-being. The market shares of both savings banks and cooperative banks are significantly higher than in the US. Each banking group has its own umbrella association and the public representation of group interests is a function that is common to all three banking groups.[6] Furthermore, all three banking groups locate their deposit insurance schemes at the level of their umbrella associations. Beyond that, the umbrella associations of both savings banks and cooperative banks assume further tasks which include the provision of management training programmes.

The fact that savings banks and cooperative banks have a significantly larger market share than their US counterparts can be explained by their internal organization. In contrast to commercial banks, both savings banks and cooperative banks are embedded in their own financial association networks. These networks support individual member banks in enhancing their supply of financial services beyond what their often small size and regional constraints would allow. They also act as clearing houses, and, by coordinating liquidity surpluses and shortages among members, assume the role of an internal capital market. Furthermore, and importantly, the network acts as lender of last resort and, in doing so, protects individual members from illiquidity and insolvency (Joint Liability Scheme). In order to minimize moral hazard, each financial network has its own auditing associations. Notably, competition between the members of either financial network is ruled out (DSGV, 2012; Theurl and Kring, 2002).

Savings banks are organized in the "Savings Banks Finance Group". The members of this group cooperate in national and international market activities. Further members are the Landesbanken, which are owned by the federal states as well as by the savings banks themselves. They combine central bank functions with commercial bank activities

[5]The Deutsche Postbank is treated as an individual large bank throughout the considered period.

[6]For commercial banks, this is the "Bundesverband deutscher Banken" (Association of German Banks, BdB), for the group of savings banks and Landesbanken, it is the "Deutscher Sparkassen- und Giroverband" (German savings Bank Association, DSGV), for the cooperative banks, it is the "Bundesverband der Volks- und Raiffeisenbanken" (Association of cooperative Banks, BVR).

and are the main lenders to the states in which they are located. The Joint Liability Scheme is based on funds provided by the network itself and provides extensive monitoring mechanisms. These monitoring mechanisms have the primary purpose of preventing savings banks from getting into trouble. To achieve this aim, quantitative indicators as well as qualitative analyzes are applied on a regular basis. Upon detecting first signs of economic problems at a savings bank, the regional funds can use their information and intervention rights accordingly. Moreover, as the contributions to the Joint Liability Scheme depend on the riskiness of bank assets, savings banks should not favor high risk strategies (DSGV, 2012, p. 20). Close similarities to the financial networks of cooperative banks exist, except that the central bank functions for cooperative banks are concentrated in two "centrals" only.[7]

A further special feature of the German banking system is its deposit insurance system. Up to 1998, the safety of deposits was considered to be a matter of self-regulation by the banking sector itself. Whereas the financial networks of savings and cooperative banks guarantee the safety of deposits by granting institutional protection, which is a consequence of the Joint Liability Scheme, commercial banks established their own deposit insurance fund after the failure of a private bank in 1974. The deposit protection scheme is located at the umbrella association of the commercial banks, so membership of the banking association is a necessary precondition for access to the scheme. Furthermore, commercial banks are required to meet specific criteria in order to gain access to the deposit protection funds, including liable capital which complies the regulations of the Federal Financial Supervisory Authority and a rating which is at least BBB^+. The deposit protection funds are generated by one-shot as well as annual contributions made by member banks depending on their riskiness. There is also an auditing association which has special access rights to information as well as the right to impose conditions on a bank that has been downgraded or may even have run into difficulties. The private deposit insurance fund guarantees a bank's deposits up to 30% of the bank's liable capital until December 2014. From then on this ratio will decline to 8.75% in 2025 (Bundesverband deutscher Banken (BDB), 2012). Notably, these self-help guarantee funds did not endow depositors with a legally enforceable claim. Initiated by a European directive (94/19/EG: CELEX Nr. 394L0019; 97/9EG: CELEX Nor. 397L0009; 2009/14/EG: CELEX No. 309L0014), a special law enacted in 1998 and amended in 2009 now gives German depositors this formal right and protects deposits up to €100,000. This formal law has left the Joint Liability Scheme of savings and cooperative banks untouched, however. Comparing the deposit protection schemes between the three banking groups, the institutional protection

[7]The DZ bank is responsible for 80% of all German cooperatives except for cooperative banks based in North Rhine-Westphalia. Their central bank is the WGZ bank. See Theurl and Kring (2002).

provided by the savings and cooperative banks sets these banks special incentives for mutual monitoring and controlling. The absence of competition between the members of each financial network association additionally facilitates the disclosure of relevant information. This would suggest a higher degree of stability compared to commercial banks.

The financial networks described above constitute cooperative solutions for internalizing externalities: Protecting institutions through the Joint Liability Scheme is a precautionary measure to prevent bank runs. The auditing and monitoring system coupled with risk-adjusted contributions to the guarantee funds seeks to prevent excessive risk-taking. Notably, the financial network of cooperative banks has not been affected by the severe financial troubles experienced by, at least, the larger cooperative banks. The same holds true for savings banks, though not for all Landesbanken. In particular, compared to commercial banks, the cooperative banks' financial network appears to have had a rather small degree of involvement in the financial crisis. Empirical studies reveal that commercial banks are indeed less stable than either cooperative banks or savings banks (Gropp, Schröder, and Trela, 2011). The German banking system suggests the conclusion that the existing risk-sharing networks characterizing each banking group might act as a substitute for depositors' market discipline, thus making punishments by depositors for high-risk behavior of their banks redundant. In the following empirical investigation we intend to find out whether this assessment can be confirmed by the data and whether differences in governance structures both on the firm-specific as well as network-specific level lead to different degrees of market discipline among depositors. In this respect we will of course have to distinguish between normal times and the financial crisis which has revealed the constraints in the shock-absorbing capacity of risk-sharing networks.

4 Data and Descriptive Statistics

We use panel data for 144 German banks based on several data bases of the Deutsche Bundesbank. For our analysis, we combine balance sheet statistics and supervisory data with bank-specific and asset-specific interest rates from the MFI interest rate statistics[8] for the period 2003-2012 on a monthly basis. Information on income statements is available annually. The MFI interest rate statistics which is representative for the German banking sector determines the final bank sample: 72 savings banks, 41 cooperative banks, and 31 commercial banks (including the large banks). As macroeconomic control variables,

[8]Interest rates are collected on a sample basis from domestic monetary financial institutions (MFIs) with the exception of money market funds.

we use the monthly growth rate of the harmonized consumer price index ($HICP$), the unemployment rate (UR, as monthly growth rate), the real exchange rate ($REALEX$), and the annual GDP growth rate, respectively. Furthermore, we include the interest rate term structure ($TERMSTRUC$) approximated by the difference between the 10-year government bond yield and the 3 month Euribor rate. Following the Bundesbank definition (Deutsche Bundesbank, 2011, p. 56), we construct dummy variables indicating two phases of the financial crisis: The first phase represents the outbreak of the financial market turmoil on August 9th, 2007. The second phase begins on September 15th, 2008 with the bankruptcy of Lehman Brothers, and ends with the start of the exit from non-standard measures taken by the European Central Bank (ECB) on December 3rd, 2009.

We measure bank risk by bank-specific variables that indicate banks' individual asset quality, their capital adequacy and liquidity. Banks' financial strength is measured by the ratio of Tier 1 capital to risk-weighted assets ($Tier1-Ratio$). The ratio of liquid assets to total assets (LR) indicates banks' capacity to meet unexpected liquidity demands without having to sell any assets.[9] The extend to which banks are involved in traditional lending activities is captured by the share of total loans in total assets ($CREDIT$, see Altunbas, Manganelli, and Marques-Ibanez (2011)). Thus, higher bank risk is associated with lower $Tier1-Ratio$ and LR, as well as a higher $CREDIT$.

Over the period under consideration, the ratio of deposits[10] to total assets varies across the three pillars (see Figure 1). Deposits exhibit a larger share of total assets for cooperative banks than they do for savings and commercial banks. The deposit ratio over the period 2003-2013 displays, on average, a similar behavior across savings and cooperative banks. In the pre-crisis period (2003-2007) this ratio is almost constant around 25% and 33%, respectively. However, at the outbreak of the crisis and until the "Merkel-Steinbrück guarantee" the deposits-to-total assets shares increase to about 33% and 39%, respectively. Following the "Merkel-Steinbrück guarantee" the ratio decreases again, but remains at a higher level after 2010 as compared to the pre-crisis period, with a slightly positive trend starting in the middle of 2009. Figure 1 shows that the deposits-to-total assets ratio developed differently for commercial banks. On average, deposits accounted for about 20% of commercial banks' total assets in 2003. Up to 2007, this ratio rose to almost 25%, where it remained until 2009. For 2009 we observe a sharp increase in deposits-to-total assets. Thereafter, the share of deposits in total assets seems to have followed a downward trend.

[9] We use a narrow concept and measure liquid assets by banks' cash holding + deposits held with the central bank + bills + treasury bills.

[10] In this study only deposits of private households are taken into account.

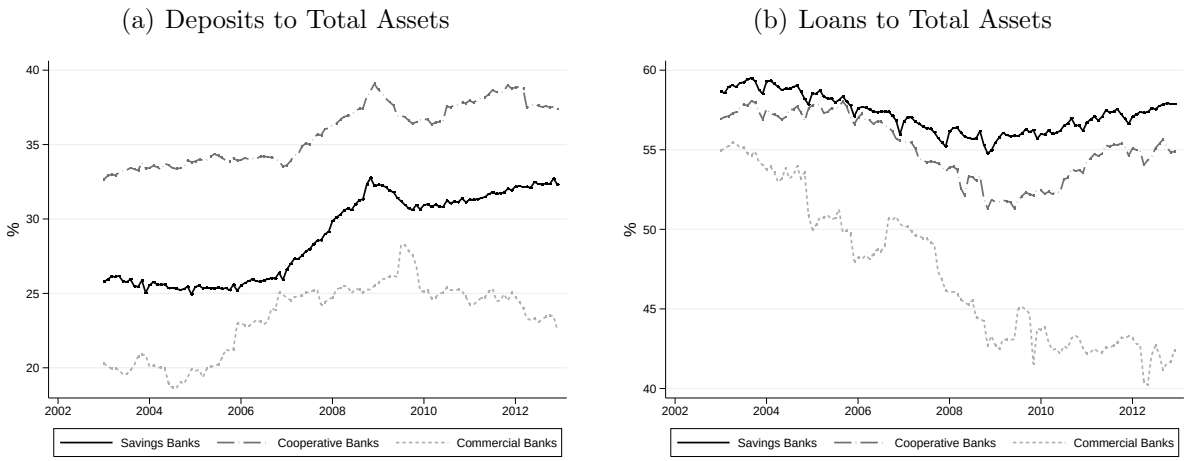


Figure 1: Deposits and Loans to Total Assets

Figure 1 illustrates notable differences between the three bank types with respect to the average lending proportion of total assets. In 2003, the loans-to-total assets ratios were very similar for all banking groups lying above 55%. Savings banks' loan share ($CREDIT$) stayed at a very high level throughout the whole 2003-2013 period, with a slight decrease during the financial crisis. In contrast, cooperative banks experienced a stronger decline between 2007 and 2011 than savings banks. A completely different development occurred among commercial banks, where $CREDIT$ decreased more or less continuously from 2003 onward reaching about 43% in 2013.

In 2003, the ratio of time deposits to sight deposits[11] (TD/SD) is highest for cooperative banks (see Figure 2). Throughout the observed period, this ratio generally followed a similar pattern for all banking groups. During the first three years of the period in question, time deposits declined relative to sight deposits. Over the next three years (roughly until the "Merkel-Steinbrück guarantee"), time deposits gained importance relative to sight deposits. In contrast to savings and cooperative banks, time deposits grew at a much stronger rate than sight deposits among commercial banks. In 2009, this ratio dropped again. Whereas TD/SD has increased among commercial banks since 2010, sight deposits have become more important relative to time deposits among savings and cooperative banks.

Figure 2 shows the average differences between interest rates on time deposits and sight deposits in the three banking groups ($IRSPREAD$). Savings banks have the largest interest rate spread, followed by cooperative banks. Commercial banks' interest rates on time deposits are much closer to sight deposit interest rates. Between 2003 and 2006, the two interest rates converged in all banking groups. Thereafter, the spread increased to

[11] Sight deposits ('overnight deposits' in the MFI interest rate statistics) are defined as deposits which are immediately convertible into cash on demand or which are transferable at any time.

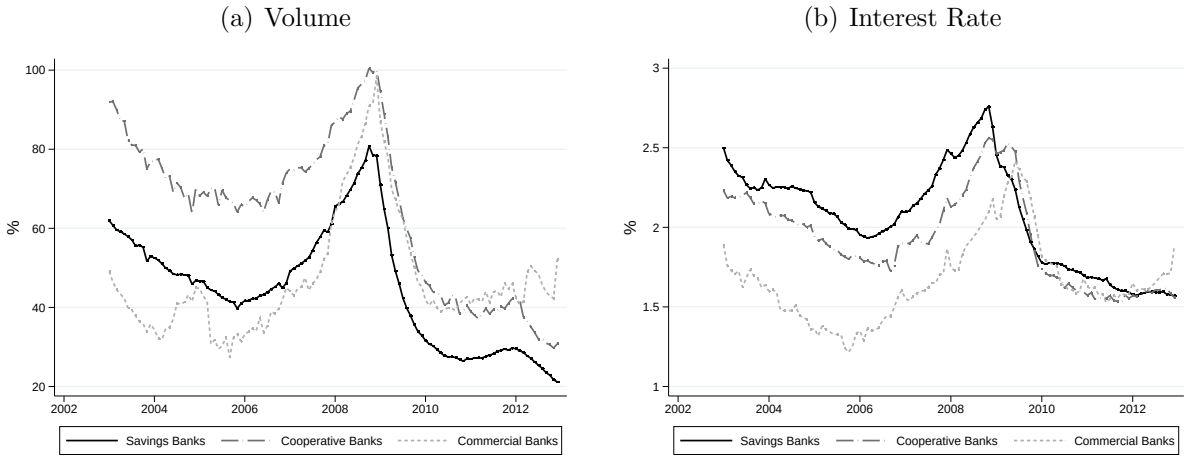


Figure 2: Time Deposits/Sight Deposits-Ratio and the Interest Rate Spread

a higher level than in 2003, with savings and cooperative banks peaking in the middle of 2008. Commercial banks' spread had its peak about one year later. It is noteworthy that the interest rate spreads differed considerably among the three bank types prior to 2010, but that they became very homogenous thereafter. However, in the course of 2012, commercial banks increased the interest rate spread to a greater extent than savings and cooperative banks.

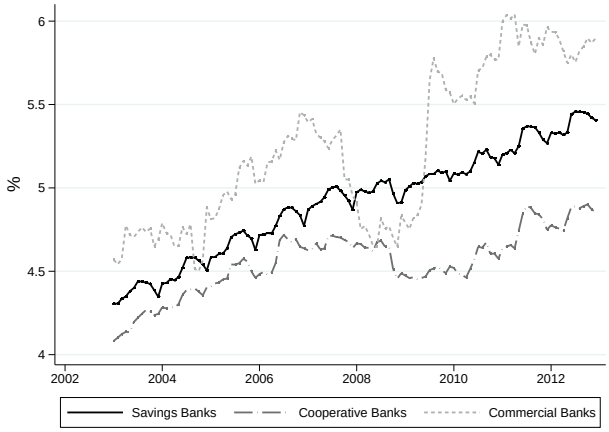


Figure 3: The development of the average equity capital-asset-ratio (CAR) in the three pillars.

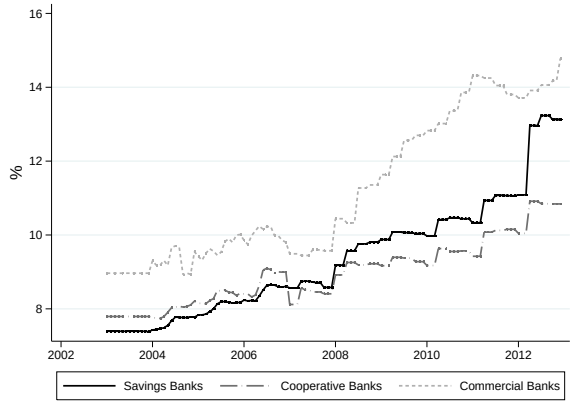
Commercial banks have a higher ratio of equity capital to total assets (CAR) than savings and cooperative banks. Over the period under consideration, a positive time trend can be observed for all bank types (see Figure 3). However, while CAR increases in the savings banks' sector throughout the entire period, the CAR of cooperative banks showed a downward shift in 2009. Commercial banks experienced a breakdown in their

CAR between 2007 and 2009, but they returned to the pre-crisis trend again in the middle of 2009. Compared to the pre-crisis period, the banking groups show greater divergence in terms of their CAR after 2009.

The $Tier1 - Ratio$ measures a bank's core capital compared to its total risk-weighted assets and is an indicator of a bank's financial strength. Figure 4 shows that commercial banks are, on average, better capitalized than savings and cooperative banks, with savings banks being less capitalized than cooperative banks. Between 2003 and 2007, the $Tier1 - Ratio$ increased across all banking groups, but since 2007 the growth rate has decreased among cooperative banks, meaning that their capitalization has fallen below savings banks' post-2007 $Tier1 - Ratio$. In contrast, commercial banks have increased their $Tier1 - Ratio$ by a greater degree in the same period. In 2012, savings banks reduced the gap between them and the commercial banks.

The Liquid Assets to Total Assets ratio (LR) is an important liquidity management tool and an indicator of a bank's ability to meet sudden liquidity demands. We use a narrow measure encompassing cash holdings plus central bank deposits plus bills plus treasury bills relative to total assets. The Liquid Asset Ratios fluctuate over the whole sample period around more or less constant values (see Figure 4). Savings and cooperative banks have similar liquid assets to total assets ratios, which are at a higher level than those of commercial banks.

(a) Tier 1 Ratio



(b) Liquidity Ratio

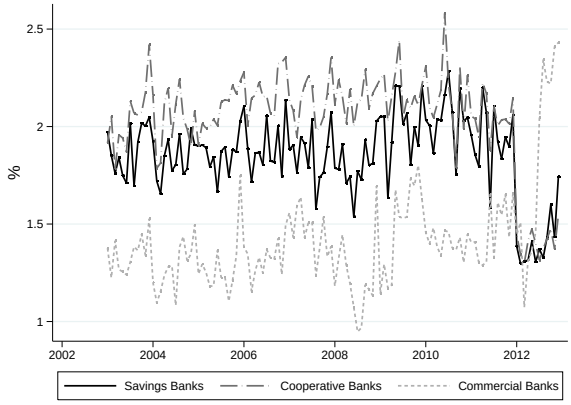


Figure 4: Tier 1 Ratio and Liquidity Ratio

Note: The considerable jump of the Tier 1 capital ratios at the beginning of 2012 relates to the launch of new details of the new capital requirements regulation and directive CRR/CRD IV.

Table 1 summarizes the descriptive statistics of the data for the period 2003-2012. We present summary statistics for all German banks and for each bank type, respectively. With respect to differences between the banking groups, it is not surprising that commercial banks are, on average, larger than savings and cooperative banks ($SIZE$)

and have more deposits ($DEPOSITS$). Savings banks have the largest loans-to-total assets ratio ($CREDIT$). The banking groups differ only slightly, on average, regarding the liquidity ratio (LR) and the $Tier1-Ratio$. Savings banks offer the lowest volume-weighted interest rate on time deposits (IR_TD) and sight deposits (IR_SD), on average amounting to 2.90% and 0.84%, respectively. Due to the very low interest rate on sight deposits, savings banks have the highest interest rate spread between time deposits and sight deposits (IR_SPREAD). Furthermore, the ratio of time deposits to sight deposits (TD/SD) is, on average, lower for savings banks than among cooperative and commercial banks; in particular, the ratio of time deposits to sight deposits is 45%, whereas this ratio is, on average, 63% and 55% for cooperative and commercial banks, respectively. In addition, savings banks are characterized by a low level of volatility with respect to the loans-to-total assets ratio ($CREDIT$), the relation of time deposits to sight deposits (TD/SD) and to the corresponding interest rates (IR_TD and IR_SD).

Cooperative banks differ from the other two bank types not only on account of their relatively low $Tier1 - Ratio$, but also because of their comparatively high liquid assets-to-total assets ratio (LR). On average, cooperative banks have a higher time deposits to sight deposits ratio (TD/SD) which, however, is also relatively volatile. Furthermore, on average, cooperative banks offer the highest interest rate on time deposits (IR_TD).

A high volatility of loans in total assets ($CREDIT$) as well as a low share of loans in total assets is characteristic of commercial banks. The interest rate spread is low due to comparatively high interest rates on sight deposits (IR_SD), though interest rates are more volatile in the commercial banks sector.

Table 2 presents summary statistics for the pre-crisis (01/2003-07/2007), crisis (08/2007-11/2009) and post-crisis period (12/2009-12/2012), respectively. Total deposits ($DEPOSITS$) increased across all bank types during the observed period. In each of the sub-periods we observe that, on average, commercial banks offer the highest volume-weighted interest rate (IR). In all sub-periods, interest rates on sight deposits are highest in the commercial banks sector, whereas savings banks offer the lowest interest rates on sight deposits. This is also true for time deposits, except for the pre-crisis period where commercial banks offered lower interest rates on time deposits. We observe the highest interest rate spread (IR_SPREAD) in the savings banks sector. Prior to the outbreak of the crisis, the smallest ratio between time deposits and sight deposits is found in the commercial banks sector. However, in the course of the crisis this ratio of the commercial banks became the highest.

All interest rates rise on average during the crisis period and decrease again after the crisis. This holds for the interest rate spread as well. During the crisis, we find higher

ratios between time deposits and sight deposits (TD/SD) across all bank types. This ratio drops after the crisis and even falls below the pre-crisis period in the savings banks and cooperative banks sector, respectively.

5 Empirical Analysis of Market Discipline in Germany

German depositors have the reputation of being patient providers of funds to their banks and indeed there has been a noticeable lack of bank runs during the entire period following the Second World War. However, this does not confirm that German depositors do not exert any market discipline at all. As has been described above, market discipline can take various forms with deposit withdrawals being only one (extreme) manifestation of this. Whether in the aftermath of the Lehman bank breakdown, German depositors would have chosen to withdraw deposits at a significant level, remains an open question because the federal government was quick to announce a state guarantee on all deposits irrespective of their size ("Merkel-Steinbrück guarantee"). However, this does not rule out market discipline at a more subtle level, involving slowing down of deposit growth, a request for higher interest rates and shorter maturities. The following empirical study seeks to provide a comprehensive picture of whether and in which form market discipline was applied in Germany, with a special focus on the role of governance. In this regard, we pay particular attention to the financial crisis and, in doing so, to the state guarantee of all deposits which was announced shortly after the bankruptcy of Lehman Brothers ("Merkel-Steinbrück guarantee").

5.1 Estimation Methodology

We estimate reduced form equations in line with Park (1995) and Martinez Peria and Schmukler (2001). Our analysis is subdivided into two parts: First, we investigate whether households slowed down deposit growth and/or demanded higher interest rates due to increased bank risk. Second, we address the question of whether households restructured their deposits in favor of sight deposits and/or demanded a higher interest rate spread from riskier banks.

Using reduced forms implies that we estimate how equilibrium combinations of the interest rate and interest rate spread, respectively, and household deposit growth and the time-to-sight-deposit ratio, respectively, respond to bank risk. Market discipline exists in either of the following cases: First, a higher bank risk is combined with higher interest rates on deposits paired with a lower growth rate of deposits (type 1). Second, a higher

bank risk is associated with a higher interest rate spread between time and sight deposits paired with a lower time-to-deposit ratio (type 2). Of course, in order to achieve results, we need to distinguish between shifts in the supply and demand curves. In this regard, we draw on Park (1995) who suggests rules of thumb based on the following arguments: Market equilibrium is characterized by the intersection of a demand and a supply function. Shifts of either function lead to a new equilibrium characterized by new combinations of the equilibrium values of the relevant variables. Given a positively sloped supply curve reflecting the behavior of depositors and a negatively sloped demand curve reflecting bank behavior[12], we can state the following: Both types of market discipline require a leftward shift of the supply curve, signaling a behavior on the part of depositors which is intended to punish their banks for taking higher risks. Empirically, we face the problem that we are unable to observe these shifts and hence have to draw appropriate conclusions from observed changes in prices and quantities. In this respect, we have to take simultaneous shifts of the supply and the demand curve into account. Hence, any leftward shift of the supply curve may be coupled with both a leftward and a rightward shift of the demand curve. In all these cases, however, we may conclude the following: Whenever we observe a simultaneous increase in the interest rate or interest rate spread, respectively, and a decrease in deposit growth or in the time-to-sight-deposit ratio, respectively, we face market discipline in its purest sense. There might have occurred a leftward shift of the demand curve, too, though to a significantly less degree. The impact of a leftward shift of the demand curve still does not dominate if we observe constant prices paired with lower quantities (deposit growth or time-to-sight-deposit ratio). Hence this case, too, signals market discipline. If on the other hand, we observe unchanged quantities (deposit growth or time-to-sight-deposit ratio) but higher prices (interest rate or interest rate spread), then this still indicates a leftward shift of the supply curve, though paired with a rightward shift of the demand curve. In all these cases, we may say that depositors' reactions outweigh the effects of a change in bank behavior, either with respect to quantities or prices, which in accordance with Park (1995), we interpret as a clear signal of market discipline.

The following empirical analysis uses Park's methodology and, in doing so, examines the prevalence of the two types of market discipline as defined above. According to the first type, depositors stand ready to deposit a smaller part of their savings with their bank if interest rates remain unaltered. Our argument here assumes a positively sloped deposit supply curve, where deposits are measured by their growth rates. Taking the financial crisis and, in particular, the failure of Lehman Brothers into account, this view

[12] A rightward shift of the supply curve leads to a higher equilibrium quantity and to a lower equilibrium price. By contrast, a leftward shift of the supply curve leads to a lower equilibrium quantity coupled with a higher equilibrium price. A rightward shift of the demand curve is followed by a higher quantity and a higher price, and a leftward shift of the demand curve implies a lower quantity and a lower price.

could be considered overly optimistic. In such a situation, it might well be possible that depositors withdraw their deposits and this at any interest rate. However, even prior to the Merkel-Steinbrück guarantee, it was not possible to observe significant signs of panicking, which supports our methodology to measure deposits by their growth rates and to assume a positive correlation with the interest rate. Therefore, following Park (1995) we first estimate two reduced-form equations, the first one representing the impact of bank risk on the equilibrium value of households deposit growth and the second one representing the impact of bank risk on the equilibrium interest rate. We estimate fixed effects models and consider differences between the banking groups by multiplying each regressor with dummy variables indicating bank type:

$$\begin{aligned}\Delta DEPOSITS_{i,t} = \alpha + \Omega + \sum_k \Bigg[\sum_j \Big[\beta_1^{j,k} RISK_{i,t-1}^j * D_{i,t}^k + \beta_2^{j,k} RISK_{i,t-1}^j * MS_{i,t} * D_{i,t}^k + \\ + \beta_3^{j,k} RISK_{i,t-1}^j * FM_{i,t} * D_{i,t}^k \Big] + \beta_4^k SIZE_{i,t} * D_{i,t}^k + \beta_5^k MS_{i,t} * D_{i,t}^k + \\ + \beta_6^k FM_{i,t} * D_{i,t}^k + \sum_m \beta_7^{m,k} MACRO_t^m * D_{i,t}^k \Bigg] + \epsilon_{i,t}\end{aligned} \tag{1}$$

$$\begin{aligned}IR_{i,t} = \alpha + \Omega + \sum_k \Bigg[\sum_j \Big[\beta_1^{j,k} RISK_{i,t-1}^j * D_{i,t}^k + \beta_2^{j,k} RISK_{i,t-1}^j * MS_{i,t} * D_{i,t}^k + \\ + \beta_3^{j,k} RISK_{i,t-1}^j * FM_{i,t} * D_{i,t}^k \Big] + \beta_4^k SIZE_{i,t} * D_{i,t}^k + \beta_5^k MS_{i,t} * D_{i,t}^k + \\ + \beta_6^k FM_{i,t} * D_{i,t}^k + \sum_m \beta_7^{m,k} MACRO_t^m * D_{i,t}^k \Bigg] + \omega_{i,t}\end{aligned} \tag{2}$$

with

$$\begin{aligned}\Omega = \alpha_1^{j,k} RISK_{i,t-1}^j + \alpha_2^{j,k} RISK_{i,t-1}^j * MS_{i,t} + \alpha_3^{j,k} RISK_{i,t-1}^j * FM_{i,t} + \alpha_4^k SIZE_{i,t} + \\ + \alpha_5^k MS_{i,t} + \alpha_6^k FM_{i,t} + \sum_m \alpha_7^{m,k} MACRO_t^m,\end{aligned}$$

where TD/SD is the ratio between time deposits and sight deposits for bank i at time t. $IRSPREAD$ is the interest rate spread between time deposits and sight deposits. $\Delta DEPOSITS$ is the growth rate of household deposits and IR is the corresponding interest rate, where IR is calculated as a bank-specific volume-weighted average interest rate on time deposits and sight deposits. $RISK^j$ denotes one of the following j variables that are associated with banks' riskiness: LR is the ratio of liquid assets (cash + central bank deposits + bills + treasury bills) to total assets. A lower LR reduces banks' ability to meet sudden liquidity demands. The $Tier1 - Ratio$ (the ratio of Tier 1 capital to risk-weighted assets) represents the degree of capitalization. $CREDIT$ (total loans-to-total assets ratio) represents banks' involvement in traditional

lending activities. $SIZE$ is the natural logarithm of total assets and is a proxy for the size of the bank. D^k is the dummy variable indicating the bank type, where $k \in \{COOPERATIVE, SAVINGS\}$, such that Ω contains all coefficients for commercial banks as the benchmark group in our analysis. We include dummy variables for the two phases of the recent financial crisis to assess the impact of the crisis itself. MS is the dummy for the first phase of the crisis (8/2007-8/2008), while FM indicates the second phase of the crisis (9/2008-11/2009) (Deutsche Bundesbank, 2011). In order to capture differences in the impact of risk measures during the recent financial crisis, we construct interaction terms between risk variables and both crisis dummies. $MACRO^m$ denotes the following m macro control variables: $HICP$ and UR are the monthly growth rates of the Harmonized Consumer Price Index and the unemployment rate, respectively. $REALEX$ is the real exchange rate (euro vs EWK-20) based on Consumer Price Indices. GDP is the yearly GDP growth rate. $TERMSTRUC$ is the interest rate term structure approximated by the difference between the 10-year government bond yield and the 3 month Euribor rate. Finally, ϵ and ω are the error terms.

We then turn to examining the market discipline of type 2 in an analogous manner using the following two reduced-form equations. The first equation represents the impact of bank risk on the equilibrium value of the time-to-sight deposit ratio and the second represents the impact of bank risk on the equilibrium interest rate spread:

$$\begin{aligned} TD/SD_{i,t} = \alpha + \Omega + \sum_k \Bigg[\sum_j \Big[\beta_1^{j,k} RISK_{i,t-1}^j * D_{i,t}^k + \beta_2^{j,k} RISK_{i,t-1}^j * MS_{i,t} * D_{i,t}^k + \\ + \beta_3^{j,k} RISK_{i,t-1}^j * FM_{i,t} * D_{i,t}^k \Big] + \beta_4^k SIZE_{i,t} * D_{i,t}^k + \beta_5^k MS_{i,t} * D_{i,t}^k + \\ + \beta_6^k FM_{i,t} * D_{i,t}^k + \sum_m \beta_7^{m,k} MACRO_t^m * D_{i,t}^k \Bigg] + \epsilon_{i,t} \end{aligned} \tag{3}$$

$$\begin{aligned} IRSPREAD_{i,t} = \alpha + \Omega + \sum_k \Bigg[\sum_j \Big[\beta_1^{j,k} RISK_{i,t-1}^j * D_{i,t}^k + \beta_2^{j,k} RISK_{i,t-1}^j * MS_{i,t} * D_{i,t}^k + \\ + \beta_3^{j,k} RISK_{i,t-1}^j * FM_{i,t} * D_{i,t}^k \Big] + \beta_4^k SIZE_{i,t} * D_{i,t}^k + \beta_5^k MS_{i,t} * D_{i,t}^k + \\ + \beta_6^k FM_{i,t} * D_{i,t}^k + \sum_m \beta_7^{m,k} MACRO_t^m * D_{i,t}^k \Bigg] + \omega_{i,t} \end{aligned} \tag{4}$$

Using Park's rules of thumb implies that if *bank risk increases* – expressed as a lower LR and $Tier1 - Ratio$, and a higher $CREDIT$, respectively, we have to distinguish between the following cases:

1. A *negative* correlation with $\Delta DEPOSITS$ (TD/SD) and a *positive* correlation with IR $(IRSPREAD)$ indicates that the major effect is a leftward shift of the supply curve and thus depositors are exercising market discipline of type 1 (type 2).

2. The *absence* of a correlation with $\Delta DEPOSITS$ (TD/SD) and a *positive* correlation with IR $(IRSPREAD)$ signals a rightward shift of the demand curve which has been outweighed by the leftward shift of the supply curve, hence signaling market discipline.

3. A *negative* correlation with $\Delta DEPOSITS$ (TD/SD) and the *absence* of a correlation with IR $(IRSPREAD)$, suggests a simultaneous leftward shift of the supply and demand curve with a predominating effect of the supply curve. This will be interpreted as a signal of market discipline.

4. A *positive* correlation with $\Delta DEPOSITS$ (TD/SD) and a *negative* correlation with IR $(IRSPREAD)$, indicates a rightward shift of the supply curve and hence market discipline of type 1 (type 2) is absent.

5. A *positive* correlation with $\Delta DEPOSITS$ (TD/SD) and a *positive* correlation with IR $(IRSPREAD)$ signals a rightward shift of the demand curve. A leftward shift of the supply curve cannot be ruled out in this case but it does not dominate effects. Hence, we will not talk about market discipline in this case.

6. A *negative* correlation with $\Delta DEPOSITS$ (TD/SD) and a *negative* correlation with IR $(IRSPREAD)$, suggests a leftward shift of the demand curve. Again, a leftward shift of the supply curve cannot be excluded but it does not dominate effects. So, again, market discipline will be ruled out.

5.2 Estimation Results

We consider the effects of each risk parameter in isolation, taking the possibility into account that depositors, in particular, have a partial perception of risk. Thus, for each banking group we distinguish between effects of increasing bank risks in "normal times" and effects during the crisis.

5.2.1 Estimation Results for Commercial Banks

Market discipline of type 1. The results for deposit growth and interest rates (Equations (1) and (2)) of commercial banks are presented in columns 2 and 4 of Table 3. Neither in normal times nor during the entire crisis period do depositors or commercial

banks respond to higher liquidity risk (lower LR) by changing the growth rate of deposits and interest rates, respectively.

Likewise, during the entire period of investigation, a higher credit-to-asset ratio ($CREDIT$) does not lead to market discipline: In normal times, a higher credit-to-asset ratio ($CREDIT$) leads to lower interest rates but does not affect deposit growth, suggesting a rightward shift of the supply curve and a simultaneous leftward shift of the demand curve. Prior to the Merkel-Steinbrück guarantee an increase in $CREDIT$ is related to a slightly significantly lower interest rate but a constant deposit growth rate, pointing to a rightward shift of the supply curve and a leftward shift of the demand curve. After the announcement of the guarantee, we observe an increased deposit growth and constant interest rates, which is associated with a rightward shift of the supply and the demand curve, hence market discipline of type 1 is absent during the entire period of investigation.

Market discipline of type 1 can only be observed for a lower $Tier1 - Ratio$, and this only during normal times. Not taking the crisis into account, we observe that a lower $Tier1 - Ratio$ is associated with an increase in interest rates. Since the deposit growth rate does not change, this indicates a leftward shift of the supply curve and a rightward shift of the demand curve. This evidence can be interpreted in favor of market discipline of type 1. For the first crisis period, the results point to a simultaneous rightward shift of the supply curve and a leftward shift of the demand curve, such that the equilibrium growth rate of deposits remained constant, but the interest rate decreased. After the Merkel-Steinbrück guarantee, changes in the $Tier1 - Ratio$ seem to have no impact on the growth of deposits and interest rates, respectively. Hence, during both crisis periods a higher insolvency risk does not lead to market discipline of type 1.

Market Discipline of Type 2. Columns 6 and 8 of Table 3 summarize the results of Equations (3) and (4). We observe that market discipline of type 2 predominates type 1. During normal times, we observe a higher interest rate spread between time deposits and sight deposits, but a constant TD/SD for commercial banks with a lower LR. This indicates that commercial banks increase their demand for time deposits relative to sight deposits, but depositors simultaneously reduce their supply with TD/SD following a lower LR. Until the Merkel-Steinbrück guarantee, a low LR led to a higher interest rate spread and a lower TD/SD, suggesting that depositors exercised market discipline as a reaction to a lower LR. During the second part of the crisis, neither depositors nor banks seem to have reacted to changes in LR by changing the deposit structure and the interest rate spread, respectively.

We also observe market discipline with respect to a higher $CREDIT$, but only for the second crisis period and at a low statistically significant level. In normal times, a higher $CREDIT$ is associated with a lower TD/SD and a lower interest rate spread, pointing to a leftward shift of the demand curve following higher $CREDIT$. During the first crisis period, $CREDIT$ does neither affect the deposit structure nor the interest rate.

Depositors as well as banks apparently do not react to a lower $Tier1 - Ratio$ during normal times. This remains unchanged during the crisis.

5.2.2 Estimation Results for Cooperative Banks

Market Discipline of Type 1. Market discipline of type 1 with respect to a lower LR can be observed for both crisis periods but not in normal times. Here we do not observe that a lower liquidity (LR) affected the growth of deposits (see Table 4, columns 2 and 4). For interest rates we find a positive correlation with LR, indicating that interest rates decrease following a reduction of the liquidity ratio. The coefficient is, however, only slightly significant. In contrast, during the first crisis period, a low LR led to an increase in the interest rate but did not affect the deposit growth rate, which signals market discipline as a leftward shift of the supply curve predominates a simultaneous rightward shift of the demand curve. After the announcement of the Merkel-Steinbrück guarantee a lower LR does not affect interest rates, but we find a reduction of the deposit growth rate. This implies a leftward shift of both the supply and the demand curves.

A higher credit ratio only leads to market discipline of type 1 during the first crisis period, but only at low statistical significance level. During normal times, a high $CREDIT$ is associated with lower interest rates while the growth rate of deposits is not affected, which is line with a rightward shift of the supply curve and a leftward shift of the demand curve. Regarding the first part of the crisis, we find a slightly statistically significant negative relationship between the deposit growth rate and $CREDIT$, whereas interest rates remain constant, such that the supply curve and the demand curve shift to the left. This indicates market discipline, though at a low statistical level. For the second crisis period, we find a reduction of interest rates following higher $CREDIT$, while the growth of deposits increases. This suggests a rightward shift of the supply curve.

Market discipline of type 1 following a lower $Tier1 - Ratio$ can be found in normal times but not during the crisis. In normal times, we observe an increase in interest rates following a low $Tier1 - Ratio$ but find no effects on the growth of deposits. By contrast, during the first crisis period we find that a falling $Tier1 - Ratio$ led to a lower interest rate without affecting the growth of deposits. This suggests that cooperative banks reduced their demand for deposits prior to the Merkel-Steinbrück guarantee whereas

depositors increased their supply. For the second part of the crisis we find an increase in the deposit growth rate and constant interest rates following a low $Tier1 - Ratio$, indicating a rightward shift of both curves.

Market Discipline of Type 2. Type 2 market discipline following a lower LR is absent for the entire period of investigation. In normal times, we find that a lower LR is associated with a lower interest rate spread but has no effect on the time-to-sight deposit ratio (see Table 4, columns 6 and 8). This points to a leftward shift of the demand curve, while the supply curve simultaneously shifts to the right. However, during both periods of the crisis LR is associated neither with the deposit structure nor with the interest rate spread.

A higher $CREDIT$, too, does not lead to market discipline during the crisis, whereas we observe disciplinary reactions by depositors during normal times, though at a weakly statistically significant level only. In normal times, we find that a higher loans-to-assets ratio ($CREDIT$) is associated with a lower time-to-sight deposit ratio (TD/SD) but does not impact the interest rate spread, implying a leftward shift of both the supply and the demand curve. During the crisis, however, a higher $CREDIT$ does not seem to affect the deposit structure (TD/SD) or the interest rate spread either.

Market discipline of type 2 follows a lower $Tier1 - Ratio$ both in normal times and during the first crisis period. If we do not take the crisis into account, we find that a lower $Tier1 - Ratio$ is followed by an increase in the interest rate spread but a constant deposit structure, suggesting that depositors' supply curve shifts to the left, whereas banks' demand shifts to the right. During the first crisis period we observe a reduction of the time-to-sight deposit ratio, while the interest rate spread remains constant, which indicates a simultaneous leftward shift of both the supply and demand curve. After the Merkel-Steinbrück guarantee, a lower $Tier1 - Ratio$ has no effect on TD/SD and the interest rate spread, respectively.

5.2.3 Estimation Results for Savings Banks

Market discipline of type 1. In normal times, savings banks did not experience market discipline at all, relating to all types of risk indicators under scrutiny. This changes in particular during the first crisis period when we observe market discipline with respect to both a lower LR and a higher $CREDIT$.

During the first crisis period, we find that a lower liquidity ratio does not affect the growth of deposits, but interest rates increase. After the Merkel-Steinbrück guarantee, this effect continues to be present, though it is only weakly statistically significant.

Concerning the loans-to-assets ratio, we observe higher interest rates following a higher $CREDIT$ during the first crisis period. This indicates a leftward shift of the supply curve and a simultaneous rightward shift of the demand curve as the growth rate of deposits remains constant. In contrast, after the Merkel-Steinbrück guarantee, we observe an increase in the deposit growth rate and constant interest rates for savings banks with higher loans-to-asset ratios. This corresponds to a rightward shift of both the supply and the demand curve in the savings banks sector.

If we do not take the crisis into account, we find that savings banks increase their demand for deposits in the case of a low $Tier1 - Ratio$. Prior to the Merkel-Steinbrück guarantee, we find lower interest rates, but a constant deposit growth rate for savings banks with a lower $Tier1 - Ratio$, indicating a simultaneous rightward shift of the supply curve and a leftward shift of the demand curve. During the second part of the crisis, however, we find no significant effects of the $Tier1 - Ratio$ on the growth rate of deposits and interest rates.

Market discipline of type 2. Market discipline of type 2 can only be observed for a lower $Tier1 - Ratio$, and this only in the first crisis period.

Not accounting for the crisis, we find no effect of LR on the deposit structure and the interest rate spread, respectively (see Table 5, columns 6 and 8). For the first crisis period, we observe an increase of TD/SD and a constant interest rate spread following a low LR, suggesting a rightward shift of the supply and demand curve. During the second crisis period, we additionally find an increase in the interest rate spread, which suggests that savings banks with a low LR increase their demand for TD/SD.

The loans-to-assets ratio ($CREDIT$) affects neither the deposit structure nor the interest rate spread in the savings banks sector, which does not change for the crisis period.

In normal times, we find that savings banks with a low $Tier1 - Ratio$ increase their demand for TD/SD (both TD/SD and IR_SPREAD increase). However, for the first part of the crisis, we observe that a low $Tier1 - Ratio$ is followed by a lower time-to-sight deposit ratio, whereas the interest rate remains constant, indicating a simultaneous leftward shift of the demand curve and the supply curve. The $Tier1 - Ratio$ does not affect the deposit structure and the interest rate spread during the second part of the crisis.

5.2.4 Interpretation of Estimation Results

Overall, we observe that cooperative banks experience the highest degree of market discipline. In this respect, both types are relevant, though type 2 is slightly less important.

With caution only should type 1 be considered as a stronger sanctioning mechanism than type two, since we do not examine total volumes of deposits and therefore deposit withdrawals. Rather, we only examine the percentage at which depositors hold their savings as deposits.

In providing an interpretation of our findings of market discipline for cooperative banks, we have to take into account that the great majority of depositors are at the same time the owners of cooperative banks. As owners they also have the possibility to affect their banks' risk-taking decisions through their votes in the general assembly. Obviously, this right is either not taken as being effective by the owner-depositors of cooperative banks or the impact of the general assembly is seen as rather restricted. In both cases market discipline remains as the only effective instrument to affect the bank's risk taking decisions. In our study we have found signs that depositors of cooperative banks are rather passive concerning their direct ownership rights but active regarding their rights as debtors. In this regard, the umbrella association into which cooperative banks are embedded obviously did not dampen depositors' fears about the safety of their investments sufficiently. In normal times, we observe reactions in particular following a lower equity ratio. In contrast to shareholders of stockholding companies, owners of cooperatives also belong to the group of debtors. Given their comparatively low share in the bank, the implications of a lower equity ratio for debtors possibly predominate their reactions. In times of crisis and prior to the Merkel-Steinbrück guarantee cooperative banks experienced market discipline concerning a lower liquidity and equity ratio. Reactions to a lower liquidity ratio can be explained by the evidence that the sector of cooperative banks are net lenders in the interbank market which quickly came under pressure due to solvency problems of net borrowing banks. Notably, depositors decided to lower the percentage of their savings meant to hold in deposits, whereas they left the maturity structure unchanged. By contrast, market discipline of type 2 prevailed with respect to a lower equity ratio, whereas prior to the crisis both types had been practiced. The missing of type 1 could well be explained by the observation that due to solvency problems of major commercial banks and Landesbanken, depositors of these two banking groups switched to cooperative banks, which might have increased their deposit growth, thus outweighing any disciplinary reaction among the group of the "old" depositors. The Merkel-Steinbrück guarantee led to a significant reduction of market discipline among cooperative banks but was unable to remove it entirely. Rather, depositors of cooperative banks continued to react to a lower liquidity ratio. This result can be justified from the perspective of a depositor-owner position. The Merkel-Steinbrück guarantee is only meant to ensure the safety of deposits but not the existence of banking institutions and therefore also not the safety of invested shares. It is true that cooperative banks were not directly involved in the crisis, however,

indirectly they participated above all through their engagement as lenders in the interbank market. Finally, we also found market discipline in normal times and during the first crisis period with respect to the credit ratio, though only at a weak statistical level. Notably, owners of cooperative banks may also belong to the group of borrowers. Hence, market discipline with respect to a higher credit ratio also signals existing conflicts of interest between depositors and borrowers, which obviously are only weakly statistically significant in our investigation.

Savings banks, by contrast, did not experience market discipline in normal times. Obviously, their depositors continued to believe in an ongoing liability of public municipalities for savings banks' debts. Also a high level of trust in the functioning of the umbrella association might have played a role. However, this changed dramatically during the first crisis period when all risk indicators triggered disciplinary reactions. This strong response can be explained by the failure of large Landesbanken, which was intensively discussed in the media. Notably, market discipline of type 1 can be observed for both a lower liquidity and a lower credit ratio, whereas a lower equity ratio only affected the maturity structure of deposits and the interest rate structure. This might be explained by media reports which at the time put the bad credit quality and liquidity shortages in the interbank market into the center. However, depositors of savings banks resumed their rather passive attitude after a state guarantee on deposits was announced. Overall, the behavior of depositors of savings banks might well be explained by their trust in public guarantees.

In the case of commercial banks, we find more evidence for market discipline of type 2 than of type 1. Interpreting type 2 as a weaker response than type 1, a possible explanation for its predominance points to a belief in some sort of a too-big-too-fail guarantee in terms of the large stockholding banks and a close trusting housebank relationship regarding smaller commercial banks. Not surprisingly, commercial banks were exposed to the highest degree of market discipline during normal times and less severely during the crisis. Indeed, the German government was quick to react to the impending insolvency of two large commercial banks at the beginning of the crisis, thus signaling that it would in fact stand ready to prevent these banks from failing. This not withstanding, government support to prevent insolvency does not exclude the possibility of short-run illiquidity, thus explaining market discipline following a lower liquidity ratio prior to the Merkel-Steinbrück guarantee, though depositors did not react by reducing deposit growth but rather by shortening maturities. Moreover, a growing public knowledge about bad loans and a related heated public debate on their fate might explain why, at least weakly so, market discipline followed after higher credit ratios during the second crisis period. In normal times, commercial banks experienced market discipline of type 1 following a lower

equity ratio. This might be explained with the leverage effect leading to a higher rate of return on equity redistributing risks at the cost of debtors, thus increasing leverage risk. We also observe market discipline of type 2 with respect to a lower liquidity ratio. Indeed, depositors of commercial banks take the exclusive role of lenders with the formal right to withdraw their loans at no or short notice. Whether easy exit can be practiced promptly, however, depends on the bank's liquidity position, and hence a focus on liquidity reserves as an important risk indicator appears plausible. On the other hand, a higher credit ratio did not lead to disciplinary reactions among depositors. Observed reactions to the liquidity and credit ratio might be connected, though. Increasingly, commercial banks reduced the proportion of bank loans in favor of activities ranging from classical investment banking to speculative engagements on derivative markets. In this respect, the relevance of the credit ratio as a comprehensive risk indicator might be put in question. On the other hand, accessible risk indicators concerning these "new" activities might not have been available. Against this background, the liquidity ratio might have served as a substitute.

6 Conclusions

German savers are renowned for preferring safe, long-term investments, thus providing patient capital, with bank deposits playing an important role (Größl, von Lüde, and Fleck, 2013). Patience, in this regard, indicates not only the absence of deposit withdrawals at the first sign of banks getting into trouble; at a more subtle level, it means that depositors are not quick to reduce that part of their savings invested in deposits and demand higher interests or shorten maturities and charge higher risk premia, but instead wait and see, signaling trust in their housebanks. Patience thus defined implies an absence of market discipline.

Using a unique data set for German banks, we examine whether German depositors are really that patient and how the financial crisis might have changed a well-established habit. Our empirical analysis does not confirm the supposed passiveness of German depositors but rather reveals the existence of market discipline and, in this regard, signals a high degree of heterogeneity among German depositors. Notably, this heterogeneity confirms the impact of governance structure. This evidence continues to hold even after the Merkel-Steinbrück guarantee which contributed to calm depositors of each banking group but obviously did not entirely silence market disciplinary reactions. Of particular interest are the following findings: First, depositors of cooperative banks practiced market discipline more frequently than depositors of the other banking groups and continued to do so even after the Merkel-Steinbrück guarantee. Since most depositors are also the owners

of cooperative banks, we interpret this evidence as a signal that these owner-depositors used market discipline as a substitute for exercising their ownership rights in the general assembly. Second, in normal times, savings banks experienced no market discipline at all. Comprehensive market discipline was present during the first crisis period but almost vanished after the Merkel-Steinbrück guarantee. One explanation for this result indicates a firm belief of savings banks' depositors in public guarantee which they also continued to hold after the Brussel Concordance took effect. Third, the lowest degree of market discipline during the crisis was practiced by depositors of commercial banks. In light of the impending failure of two large commercial banks, this finding can be interpreted as both a firm belief in the too-big-too-fail guarantee and quick steps undertaken by the government to support this belief.

Appendix

Table 1: Descripitve Statistics for the period 2003-2012

Bankspecific variables	All Banks				Saving Banks			
	N	Mean	Std.dev	Median	N	Mean	Std.dev	Median
DEPOSITS	15,309	0.005	0.039	0.003	8,233	1.798	1.470	1.351
$\Delta DEPOSITS$	15,453	0.462	0.958	0.284	8,161	0.004	0.025	0.003
IR	15,453	1.547	0.746	1.450	8,233	1.436	0.643	1.379
IR_TD	15,453	2.913	0.811	2.904	8,233	2.897	0.760	2.934
IR_SD	15,453	0.958	0.619	0.827	8,233	0.837	0.478	0.762
IR_SPREAD	15,453	1.955	0.685	1.951	8,233	2.060	0.614	2.037
TD	15,453	0.798	1.799	0.354	8,233	0.460	0.385	0.362
SD	15,453	2.344	5.491	0.901	8,233	1.338	1.288	0.954
TD/SD	15,453	0.520	0.498	0.364	8,233	0.450	0.365	0.336
TA	15,453	25.461	112.992	4.968	8,233	7.010	5.629	5.358
SIZE	15,453	1.848	1.126	1.603	8,233	1.755	0.566	1.679
LR	15,453	0.019	0.010	0.018	8,233	0.019	0.007	0.017
CREDIT	15,321	0.544	0.173	0.571	8,233	0.572	0.125	0.586
Tier1_Ratio	15,268	0.093	0.030	0.087	8,227	0.093	0.028	0.088
	Cooperative Banks				Commercial Banks			
DEPOSITS	4,632	1.384	1.327	0.969	2,588	10.568	14.507	4.428
DEPOSITS growth	4,592	0.006	0.040	0.004	2,556	0.007	0.066	0.002
IR	4,632	1.605	0.738	1.506	2,588	1.797	0.962	1.691
IR_TD	4,632	2.934	0.798	2.916	2,588	2.924	0.975	2.756
IR_SD	4,632	1.006	0.544	0.893	2,588	1.255	0.943	1.080
IR_SPREAD	4,632	1.928	0.627	1.894	2,588	1.669	0.882	1.577
TD	4,632	0.375	0.448	0.233	2,588	2.632	3.801	0.944
SD	4,632	1.009	1.113	0.591	2,588	7.937	11.615	3.426
TD/SD	4,632	0.625	0.638	0.423	2,588	0.554	0.543	0.396
TA	4,632	4.404	5.474	3.186	2,588	121.842	254.819	22.106
SIZE	4,632	1.168	0.706	1.159	2,588	3.363	1.585	3.096
LR	4,632	0.021	0.011	0.020	2,588	0.017	0.014	0.013
CREDIT	4,564	0.545	0.146	0.552	2,524	0.448	0.283	0.399
Tier1_Ratio	4,629	0.090	0.023	0.087	2,412	0.100	0.043	0.084

Macroeconomic variables	N	Mean	Std.dev	Median
HICP	15,313	0.152	0.389	0.104
UR	15,313	-0.354	3.728	-1.149
REALEX	15,453	103.655	4.297	104.064
GDP	15,453	2.205	2.798	2.236
TERMSTRUC	15,453	1.285	0.984	1.320

$DEPOSITS$ display households' deposits in billion euros. $\Delta DEPOSITS$ is the growth rate of deposits. The interest rates IR are given in percent. IR_TD (IR_SD) represents the volume-weighted interest rates for time (sight) deposits in percent and IR_SPREAD the difference between IR_TD and IR_SD. Time (sight) deposits in billion euros are denoted by TD (SD) and their ratio is displayed as TD/SD. $SIZE$ is defined as the natural logarithm of total assets TA. LR represents the ratio of liquid assets to total assets. $CREDIT$ represents the total credit volume relative to total assets. The $Tier1\_Ratio$ is the ratio of Tier 1 capital and risk-weighted assets. $HICP$ is the monthly growth rate of the Harmonized Consumer Price Index in percent, UR is the monthly unemployment rate in percent, $REALEX$ is the real exchange rate (euro vs. EER-20) based on consumer price indices (base year 1999Q1) and GDP is the yearly growth rate of GDP. $TERMSTRUC$ is the interest rate term structure approximated by the difference betwenn the 10-year governmentbond yield and the 3 month Euribor rate

Table 2: Descriptive Statistics split for pre-crisis, crisis and post-crisis periods

Bank-specific variables	**pre crisis (01/2003 - 07/2007)**				**crisis (08/2007 - 11/2009)**				**post crisis (12/2009 - 12/2012)**			
	N	Mean	Std.dev	Median	N	Mean	Std.dev	Median	N	Mean	Std.dev	Median
All Banks												
DEPOSITS	7,146	2.471	5.052	1.116	3,612	3.397	6.871	1.470	4,695	3.970	9.031	1.601
IR	7,146	1.654	0.526	1.593	3,612	2.171	0.827	2.262	4,695	0.905	0.393	0.844
IR_TD	7,146	3.019	0.570	3.025	3,612	3.631	0.707	3.808	4,695	2.198	0.602	2.159
IR_SD	7,146	1.030	0.533	0.961	3,612	1.342	0.761	1.267	4,695	0.552	0.310	0.523
IR_SPREAD	7,146	1.989	0.654	1.972	3,612	2.289	0.684	2.308	4,695	1.646	0.590	1.639
TD	7,146	0.635	0.985	0.322	3,612	1.155	2.419	0.509	4,695	0.772	2.130	0.304
SD	7,146	1.835	4.372	0.743	3,612	2.242	4.705	0.929	4,695	3.198	7.211	1.230
TD/SD	7,146	0.552	0.495	0.399	3,612	0.690	0.552	0.562	4,695	0.341	0.394	0.231
TA	7,146	21.747	84.638	4.615	3,612	25.260	98.838	5.136	4,695	31.268	153.472	5.369
LR	7,146	0.019	0.010	0.018	3,612	0.019	0.010	0.018	4,695	0.019	0.011	0.017
CREDIT	7,146	0.562	0.172	0.590	3,612	0.522	0.174	0.549	4,563	0.533	0.170	0.565
Tier1_Ratio	7,132	0.082	0.022	0.077	3,539	0.094	0.027	0.091	4,597	0.110	0.033	0.104
Saving Banks												
DEPOSITS	3,813	1.484	1.054	1.136	1,904	1.952	1.535	1.462	2,516	2.158	1.821	1.611
IR	3,813	1.550	0.409	1.533	1,904	2.018	0.705	2.194	2,516	0.821	0.264	0.803
IR_TD	3,813	3.049	0.461	3.087	1,904	3.573	0.686	3.766	2,516	2.153	0.529	2.157
IR_SD	3,813	0.894	0.392	0.915	1,904	1.182	0.582	1.175	2,516	0.489	0.207	0.496
IR_SPREAD	3,813	2.156	0.534	2.094	1,904	2.390	0.568	2.396	2,516	1.664	0.553	1.679
TD	3,813	0.435	0.344	0.339	1,904	0.633	0.512	0.534	2,516	0.366	0.276	0.314
SD	3,813	1.049	0.826	0.785	1,904	1.319	1.225	0.948	2,516	1.791	1.710	1.221
TD/SD	3,813	0.487	0.350	0.380	1,904	0.607	0.440	0.509	2,516	0.276	0.231	0.223
TA	3,813	6.592	5.148	5.186	1,904	7.266	5.862	5.656	2516	7.450	6.086	5.680
LR	3,813	0.019	0.007	0.018	1,904	0.019	0.008	0.017	2,516	0.018	0.008	0.017
CREDIT	3,813	0.581	0.123	0.602	1,904	0.558	0.123	0.572	2,516	0.570	0.130	0.581
Tier1_Ratio	3,807	0.080	0.018	0.076	1,904	0.096	0.024	0.092	2,516	0.112	0.030	0.106
Cooperative Banks												
DEPOSITS	2,139	1.104	1.128	0.725	1,092	1.459	1.328	1.078	1,401	1.752	1.498	1.240
IR	2,139	1.751	0.524	1.637	1,092	2.217	0.790	2.271	1,401	0.906	0.289	0.868
IR_TD	2,139	3.047	0.557	2.995	1,092	3.663	0.650	3.821	1,401	2.194	0.569	2.112
IR_SD	2,139	1.083	0.438	1.045	1,092	1.392	0.657	1.318	1,401	0.587	0.221	0.608
IR_SPREAD	2,139	1.964	0.613	1.921	1,092	2.271	0.574	2.244	1,401	1.607	0.523	1.532
TD	2,139	0.375	0.507	0.230	1,092	0.474	0.479	0.343	1,401	0.297	0.281	0.190
SD	2,139	0.729	0.775	0.426	1,092	0.984	1.056	0.599	1,401	1.455	1.411	0.827
TD/SD	2,139	0.720	0.705	0.465	1,092	0.762	0.629	0.608	1,401	0.373	0.432	0.208
TA	2,139	3.801	4.573	2.701	1,092	4.658	5.995	3.508	1,401	5.128	6.168	3.740
LR	2,139	0.021	0.010	0.021	1,092	0.022	0.012	0.021	1,401	0.019	0.011	0.018
CREDIT	2,139	0.568	0.144	0.582	1,092	0.517	0.146	0.514	1,333	0.533	0.143	0.544
Tier1_Ratio	2,139	0.082	0.019	0.081	1,092	0.091	0.023	0.088	1,398	0.100	0.024	0.095
Commercial Banks												
DEPOSITS	1,194	8.070	10.450	3.497	616	11.298	13.825	5.324	778	13.825	19.004	4.416
IR	1,194	1.809	0.746	1.758	616	2.565	1.069	2.707	778	1.171	0.682	1.105
IR_TD	1,194	2.872	0.828	2.731	616	3.753	0.839	4.010	778	2.349	0.821	2.276
IR_SD	1,194	1.369	0.829	1.240	616	1.745	1.157	1.580	778	0.692	0.566	0.464
IR_SPREAD	1,194	1.503	0.810	1.410	616	2.007	1.026	2.125	778	1.657	-0.783	1.609
TD	1,194	1.740	1.871	0.838	616	3.972	4.851	1.555	778	2.939	4.623	0.903
SD	1,194	6.330	9.319	2.764	616	7.326	9.594	3.976	778	10.886	15.167	3.833
TD/SD	1,194	0.457	0.334	0.358	616	0.816	0.662	0.634	778	0.496	0.624	0.321
TA	1,194	102.291	187.022	21.052	616	117.396	216.634	23.85	778	155.366	351.588	32.371
LR	1,194	0.017	0.013	0.013	616	0.016	0.013	0.012	778	0.018	0.017	0.013
CREDIT	1,194	0.487	0.293	0.433	616	0.421	0.282	0.307	714	0.405	0.256	0.337
Tier1_Ratio	1,186	0.087	0.035	0.077	543	0.097	0.040	0.088	683	0.124	0.048	0.120
Macroeconomic variables												
HICP	7,007	0.158	0.365	0.194	3,612	0.089	0.390	0.093	4,694	0.191	0.415	0.092
UR	7,007	-0.363	3.515	-0.980	3,612	-0.459	3.606	-1.184	4,694	-0.260	4.109	-1.163
REALEX	7,146	103.847	2.319	104.314	3,612	108.578	2.162	108.699	4,695	99.575	3.692	99.789
GDP	7,146	2.478	1.720	1.761	3,612	-0.116	4.007	0.790	4,695	3.575	1.669	3.498
TERMSTRUC	7,146	1.370	0.729	1.384	3,612	0.699	1.417	-0.251	4,695	1.610	0.673	1.403

Table 3: Commercial Banks

Dependent Variable	$\Delta DEPOSITS$		IR		TD/SD		IR_SPREAD	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SIZE_t$	0.0077	0.0063	-0.2634	-0.2959**	-0.0344	-0.0372	-0.2769	-0.2763
	[0.0154]	[0.0155]	[0.1622]	[0.1483]	[0.1732]	[0.1749]	[0.2342]	[0.2205]
LR_{t-1}	-0.0627	0.0013	-5.1482**	-3.6222	-2.1189	-2.2887	-9.5171***	-8.2503**
	[0.1080]	[0.1342]	[2.2678]	[2.2703]	[2.5141]	[2.9413]	[3.1366]	[3.2533]
$CREDIT_{t-1}$	0.0065	0.0049	-0.8527**	-0.8269**	-1.0980*	-1.1060*	-2.2324***	-2.3151***
	[0.0273]	[0.0276]	[0.3932]	[0.3814]	[0.6550]	[0.6532]	[0.6850]	[0.6323]
$Tier1\_Ratio_{t-1}$	-0.0929	-0.1154	-3.7271***	-3.8185***	1.6891	1.5076	0.9749	0.6215
	[0.0760]	[0.0925]	[1.1101]	[1.0644]	[2.0773]	[2.1983]	[2.2690]	[2.2501]
MS	-0.0012	0.0061	0.3491***	0.2885***	0.2457***	0.0927	0.3938***	0.5272***
	[0.0039]	[0.0103]	[0.0792]	[0.0824]	[0.0710]	[0.1173]	[0.1072]	[0.1576]
FM	-0.0096	-0.0217	0.4194**	0.3174**	0.4468***	0.2967*	0.9171***	0.7591***
	[0.0100]	[0.0231]	[0.1698]	[0.1455]	[0.1553]	[0.1649]	[0.2167]	[0.1691]
$LR_{t-1} * MS$		-0.4037***		-10.2689**		6.3544*		-13.7985**
		[0.1454]		[4.3012]		[3.5577]		[6.1752]
$LR_{t-1} * FM$		-0.2821		-3.4782		-2.6625		-0.8278
		[0.5522]		[4.9116]		[4.5608]		[4.8726]
$CREDIT_{t-1} * MS$		-0.0035		-0.4524*		0.0863		0.5122
		[0.0087]		[0.2535]		[0.2455]		[0.4070]
$CREDIT_{t-1} * FM$		0.0297**		0.4787		0.5336		0.7140*
		[0.0125]		[0.3658]		[0.3818]		[0.3985]
$Tier1\_Ratio_{t-1} * MS$		-0.0141		4.8109***		0.5009		-1.8487
		[0.0878]		[0.9708]		[0.9998]		[2.6046]
$Tier1\_Ratio_{t-1} * FM$		0.0892		-0.1959		-0.0586		-0.675
		[0.1517]		[1.2032]		[0.8660]		[1.4454]
$HICP$	0.002	-0.0496	-3.7486***	-4.1548***	1.5473	0.6587	2.7929	2.1628
	[0.4260]	[0.4179]	[1.2074]	[1.1135]	[1.4120]	[1.4867]	[2.0286]	[1.7829]
UR	-0.0051	-0.0105	-0.0839	-0.088	0.3197**	0.3228**	0.3116	0.2142
	[0.0294]	[0.0286]	[0.1444]	[0.1435]	[0.1479]	[0.1404]	[0.2619]	[0.2583]
$REALEX$	0.0003	0.0002	0.0415***	0.0412***	0.0047	0.0032	0.0053	0.0039
	[0.0004]	[0.0004]	[0.0060]	[0.0065]	[0.0048]	[0.0048]	[0.0111]	[0.0117]
GDP	-0.0008	-0.0004	-0.0021	0.0006	0.0021	0.0047	0.0172	0.0219
	[0.0010]	[0.0009]	[0.0125]	[0.0140]	[0.0121]	[0.0118]	[0.0190]	[0.0200]
$TERMSTRUC$	-0.0032*	-0.0039**	-0.4114***	-0.4104***	-0.0797***	-0.0776***	0.048	0.039
	[0.0017]	[0.0019]	[0.0520]	[0.0544]	[0.0194]	[0.0189]	[0.0637]	[0.0640]
$Constant$	-0.0095	0.0062	-0.1728	-0.1822	0.7818**	0.9193**	2.5637***	2.6829***
	[0.0238]	[0.0227]	[0.6011]	[0.6455]	[0.3693]	[0.3957]	[0.6191]	[0.6667]
$R-squared$	0.0173	0.0223	0.7242	0.7382	0.298	0.3128	0.3227	0.3369
$Observations$	15,029	15,029	15,029	15,029	15,029	15,029	15,029	15,029

*Heteroskedasticity- and cluster-robust standard errors for fixed effects panel data are not displayed. Coefficients significantly different from 0 at 1%, 5%, and 10% significance level are denoted by ***, **, and *. LR is the ratio of liquid assets to total assets. $CREDIT$ is the share of total loans in total assets. The $Tier1-Ratio$ is the Tier 1-Capital/Risk-weighted assets. $SIZE$ is the natural logarithm of total assets and is a proxy for the size of the bank. We include dummy variables for the two phases of the recent financial crisis in order to capture differences in the impact of risk measures during the recent financial crisis as well as the impact of the crisis itself. MS is the dummy for the first phase of the crisis (8/2007-8/2008), and FM indicates the second phase of the crisis (9/2008-11/2009). $HICP$ is the monthly growth rate of the Harmonized Consumer Price Index, UR is the monthly growth rate of the unemployment rate, $REALEX$ is the real exchange rate (euro vs. EWK-20) based on consumer price indices, base year 1999Q1, GDP is the yearly growth rate of GDP. $TERMSTRUC$ is the interest rate term structure approximated by the difference between the 10-year government bond yield and the 3 month Euribor rate. Source: Deutsche Bundesbank.*

Table 4: Cooperative Banks

Dependent Variable	$\Delta DEPOSITS$		IR		TD/SD		IR_SPREAD	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SIZE_t$	0.0039	0.0013	-0.9314***	**-0.9024*** **	-0.4042**	-0.4004**	-0.5687***	-0.5673***
	[0.0047]	[0.0045]	[0.1683]	[0.1677]	[0.1886]	[0.1908]	[0.2083]	[0.2097]
LR_{t-1}	0.0045	-0.1126	1.1311	3.5727*	1.6197	1.7758	**6.6988*** **	**5.7267** **
	[0.0908]	[0.0849]	[1.8722]	[1.9455]	[1.3943]	[1.3801]	[1.9893]	[2.3598]
$CREDIT_{t-1}$	0.0067	0.0097	-1.3860**	-1.4067**	-1.1377*	-1.1385*	-0.0726	-0.0696
	[0.0153]	[0.0149]	[0.6450]	[0.6444]	[0.6461]	[0.6508]	[0.8544]	[0.8412]
$Tier1\_Ratio_{t-1}$	-0.0272	-0.0268	-5.7234***	-6.0194***	-2.6998	-3.039	-5.9905***	-6.4075***
	[0.0440]	[0.0438]	[2.0306]	[1.9809]	[1.9300]	[1.8905]	[2.1840]	[2.2138]
MS	-0.0037	0.0026	**0.1368** **	0.1707**	-0.0089	-0.0713	0.3050***	0.0725
	[0.0033]	[0.0061]	[0.0661]	[0.0820]	[0.0593]	[0.0593]	[0.0863]	[0.0936]
FM	-0.0058	-0.0121***	0.1242	0.2326**	-0.0903	-0.0772	**0.3786*** **	**0.3415*** **
	[0.0037]	[0.0036]	[0.1181]	[0.0950]	[0.1265]	[0.1006]	[0.1084]	[0.1062]
$LR_{t-1} * MS$		0.3205		**-21.1921*** **		-3.6288		4.0659
		[0.2203]		[3.8029]		[2.2617]		[5.5465]
$LR_{t-1} * FM$		0.4318***		-0.07		1.9687		2.8492
		[0.1558]		[3.2183]		[2.9500]		[4.1682]
$CREDIT_{t-1} * MS$		-0.0240*		0.1081		-0.1073		0.2582
		[0.0130]		[0.2805]		[0.1646]		[0.6744]
$CREDIT_{t-1} * FM$		0.0148*		-0.4058**		-0.2104		-0.3321
		[0.0084]		[0.1958]		[0.1792]		[0.2146]
$Tier1\_Ratio_{t-1} * MS$		-0.0128		4.1641***		2.5011***		0.681
		[0.0513]		[1.2266]		[0.9096]		[4.0349]
$Tier1\_Ratio_{t-1} * FM$		-0.0686*		0.6742		0.5232		1.4777
		[0.0384]		[0.7622]		[0.6687]		[1.1418]
$HICP$	-0.4921	-0.519	-4.1147***	-3.5426***	-1.5857	-1.6422	0.4981	-0.1021
	[0.3219]	[0.3188]	[1.0277]	[0.8635]	[1.2279]	[1.1312]	[1.0619]	[1.0347]
UR	-0.0509**	-0.0543**	-0.1917*	-0.1462	-0.0509	-0.0113	0.0286	0.099
	[0.0228]	[0.0227]	[0.1044]	[0.1020]	[0.1180]	[0.1082]	[0.1152]	[0.1123]
$REALEX$	0.0002	0.0002	**0.0534*** **	**0.0526*** **	0.0140***	0.0126**	-0.0003	-0.0018
	[0.0003]	[0.0003]	[0.0054]	[0.0062]	[0.0048]	[0.0054]	[0.0065]	[0.0071]
GDP	-0.0005	-0.0002	-0.0223***	-0.0262***	-0.0256***	-0.0260***	-0.0367***	-0.0365***
	[0.0003]	[0.0004]	[0.0074]	[0.0082]	[0.0087]	[0.0094]	[0.0062]	[0.0070]
$TERMSTRUC$	-0.0039***	-0.0043***	-0.3655***	-0.3629***	-0.0892***	-0.0849***	-0.0376	-0.0282
	[0.0010]	[0.0009]	[0.0213]	[0.0216]	[0.0149]	[0.0145]	[0.0290]	[0.0294]
$Constant$	-0.0095	0.0062	-0.1728	-0.1822	0.7818**	0.9193**	2.5637***	2.6829***
	[0.0238]	[0.0227]	[0.6011]	[0.6455]	[0.3693]	[0.3957]	[0.6191]	[0.6667]
$R-squared$	0.0173	0.0223	0.7242	0.7382	0.298	0.3128	0.3227	0.3369
$Observations$	15,029	15,029	15,029	15,029	15,029	15,029	15,029	15,029

*Heteroskedasticity- and cluster-robust standard errors for fixed effects panel data are not displayed. Coefficients significantly different from 0 at 1%, 5%, and 10% significance level are denoted by ***, **, and *. LR is the ratio of liquid assets to total assets. $CREDIT$ is the share of total loans in total assets. The $Tier1-Ratio$ is the Tier 1-Capital/Risk-weighted assets. $SIZE$ is the natural logarithm of total assets and is a proxy for the size of the bank. We include dummy variables for the two phases of the recent financial crisis in order to capture differences in the impact of risk measures during the recent financial crisis as well as the impact of the crisis itself. MS is the dummy for the first phase of the crisis (8/2007-8/2008), and FM indicates the second phase of the crisis (9/2008-11/2009). $HICP$ is the monthly growth rate of the Harmonized Consumer Price Index, UR is the monthly growth rate of the unemployment rate, $REALEX$ is the real exchange rate (euro vs. EWK-20) based on consumer price indices, base year 1999Q1, GDP is the yearly growth rate of GDP. $TERMSTRUC$ is the interest rate term structure approximated by the difference between the 10-year government bond yield and the 3 month Euribor rate. Bold coefficients indicate significant differences in comparison to the coefficients of commercial banks at the 10% significance level. Source: Deutsche Bundesbank.*

Table 5: Savings Banks

Dependent Variable	$\Delta DEPOSITS$		IR		TD/SD		IR_SPREAD	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SIZE_t$	0.0091**	0.0072	-0.7246***	-0.6937**	-0.2708*	-0.2562	-0.4539	-0.4199
	[0.0046]	[0.0049]	[0.2755]	[0.2731]	[0.1613]	[0.1591]	[0.2770]	[0.2779]
LR_{t-1}	-0.1059**	-0.1182***	-0.6157	2.0293	-0.1592	0.7886	-0.705	0.9731
	[0.0468]	[0.0451]	[1.7782]	[1.6450]	[0.7108]	[0.8548]	[1.7324]	[1.6084]
$CREDIT_{t-1}$	0.01	0.0104	-0.6802	-0.6848	-0.4323	-0.4164	-0.2693	-0.276
	[0.0135]	[0.0131]	[0.5178]	[0.5216]	[0.4533]	[0.4483]	[0.6087]	[0.6129]
$Tier1\_Ratio_{t-1}$	-0.0383	-0.0578**	**-8.9165*** **	**-8.9451*** **	-3.1348***	-3.3693***	-7.5134***	-7.6593***
	[0.0249]	[0.0259]	[1.3702]	[1.3669]	[0.9444]	[0.9284]	[1.4107]	[1.4204]
MS	0.0011	0.0019	0.2287***	0.1372***	**0.0855*** **	-0.0262	0.2366***	-0.0085
	[0.0013]	[0.0016]	[0.0324]	[0.0417]	[0.0194]	[0.0266]	[0.0377]	[0.0546]
FM	0.0005	-0.0087***	0.2243***	0.3195***	**0.0655** **	0.0563*	**0.1660*** **	**0.2073*** **
	[0.0020]	[0.0020]	[0.0441]	[0.0408]	[0.0315]	[0.0287]	[0.0569]	[0.0528]
$LR_{t-1} * MS$		-0.0258		-19.3869***		**-4.4363***		-2.1521
		[0.0966]		[5.3123]		[2.4489]		[6.4856]
$LR_{t-1} * FM$		0.062		-4.9938*		-3.2976*		-8.0253**
		[0.1534]		[2.5425]		[1.7131]		[3.1529]
$CREDIT_{t-1} * MS$		-0.0038		**0.5238** **		0.0476		0.3885
		[0.0055]		[0.2027]		[0.1345]		[0.3222]
$CREDIT_{t-1} * FM$		0.0143**		-0.191		-0.07		-0.058
		[0.0064]		[0.1374]		[0.0830]		[0.2030]
$Tier1\_Ratio_{t-1} * MS$		0.0233		**1.8556***		2.1545**		1.3683
		[0.0330]		[1.0472]		[0.9953]		[1.9392]
$Tier1\_Ratio_{t-1} * FM$		0.0353		0.6266		1.076		1.0617
		[0.0467]		[0.7168]		[0.7688]		[1.0546]
$HICP$	-0.7914***	-0.8344***	-2.6414***	-2.3525***	-0.9568***	-1.1281***	-1.7440***	-1.7743***
	[0.0912]	[0.0913]	[0.4844]	[0.3847]	[0.2680]	[0.2354]	[0.5411]	[0.4161]
UR	-0.0279**	-0.0308***	-0.0577	0.0177	0.0458	0.0868***	-0.0237	0.0617
	[0.0114]	[0.0115]	[0.0392]	[0.0398]	[0.0300]	[0.0293]	[0.0595]	[0.0591]
$REALEX$	-0.0001	-0.0002*	0.0381***	0.0379***	0.0064***	0.0049**	0.0162***	0.0148***
	[0.0001]	[0.0001]	[0.0036]	[0.0042]	[0.0020]	[0.0022]	[0.0040]	[0.0046]
GDP	0.0004*	0.0006***	-0.0153***	-0.0193***	-0.0131***	-0.0138***	-0.0267***	-0.0302***
	[0.0002]	[0.0002]	[0.0029]	[0.0034]	[0.0025]	[0.0028]	[0.0049]	[0.0055]
$TERMSTRUC$	-0.0034***	-0.0037***	-0.3226***	**-0.3152*** **	-0.0691***	-0.0637***	-0.0968***	-0.0837***
	[0.0004]	[0.0004]	[0.0141]	[0.0146]	[0.0083]	[0.0084]	[0.0247]	[0.0247]
$Constant$	-0.0095	0.0062	-0.1728	-0.1822	0.7818**	0.9193**	2.5637***	2.6829***
	[0.0238]	[0.0227]	[0.6011]	[0.6455]	[0.3693]	[0.3957]	[0.6191]	[0.6667]
$R-squared$	0.0173	0.0223	0.7242	0.7382	0.298	0.3128	0.3227	0.3369
$Observations$	15,029	15,029	15,029	15,029	15,029	15,029	15,029	15,029

*Heteroskedasticity- and cluster-robust standard errors for fixed effects panel data are not displayed. Coefficients significantly different from 0 at 1%, 5%, and 10% significance level are denoted by ***, **, and *. LR is the ratio of liquid assets to total assets. $CREDIT$ is the share of total loans in total assets. The $Tier1-Ratio$ is the Tier 1-Capital/Risk-weighted assets. $SIZE$ is the natural logarithm of total assets and is a proxy for the size of the bank. We include dummy variables for the two phases of the recent financial crisis in order to capture differences in the impact of risk measures during the recent financial crisis as well as the impact of the crisis itself. MS is the dummy for the first phase of the crisis (8/2007-8/2008), and FM indicates the second phase of the crisis (9/2008-11/2009). $HICP$ is the monthly growth rate of the Harmonized Consumer Price Index, UR is the monthly growth rate of the unemployment rate, $REALEX$ is the real exchange rate (euro vs. EWK-20) based on consumer price indices, base year 1999Q1, GDP is the yearly growth rate of GDP. $TERMSTRUC$ is the interest rate term structure approximated by the difference between the 10-year government bond yield and the 3 month Euribor rate. Bold coefficients indicate significant differences in comparison to the coefficients of commercial banks at the 10% significance level. Source: Deutsche Bundesbank.*

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