WORKING PAPER

Are private banks the better banks? An insight into the principal-agent structure and risk-taking behavior of German banks.

by

Frank Schmielewski and Thomas Wein

Are private banks the better banks?
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Frank Schmielewski[1]
Prof. Dr. Thomas Wein
Leuphana University of Lüneburg [2]

Abstract

In this study, we propose our hypothesis that the distinguishable principal-agent relationships of German banks are significantly influencing the risk-taking attitudes of bank managers. Particularly, we intend to substantiate the theory that banks owned by dispersed shareholders or federal state authorities face a higher relevance of principal-agent problems than other banking sectors due to a missing ability to monitor bank managers. Our results underline that these problems appear to mislead bank managers showing an unreasonable risk-taking behavior. In a first stage, we rely on a theoretical model explaining that from the bank owners' viewpoint three factors of the principal-agent relationships are determining the probability of choosing the optimal portfolio of risky assets. These factors cover the ability to control bank managers, the risk pooling capabilities of bank owners and bank managers, and the incentives of seeking high returns. To support our hypothesis we apply an empirical study to the distances-to-default of different German banking sectors. This demonstrates that risk-taking attitudes of banks are closely related to banks' ownership. Consequently, our findings offer evidence, that legislative and regulatory authorities should increase their vigilance in terms of principal-agent problems within certain sectors of the banking industry.

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[1] Author's eMail address: wein@leuphana.de
[2] Author's eMail address: frank.schmielewski@stud.leuphana.de

1. Introduction

Our paper intends to examine whether multistage principal-agent relationships are explaining the different risk-taking behavior of German banks in the course of the financial crisis from 2007 to 2008. Within this context, it appears reasonable to distinguish between banks with dispersed shareholders and banks with a high ownership concentration.[3] The classical principal-agent theory assumes that managers pursue different objectives and show different risk-taking attitudes than firms' owners. Amihud and Levy (1981) or Hirshleifer and Thakor (1992), for example, argue that managers generally avoid risk-taking due to career concerns. Accordingly, managers show a more averse risk-taking behavior than firms` owners, because they are not able to diversify their unemployment risk.

By contrast to managers, dispersed shareholders have larger incentives to behave risk-neutral (Jensen and Meckling [1976], Demsetz and Lehn [1985], Esty [1998]), because they are capable to diversify their risk by engaging in a large number of projects. Furthermore, dispersed shareholders obtain lower incentives to control managers because they have to share the benefits of controlling activities with other shareholders irrespective of their capability to control. Thus, large shareholders are able to overcome this incentive problem, and therefore attain a higher chance to prevent low risk-taking by managers (Morck et al. [2005], Stultz [2005]). Our paper contributes to this discussion by modelling the theoretical background of principal-agent problems in the banking industry taking into account the probability of their occurrence depending on different types of banks. Moreover, our study offers empirical evidence of a distinguishable risk-taking behavior of German banks that relates to the ownership structure and monitoring capabilities of different banking sectors.

Taking into account the ambiguous effects of the shareholder structure on risk-taking behavior of banks as considered by Stultz (2005), Beck et al. (2009), and Barry et al. (2011) a number of recent studies are clearly distinguishing between shareholder concentration and shareholder rights to explain the influences of the shareholder structure on risk-taking attitudes of bank managers. Gropp and Köhler (2010) have reported that shareholders prefer more risk compared to managers irrespective of whether using shareholder rights or ownership concentration as a measurement of owner control. Moreover, Gropp and Köhler argue that bank managers generally prefer a less exposure to risk compared to owners, whether dispersed or not. Thus, their hypothesis is contradictory to some policy reports assuming that extremely generous performance based compensations obtained by poor controlled bank managers are leading to extremely risk-taking by bank managers (Kirkpatrick

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[3]Caprio et al. (2007) classify a bank having an influencing owner if the shareholder has voting rights of more than 10%.

[2009]). Laeven and Levine (2009) also underscore that the relationship between banks' risks and capital regulation depends critically on the ownership structure of a bank and therefore have important policy implications.[4] In general terms, these authors offer empirical evidence that risk-taking by banks positively correlates with the comparative power of shareholders. This hypothesis coincides with the results provided by Saunders et al. (1990) suggesting that owner-controlled banks enter into higher risks than banks controlled by managers with small shareholdings. Furthermore, Beck et al. (2009) provide evidence that larger privately held banks move closer to insolvency than the smaller peers, but face lower distress probability. Moreover, Beck et al. show that within the German banking industry, privately owned banks are less stable than savings banks or cooperatives whereas they describe savings banks as reporting greater distances-to-default than cooperatives. This view is consistent with Fonteyne (2007) who highlight that cooperative banks in Europe are engaging in less risky activities than commercial banks (see also Cihák and Hesse [2007]).

Barry et al. (2009) have found some contradictory results by comparing five categories of shareholders that are managers/directors, institutional investors, non-financial companies, individuals/families, and banks. Barry et al. demonstrate that the ownership structure is evidently explaining differences in risk exposures of privately owned banks. Accordingly, high equity stakes held by individuals/families or banking institutions correlate with a decrease in asset risk and default risk. These findings confirm results published by Iannotta et al. (2007) who demonstrate that a higher ownership concentration is associated with better loan quality, lower asset risk, and lower insolvency risk.[5] De Nicolò and Loukoianova (2007) indicate that due to the country and firm specific characteristics the risk exposure of foreign banks appears significantly higher than that reported for private domestic banks. Nevertheless, De Nicolò and Loukoianova are not able to maintain their findings in the case of state-owned banks and private domestic banks. In addition, the authors verify that private domestic banks enter to more risk than state-owned or foreign banks due to the larger market share of state-owned or foreign banks. By contrast, Barry et al. (2009) have not been able to find a significant relationship between ownership structure and risk-taking attitudes in the category of public banks. Moreover, they do not report a significant difference between publicly held and privately owned banks while Berger et al. (2005) demonstrate state-owned banks

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[4]Leaven and Levine (2009) argue that owners might compensate for the loss of utility from capital requirements by selecting riskier investment strategies. Thus, it seems likely that stricter capital regulations and banking regulation correlate with greater risk when the bank has a sufficiently powerful owner.

[5] Iannotta et al. (2007) have found some empirical evidence that public sector banks have poorer loan quality and higher insolvency risk than other banks. Furthermore, their results indicate that mutual banks (saving banks and cooperatives) rely on better loan quality and lower asset risk than both private and public sector banks.

reporting poorer loan quality and higher default risk than privately owned banks. Another strain of papers also differentiate between categories of risks by showing that mutual banks enter to lower asset risk and lower default risk than government owned banks (Fraser and Zardkoohi [1996], Hansmann [1996]), Esty [1997], and Iannotta et al. [2007]).

Finally, Kwan (2004) illustrates that the exposure to risk of publicly held and privately owned banks are statistically indistinguishable when considering US bank holding companies. This is consistent with Altunbas et al. (2001) who indicate only a low significance of their findings in the German banking system that privately owned banks are operating their business more efficiently than mutual and publicly held banks. Furthermore, Beltratti and Stultz (2009) have studied the influence of bank-level governance, country-level governance, country-level regulation, and banks' balance sheet and profitability characteristics on banks' performance in the course of the financial crisis from 2007 to 2008. In accordance with the ownership structure of banks, Beltratti and Stultz underline that there is no consistent evidence that better governance lead to better performance during the crisis, but have found strong evidence that those banks with more shareholder-friendly boards perform worse.

A considerable amount of research works indicates a significant relationship between ownership concentration and risk-taking. Nevertheless, there is apparently no consensus whether this relationship is positive or negative (Iannotta et al. [2007], Barry et al. [2009]). These ambiguous results in recent literature may be occurring because besides the ownership concentration a number of further conditions are also determining the risk-taking attitudes of bank managers and bank owners. These are, for instance, the role of banking regulation (Macey and O`Hara [2003], Levine [2004], Laeven and Levine [2009]), deposit insurance (Prowse [1997], Beck and Laeven [2008]), or the globalization of the banking industry (Pathan [2009]). Furthermore, bank market concentration (Boyd and De Nicoló [2005], De Nicolò and Loukoianova [2007]), stock ownership programs, and annual compensation schemes for bank managers (Erkens et al. [2009], Bebchuk and Spamann [2010]), and the strength of bank boards (Sullivan and Spong [2007]) seem to relate to banks' risk-taking attitudes. Moreover, general macroeconomic circumstances appear to influence the risk-taking behavior of banks.[67]

In this study, we intend to prove our hypothesis that it depends on the relevance of principal-agent problems whether a bank is willing to enter to substantial risks or not.

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[6]Erkens et al. (2009) have shown that banks applying CEO compensation contracts with heavier emphasis on annual bonuses were faced larger losses during the financial crisis from 2007 to 2009. Bebchuk and Spamann (2010) suggest using regulation of banks' executive pay as an important element of financial regulation because they show a significant relationship between banks' executive pay and risk-taking behavior of banks' executives.
[7] Boyd and De Nicoló (2005) argue that banks behave more risky as their markets become more concentrated.

Particularly, banking sectors appear to be vulnerable to risks that do not allow bank owners monitoring bank managers. Furthermore, risk attitudes of banks depend on the capability of bank owners and bank managers to distribute risks on several firms. Finally, we intend to argue that the bank owners' incentives for gaining high returns strongly influence banks' risk taking behavior. Bank managers strongly depending on high profit-motivated principals (capital market oriented or profit-seeking public owners) to a high degree tend to operate their business by strategies that emphasize above average returns without looking at risks. Therefore, we use several aspects of the principal-agent model to predict bank managers' risk-taking behavior. Moreover, we apply an empirical study to the distances-to-default of different German banking sectors to enlighten banks' risk-taking attitudes prior to, and during the financial crisis of 2008.[8]

In section 2, following, we will start outlining the theoretical background to gain ideas whether it is possible that bank managers deviate from the expected return to risk relation that bank owners prefer. Section 3 will summarize the data with a focus on explaining the different ownership structures of German banks. Section 4 will compile the results and assess those results within the scope of our proposed hypothesis. The paper will close with section 5 with a summary and a conclusion of our findings.

2. Theoretical Backgrounds

As pointed out before, the basic hypothesis of our paper is grounded on the assumption that the default probability of a bank measured by the distance-to-default depends on the bank's ownership structure and corresponding property rights structure. Accordingly, we will argue, that in the case of decreasing influence of bank owners on the behavior of the bank's employees, the occurrence of principal-agent problems is more likely.[9]

The basic principal-agent theory (see for example Cullis and Jones [2009], pp. 255-6) applied to the organizational structure of a bank suggests that the principal (bank owner) *P* mandates an employee as his agent *A* to do bank operations. The agent *A* is free how to do these operations, but has to accept given restrictions. In the case of banks, agents have to choose a portfolio that consists of more or less risky assets. Thus, the behavior of *A* is influencing principal's profit $E(r_p)$. If the agent is using more effort *e* in her operations, she has to bear higher costs whereas from the principal's viewpoint executing more effort by the agent is a neutral good.

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[8] We define distances-to-default as the ratio of the sum of capital-asset-ratio (CAR) and return-on-assets (ROA) to standard deviation of return-on-assets (σ [ROA]). See for example Boyd and Graham (1986).
[9] See for example Saunders et al. (1990), Stultz (2005), Beck et al. (2009) and Barry et al. (2009)

Typically, the bank owner offers a contract regulating the working conditions for the potential employee, including commitments on fixed salaries, variable salaries (rewards), and fringe benefits. Depending on alternative employing opportunities, *A* decides to enter or not to enter the firm. If she is in the bank, she will be able to decide on her level of effort, for example, on the amount of collecting information prior to making investment decisions and choosing the optimal portfolio of assets. Unforeseeable market conditions or chance θ (state of nature) also influence return on assets. Depending on *e* and θ the bank will receive returns that owners and employees have to share according with the commitments agreed by both parties in the initial offer.

We will adopt a very simple Holmström/Milgrom principal-agent model to demonstrate the relationship between risk aversion of agents and their risk-taking attitudes under uncertainty. This model grounds on a risk neutral principal *P* who employs a risk averse or risk neutral agent *A* with a coefficient of risk aversion *F*.[10] In addition to the classic principal-agent model, our model assumes that the agent is free to choose any combination of risky and less risky projects (assets), whereas an efficient frontier as suggested by Markowitz (1952) is characterizing combinations of risky and less risky assets. Moreover, the agent supposes a probability function of possible returns and risk over different holding periods assuming that financial markets are frictionless. Agents obey a single-period utility functions *U*, which will be maximized in accordance with the law of diminishing marginal utility of wealth. The principal supposes that agent's effort increase the likelihood of choosing the optimal portfolio. If the agent's effort is generally not observable or it is costly for the principal to monitor the agent, the principal (bank owner) has to use incentives to encourage the agent selecting the owner's optimal portfolio.

We will use a commonly accepted utility function to illustrate the relationship between risk aversion of the agent and her risk-taking behavior that may depend on incentives paid by a risk neutral principal

$$U = E\left(r_p\right) - 0.005F\sigma_p^2,$$

whereas *F* characterizes the agent's risk aversion factor (for further information see Sharpe [2007].) In the case of risk-neutral agents, *F=0*. Larger values for *F* are reflecting higher degrees of risk aversion. The agent's optimal portfolio is the one that provides the highest utility for the agent. This portfolio will be at the tangent of the respective indifference curve and the efficient frontier (Markowitz [1952]).

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[10]See for example Sinclair-Desagné and Spaeter (2011) who developed a model describing behavior of prudent principals

Figure 1 explains the relationship between expected returns and risk. Point A and points in the northeast of A like B, C, and D are efficient in the sense of Markowitz. Indifference curves I_1 to I_3 represent risk averse individuals, whereas I_1 is the indifference curve of a more risk averse individual. Moreover, we characterize I_2 and I_3 as modest and low risk averse individuals.

The degree of risk aversion becomes clearer, if we assume B, C, or D as starting points and alternatively consider for the tradeoff between the return that an individual have to receive and a given value of additional risk exposure (expected utility is assumed constant). The additional expected returns are decreasing if we move from B to D. Thus, a decreasing curvature of indifference curve indicates a decreasing risk aversion. Within this frame, we argue that bank owners will prefer point C if they are modest risk averse. Grounded on the basic principal-agent theory, bank managers are more risk averse than bank owners because they have lower possibilities of risk pooling. Managers are realizing less risk than owners, for instance, by choosing point B. If bank managers have alternative job opportunities in other firms, it becomes more likely that they engage in excessively risky activities, and may prefer point D. Both deviations from the preferred point C are restricted by the owners' ability to control the bank managers.

Risk attitudes of bank owners may also relate to multistage principal-agent relationships. If we presume a sole owner, she is free to choose her combination of risk and expected return depending on her preferences, point B in figure 1 may be optimal. Principals of bank managers are typically the 'boards of banks'. Highly profit-oriented capital markets frequently force the boards of banks mandated by their shareholders to seek point C in figure 1. In the case of state owned banks, the principals (politicians) may also be looking for above average returns to finance public expenses outside of public budgets so that we suppose bank owners choosing Point C as well. Moreover, often the owner of a bank is simultaneously operating as the agent on behalf of another private firm (e.g. International bank holdings or insurance companies), the citizens of a region (local communities), or the cooperative members of the bank (cooperatives) so that we frequently observe multistage principal-agent relationships. Due to these more complex ownership structures, the preferred combination of risk and expected return is tied to an increasing relevance of the principal-agent problems.

All the above conditions explain why from the bank owner's viewpoint the selection of optimal portfolios of risky assets will be most unlikely with the emergence of multistage principal-agent relationships because higher information asymmetries between bank owners and bank managers are additionally increasing the probability of principal-agents problems.

Figure 1: Indifference curves of principal and agents
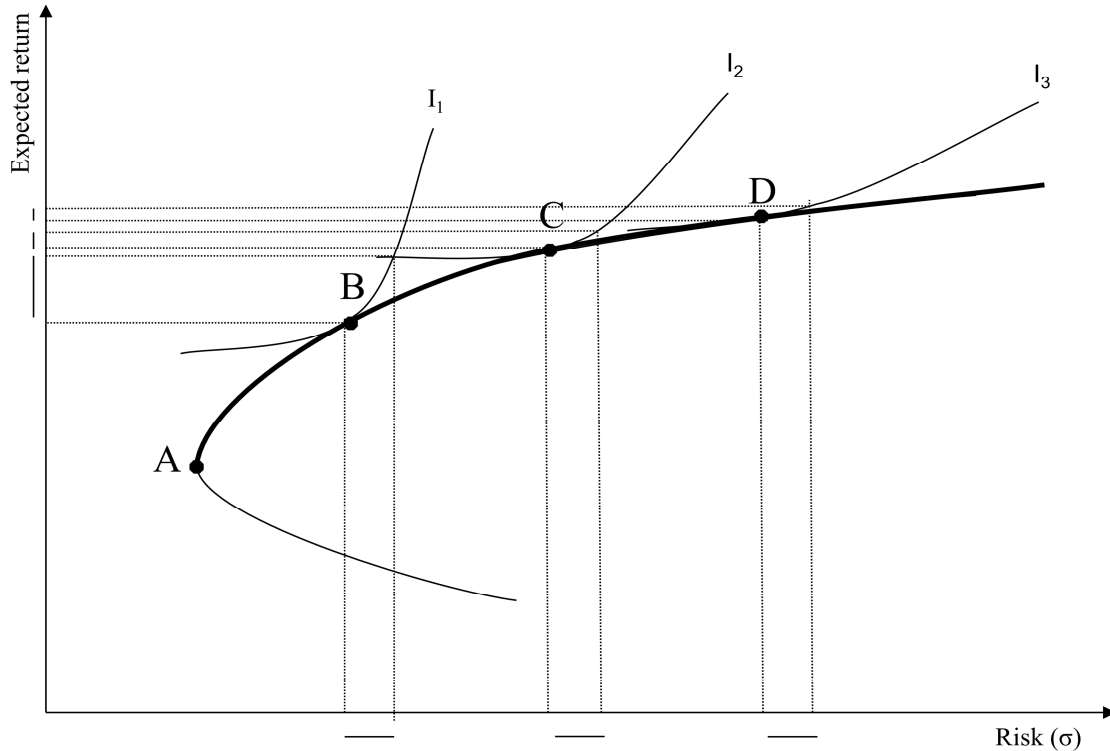
As stated out before, because of such uncertainties and information asymmetries we propose a (significantly) higher probability of a firm-specific financial crisis that is measured, for instance, by distances-to-default. Moreover, the probability of default is depending on the degree of pressure on bank managers exerted by bank owners to seek higher returns.

3. Data and assessment of different ownership structures

The Bankscope Database has provided the data, on which this study is based, for the period 2000 to 2010. Our panel involves 397 banks assigned to ten different principal-agent relationships, while we have collected the information on the principal-ownership structures manually from banks' annual reports published in 2008. Furthermore, we have marked all banks in our database traded on a stock exchange in 2008 and have discarded all banks from our sample if we did not get the relevant information for the years 2007 and 2008. Annual observations have entered our sample only if we get the complete information on 'return-on-assets', 'common equity' and 'total assets' for the corresponding year of examination. After eliminating discarded data sets our final sample covers 3,194 annual observations.[11]

In order to prepare the ground for our study we are first of all showing a number of descriptive statistics. Furthermore, we shall apply a number of least square regressions on the so-called z-score (distance-to-default) described, for example, in Boyd and Graham's seminal

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[11] Bankscope database, Bureau van Dijk Electronic Publishing

paper of 1986 as an appropriate measure of a bank's probability of default. The distances-to-default (DD) will be calculated from the 'return-on-assets' (ROA), the ratio of 'common equity' to 'total assets' (CAR) and the standard deviation of 'return-on-assets' (σROA):

$$DD = \frac{CAR + ROA}{\sigma ROA} \text{ , whereas } ROA = \frac{return}{total\ assets} \text{ and } CAR = \frac{common\ equity}{total\ assets}.$$

Thus, the somewhat intuitive z-score estimates the number of standard deviations the annual return-on-assets figures could fall, before the common equity of a bank turns negative. We will compute this risk figure grounded on the standard deviation (σROA) of each corresponding banking sector (see Table 13). Besides the higher validity of these distances-to-default, a further advantage of computing sector specific standard deviations of the return on assets is the comparability of banks that are reporting similar business objectives.

In the section, following, we will use three commonly influencing factors of the principal-agent relationship on banks' risk taking behavior in order to illustrate the emergence of principal-agent problems within the different ownership structures.

If bank owners have the *ability to control bank managers* sufficiently, we do not expect that the bank managers deviate from the optimal investment portfolio. Thus, principal-agent problems do not seem likely. Accordingly, Table 1 displays our estimations of the monitoring capabilities within the distinguishable banking categories.

We tend to characterize *Landesbanken* by low abilities of owners to control bank managers because the politicians who are conducting governance issues instead of the factual owners ('citizens') are typically uninformed about the banking business. Local politicians mandated by the citizens to monitor savings banks are also constrained by missing knowledge about the banking business.

In case of dispersed shareholders, we traditionally assume that shareholders have no control incentives because they have to share the benefits of monitoring to all other shareholders. Thus, regarding monitoring capabilities we assume a high relevance of principal-agent problems for banks held by dispersed shareholders. By contrast, banks owned by only one individual (or 'family') are subject to high control incentives. The risk-taking behavior of banks affiliated with commercial banks *(commercial banks)* depends on their specific ownership structure. If one individual or family owns a *commercial bank*, we expect the owner to have a considerable incentive to control. If dispersed shareholders are owners of a *commercial bank*, we contrarily do not presume a sufficient monitoring by bank owners. Hence, for *commercial banks* we suppose a medium relevance of principal-agent problems.

Taking into account federal state authority's banks with special business purposes owned by the federal states, we suppose that the governments and namely the ministries of finance are able to control the bank managers to a high degree. By contrast, members of cooperatives generally are not able to monitor the bank managers. Finally, we assess controlling abilities of banks affiliated with insurance companies or International bank holdings to be comparable to those of *commercial banks*.

Table 1: This table shows our assessment of capability of bank owners to monitor bank managers and relevance of principal-agent problems assigned to the distinguishable ownership structures.

Ownership structure	Capability	Relevance of principal-agent problems
Federal state authorities (Landesbanken)	Low	High
Local communities (savings banks)	Low	High
Private owner	High	Low
Dispersed shareholders	Low	High
Commercial bank		
– Private owner	High	Medium
– Dispersed shareholders	Low	
Cooperatives	Low	High
Insurance Companies		
– Private owner	High	Medium
– Dispersed shareholders	Low	
International bank holdings		
– Private owner	High	Medium
– Dispersed shareholders	Low	

The theoretical background on *risk pooling by bank owners or bank managers* explain that the bank owners appear to be risk neutral or less risk averse than bank managers if owners have better pooling possibilities (pp). Therefore, bank owners prefer higher risk than bank managers do. By contrast, if bank manager do not fear to lose their workplace (wp) they are seeking unreasonable high risks. In this case, bank managers prefer higher risks than the owners do and principal-agent problems are more likely. More generally speaking, we assume that throughout the years prior to the financial crisis of 2007/2008 investment bankers faced low risk of loosing their workplace. Both high pooling possibilities of bank owners and low risk of bank managers of losing their workplace lead to seeking high risk by banks.

In the case of banks owned by federal state authorities (*Landesbanken*), we do not notice a chance of risk pooling by bank owners ('citizens'). By contrast, we presume that *Landesbanken* engaged investment bankers that have incentives to seek unreasonably high risk. Thus, both the missing capability of risk pooling and the engagement of investment bankers correlate with a high relevance of principal-agent problems.

Owners of savings banks ('local communities') and cooperatives are also very restricted in risk pooling. In addition, savings banks and cooperatives typically do not engage investment

bankers. Therefore, we expect low incentives to search for risky activities resulting in a low relevance of principal-agent problems.

By contrast, dispersed shareholders retain good opportunities to diversify their wealth in several firms. Therefore, they are behaving (nearly) risk neutral. Furthermore, banks owned by dispersed shareholders are able to engage investment bankers. Thus, in this case we presume a high relevance of principal-agent problems.

If an individual or family owns a bank, the capacity of risk dispersion usually is limited so that we do not expect a divergence between risk attitudes of bank owners and bank managers. Private banks face also good job opportunities of engaged investment bankers that create excessive risk-taking incentives and causes a high relevance of principal-agent problems. *Commercial banks*, banks affiliated with insurance companies and subsidiaries of International bank holdings are owned either by private owners or by dispersed shareholders. Hence, the relevance of principal-agent problems appears to be medium to high.

Table 2: This table shows our assessment whether bank owners are equal risk averse than bank managers (lower pooling capabilities [pp])) and whether managers have good chances to find a new workplace (wp).

Ownership structure	Yes/ No	Relevance of principal-agent problems
Federal state authorities (Landesbanken)	No (pp), Yes (wp)	High
Local communities (savings banks)	No (pp), No (wp)	Low
Private owner	No (pp), Yes (wp)	High
Dispersed shareholders	Yes (pp), Yes (wp)	High
Commercial bank		
– Private owner – Dispersed shareholders	No (pp), Yes (wp) Yes (pp), Yes (wp)	Medium to high
Cooperatives	No (pp), No (wp)	Medium
Insurance Companies		
– Private owner – Dispersed shareholders	No (pp), Yes (wp) Yes (pp), Yes (wp)	Medium to high
International bank holdings		
– Private owner – Dispersed shareholders	No (pp), Yes (wp) Yes (pp), Yes (wp)	Medium to high

Incentives of seeking higher returns may be excessive, when banks' operations ground on higher profit-orientated principal-agent relationships. In the case of federal state authorities (*Landesbanken*) we assume that the influence of the principal ('politicians') creates incentives to seek higher returns because of principals' expectation on financing public expenditures out of bank profits while savings banks owned by local communities as well as cooperatives do not seem to be influenced by such incentives. Banks owned by dispersed shareholders appear to be tied to capital market expectations on gaining high returns to a high degree. By contrast, banks with individual owners apparently do not obey this kind of expectation. Thus, dispersed shareholders fortify principal-agent problems while private owners may weaken this issue.

Finally, we suppose that *commercial banks*, banks affiliated with insurance companies and subsidiaries of International bank holdings relate to medium expectations on future returns.

Table 3: This table shows our assessment whether bank owners have incentives of seeking high returns.

Ownership structure	Yes/ No	Relevance of principal-agent problems
Federal state authorities (Landesbanken)	Yes	High
Local communities (savings banks)	No	Low
Private owner	No	Low
Dispersed shareholders	Yes	High
Commercial bank		
− Private owner − Dispersed shareholders	No Yes	Medium
Cooperatives	No	Low
Insurance Companies		
− Private owner − Dispersed shareholders	No Yes	Medium
International bank holdings		
− Private owner − Dispersed shareholders	No Yes	Medium

Table 4 summarizes the *aggregated relevance of principal-agent problems* emerging from the factors mentioned above while we assume that all these factors show an equal impact on the risk-taking attitudes of banks. Thus, we apparently find the highest relevance of principal-agent problems in the case of federal state authorities (*Landesbanken*) and banks owned by dispersed shareholders while we predict a low relevance for local communities as well as private banks and medium-scale relevance in the case of other bank categories.

Table 4: This Table aggregates the relevance of principal-agent problems displayed in Table 1 to Table 3

	Monitoring Capabilities	Risk Aversion	Seeking High Returns	Aggregation
Federal state authorities (Landesbanken)	High	High	High	High
Local communities (savings banks)	High	Low	Low	Low to medium
Private owner	Low	High	Low	Low
Dispersed shareholders	High	High	High	High
Commercial bank	Medium	Medium to high	Medium	Medium
Cooperatives	High	Medium	Low	Low
Insurance companies	Medium	Medium to high	Medium	Medium
International bank holdings	Medium	Medium to high	Medium	Medium

Accordingly, Figure 2 shows the importance of the principal-agent problems graphically. We draw simplified curves of equal distances-to-default, for example DD_1 to DD_3. Curves that are closer to the origin indicate higher distances-to-default. Consequently, we expect the highest

distances-to-default for banks owned by an individual owner and the lowest ones for federal state authorities *(Landesbanken).*

Figure 2: This figure illustrates the distances-of-default of different ownership-structures
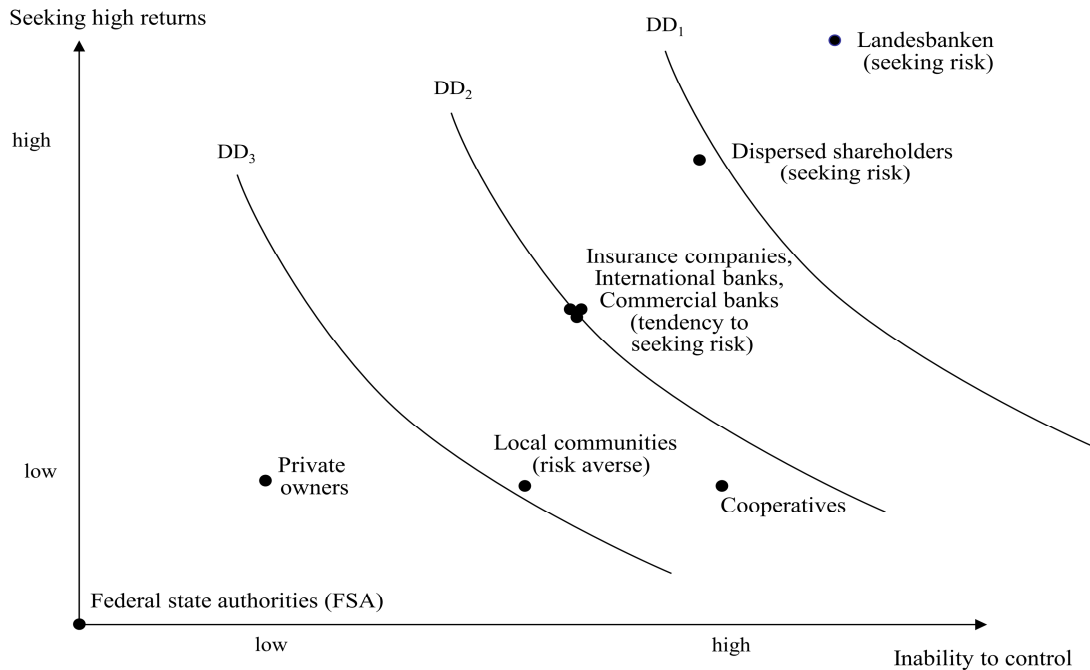
It seems reasonable to compare distinguishable categories of bank with credit institutions owned by federal state authorities', like Kreditanstalt für Wiederaufbau' (KfW Bankengruppe) that special purposes are centered exclusively on the financing of private firms. Hence, for these institutions aspects like risk-taking or capital market pressure are irrelevant. We additionally assume that the government uses appropriate instruments to control the behavior of such special-purpose banks. Therefore, we expect federal state authorities in the origin of figure 2.

4. Analysis and Results

The following section covers our descriptive statistics and regression models applied to enlighten the influence of ownership structures on risk-taking attitudes of banks with a focus on the subprime crisis of 2008.

First, Table 6 shows the 'capital asset ratio' (CAR) assigned to the different ownership categories throughout the observation period. We can ascertain that special purpose banks owned by federal authorities report the highest capital asset ratios. By contrast, *Landesbanken* display the lowest capital asset ratio, which may be due the fact that these banks are also controlled by federal authorities, but have adopted a completely different business model as described by Hüfner (2010) or Hardy and Howarth (2009). Furthermore, private banks,

subsidiaries of insurance companies, and banks affiliated with cooperatives are distinguishable by relatively low capital asset ratios while banks monitored by dispersed shareholders or International bank holdings apparently prefer higher capitalizations. Not surprisingly, savings banks and cooperatives display similar capital asset ratios over the examination period that may be due to their comparative business models (Beck et al. [2009]). As pointed out by Adrian and Shin (2010), Brunnermeier (2009), or Schmielewski (2012), low capital asset ratios by banks may indicate a low risk aversion throughout periods of booming asset markets particularly if banks are simultaneously reporting high leverages and a high volatility of 'return on assets' (ROA).

Table 6: Capital Asset Ratio (CAR) by principal
This table shows the Capital Asset Ratio (CAR) grouped by the examined ownership structures (principal) over the period 2001 to 2009. The Capital Asset Ratio (CAR) is the ratio of common equity to total assets. The sample contains 3,194 yearly observations from 397 banks. For further details of sample structure, see section 'data'.

Principal	Average	Median	Max	Min	Avg. quantiles
Federal state authorities	0.1695	0.5068	0.9911	0.0226	0.61
Dispersed shareholders	0.0934	0.3967	0.7971	- 0.0036	0.49
International bank holdings	0.0738	0.3775	0.7515	0.0036	0.48
Local communities (savings banks)	0.0517	0.2789	0.5490	0.0088	0.52
Member of cooperatives	0.0516	0.2745	0.5411	0.0078	0.49
Commercial bank	0.0491	0.1101	0.2177	0.0025	0.36
Private	0.0597	0.0771	0.1526	0.0015	0.59
Insurance company	0.0443	0.0475	0.0741	0.0210	0.42
Cooperatives	0.0370	0.0419	0.0744	0.0095	0.33
Federal state authorities (Landesbanken)	0.0223	0.0240	0.0415	0.0064	0.06

Table 7 reports 'return on assets' (ROA) of banks tied to the different ownership structures over the observation period. Within this context, it is remarkable that some *Landesbanken* that are reporting the lowest returns on assets have been among the crisis-ridden banks that the Financial Markets Stabilization Fund (SoFFin) has to support in the aftermath of the financial markets crisis of 2007/2008 to a high degree. This fact may be due to their changing business environment over the last decade, as pointed out, for example, by Hardy and Howarth (2009) or Hüfner (2010). By contrast, cooperatives, banks controlled by dispersed shareholders, and subsidiaries of International bank holdings demonstrate the highest returns on assets from 2000 to 2009, while savings banks and affiliates of cooperatives are reporting relatively low returns on assets.

Table 7: Return on Assets (ROA) by principal
This table reports the Return on Assets (ROA) grouped by the examined ownership structures (principal) over the period 2001 to 2009. We define Return on Assets (ROA) as the ratio of yearly return on total assets. The sample contains 3,194 yearly observations from 397 banks.

Principal	Average	Median	Max	Min	Avg. quantiles
Member of cooperatives	0.0029	0.0955	0.1918	-0.0007	0.47
Dispersed shareholders	-0.0003	0.0486	0.0975	-0.0004	0.44
International bank holdings	0.0038	0.0482	0.0967	-0.0002	0.44
Federal state authorities	0.0030	0.0284	0.0578	-0.0010	0.34
Private	0.0038	0.0124	0.0284	-0.0036	0.58
Commercial bank	-0.0004	0.0095	0.0195	-0.0004	0.56
Insurance company	0.0028	0.0076	0.0153	-0.0001	0.50
Cooperatives	0.0015	0.0046	0.0092	0.0000	0.30
Local communities (savings banks)	0.0016	0.0045	0.0092	-0.0001	0.43
Federal state authorities (Landesbanken)	-0.0001	0.0024	0.0050	-0.0002	0.56

However, returns on assets are only a rough indicator on the risk appetite of banks. By contrast, the 'distance-to-default' (DD) or so-called 'z-score' that is described in detail in section 3 is a widely accepted and intuitive risk figure because it takes into account the volatility of returns on assets. Table 8 demonstrates that special purpose banks owned by federal authorities will apparently be the most risk averse banks with a distance-to-default of more than five times higher when compared with banks assigned to other ownership categories. We tend to explain this observation by the very special business purposes of such banks that are focused primarily on project financing activities. Quite the opposite, banks monitored by dispersed shareholders, banks affiliated with commercial banks, subsidiaries of International bank holdings as well as *Landesbanken* are evidently reporting the lowest distances-to-default during the period 2000 to 2009. As pointed out before, we are able to typify these kinds of ownership structures by multistage-principal-agent relationships with only weak opportunities to monitor bank managers that may explain their low risk aversion as demonstrated by the according low distances-to-default.

In addition, it is interesting to note that the distances-to-default of cooperatives are relatively low. We tend to explain this observation by relatively strong fluctuations of the returns on assets during the observation period. Contrarily, private banks, banks allied to cooperatives, and subsidiaries of insurance companies are reporting the highest distances-to-default due to the low volatility of return on assets of these banks throughout the examination period in question.

Table 8: Distance-to-default (DD) by principal
This table shows the distance-to-default (DD) grouped by the examined ownership structures (principal) over the period 2001 to 2009. The distance-to-default (DD) equals DD=CAR+ROA/σ (ROA), where σ (ROA) is the standard deviation of ROA. The sample contains 3,194 yearly observations from 397 banks.

Principal	Average	Median	Max	Min	Avg. quantiles
Federal state authorities	19.2752	54.9863	99.3889	10.5838	0.55
Cooperatives	14.6764	9.9157	9.4713	10.3601	0.77
Insurance company	15.9971	9.9104	9.5967	10.2242	0.90
Member of cooperatives	5.4461	5.3732	9.9210	0.8253	0.29
Private	11.8148	5.0530	9.8265	0.2795	0.76
Local communities (savings banks)	8.2962	4.4765	9.9962	-1.0432	0.62
International bank holdings	6.6964	4.2411	9.5652	-1.0830	0.32
Federal state authorities (Landesbanken)	5.5064	4.1766	9.7770	-1.4237	0.34
Commercial bank	4.2783	3.7843	8.5003	-0.9318	0.21
Dispersed shareholders	3.3992	3.4526	7.5120	-0.6068	0.14

Table 9 reports the 'total assets' over the observation period assigned to the different ownership structures. Column 4 shows that the banks owned by dispersed shareholders, savings banks, subsidiaries of commercial banks and *Landesbanken* hold the majority of total assets allocated to the German banking system. Accordingly, the listed values of total assets demonstrate the important role of savings banks and particularly *Landesbanken* within the German financial industry. Furthermore, Table 9 illustrates that in accordance with their total assets savings banks and cooperatives may be of key importance for the stability of the German banking system. In contrast, we are able to characterize private banks and affiliates of insurance companies by relatively low amounts of total assets from 2000 to 2009.

However, our results so far draw a relative rough picture of the relationship between market shares of German banking sectors and risk-taking attitudes of banks during the last decade. Thus, in the following sections, we will offer a deeper insight to the structure of the German banking systems by considering pro-cyclical changes of distances-to-default prior to, and during the financial crisis of 2007/2008 in more detail (Adrian and Shin [2010] or Schmielewski [2012]).

Table 9: Total Assets by principal
This table shows the Total Assets in thousands of Euro grouped by the examined ownership structures (principal) over the period 2001 to 2009. The sample contains 3,194 yearly observations from 397 banks.

	Average	STD. Dev.	Median	Total
Dispersed shareholders	75,310,049	279,993,576	1,073,820,924	12,501,468,147
Local communities (savings banks)	5,604,928	16,663,472	126,147,600	9,881,488,100
Commercial bank	73,986,175	149,746,162	422,138,000	8,952,327,200
Federal state authorities (Landesbanken)	197,825,514	124,029,856	233,269,500	8,704,322,600
International bank holdings	35,535,673	98,577,197	358,345,600	7,711,241,000
Member of cooperatives	10,539,121	68,322,704	512,730,650	6,239,159,600
Federal state authorities	36,796,351	73,083,754	200,092,450	4,157,987,700
Cooperatives	28,383,246	25,017,461	43,805,100	1,419,162,300
Private	3,291,562	2,375,028	5,911,200	306,115,300
Insurance company	3,093,011	1,537,790	2,945,100	108,255,400

Because of substantial losses by German banks and capital asset ratios that are not sufficiently covering an unexpected volatility of return on assets, Table 10 reports a significant decline of distances-to-default in 2008 and 2009. It is interesting to note that the distances-to-default from 2005 to 2007 tend to be significantly increased compared to the period 2001 to 2004. As pointed out before, we are able to highlight the period 2002 to 2008 by increasing averaged values of total assets displayed by German banks. We tend to explain this observation by a large number of banks actively operating their balance sheets to adjust the ratio of total assets to common equity. In the aftermath of the financial turmoil of 2007/2008, banks apparently start de-leveraging their balance sheets by diminishing the assets of the balance sheets as suggested by the averaged value of total assets in 2009 reported in Table 11 (see Schmielewski [2012]).

Table 10: Distances-to-default (DD) from 2001 to 2009
This table shows the distance-to-default (DD) grouped by year over the period 2001 to 2009.The distance-to-default (DD) equals DD=CAR+ROA/σ (ROA) where σ (ROA) is the standard deviation of ROA. The sample contains 3,194 yearly observations from 397 banks.

Year	Distance-to-default				Quantile Rank
	Average	Max	Median	Min	Average
2001	7.4396	93.5773	46.9822	0.3872	0.44
2002	7.2748	95.3766	46.2983	-2.78	0.45
2003	7.8371	96.907	48.6635	0.4201	0.47
2004	7.777	97.3638	48.9642	0.5647	0.49
2005	8.168	97.8812	48.3991	-1.083	0.51
2006	8.3698	98.9628	49.6713	0.3798	0.53
2007	8.4986	99.3889	49.9802	0.5715	0.54
2008	7.5124	9.9354	4.6643	-0.6068	0.51
2009	8.0036	9.9591	5.0827	0.2063	0.54

Table 11: Total Assets from 2001 to 2009
This table shows Total Assets in thousands of Euro grouped by year over the period 2001 to 2009.The sample contains 3.194 yearly observations from 397 banks.

Year	Average	Median	STD. Dev.	Total
2001	8,795,669	49,253,965	2,400,000	2,843,459,600
2002	8,402,511	38,470,427	2,600,000	2,783,116,000
2003	10,245,837	39,487,252	2,800,000	3,447,078,600
2004	11,712,522	41,045,003	3,000,000	4,146,435,500
2005	13,472,913	45,093,730	3,100,000	4,905,714,800
2006	24,165,231	101,704,532	3,200,000	9,278,780,200
2007	28,814,919	127,709,352	3,400,000	11,128,899,900
2008	31,255,892	141,117,481	3,500,000	12,004,791,600
2009	28,857,375	111,876,519	3,700,000	9,371,500,000

At this stage of our study, we have found evidence of the distinguishable risk-taking behavior of various banking sectors by the different ownership structures of German banks. The section, following, will illustrate our results of ordinary least squares regressions applied with the purpose of further clarifying influences on the percentiles of the distance-to-default (DD) for the period 2001 to 2007 and from 2008 to 2009 respectively. In addition, Table 13 relates

distances-to-default to the relevance of principal-agent problems. The independent variables (Table 12) of our regressions cover banks' market share ('market share'), a dummy variable to distinguish between exchange traded and non-exchange traded banks ('exchange traded'), and a factored variable reflecting the ownership structure ('principals') of banks.[12]

Table 12: This Table illustrates our variables used for descriptive statistics and ordinary least square regressions

Variable	Definition	Calculation formula
DD	Distance-to-default	$DD = \dfrac{CAR + ROA}{\sigma ROA}$ $ROA = \dfrac{annual\ return}{total\ assets}$ $CAR = \dfrac{common\ equity}{total\ assets}$ $\sigma ROA = standard\ deviation\ of\ ROA$
QDD (Dependent variable)	Percentile of DD rank within sample	1 = bank with highest DD 0 = bank with lowest DD
market_share	Market share	$market\ share = \dfrac{total\ assets\ bank}{total\ assets\ industry}$
Exchange traded (dummy variable)	Exchange traded bank	1= yes; 0 = no
Principal agent index (factored variable)	Ownership structure of banks	− Federal state authorities (project financing banks) − Banks with dispersed shareholders − International bank holdings − Private banks (e.g. family owned banks) − Local communities (savings banks) − Cooperatives (banks owned by cooperative members) − Banks owned by commercial banks − Banks owned by insurance companies − Banks owned by cooperatives − Federal state authorities (Landesbanken)

Not surprisingly, the standardized beta coefficients of the assigned ownership structures fluctuate over the period in question to a different extent. The intercepts of the two regression models applied to the period 2001 to 2007 and from 2008 to 2009 respectively demonstrate the significant contraction of distances-to-default within the German banking system during our observation period. Table 13 reports a low relevance of principal-agent problems for cooperatives as well as for the affiliates of cooperatives. Cooperatives obtain negative and

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[12] We defined 'Federal state authorities' as the basis of our factored variable

statistically significant standardized beta coefficients, but with higher values from 2008 to 2009 than during the period 2001 to 2007 (Table 14). Compared to special purpose credit institutions owned by federal state authorities, cooperatives generally appear to operate their business activities with relatively low distances-to-default. Nevertheless, the lower coefficients of our regression model for the period 2001 to 2007 in comparison to the period 2008 to 2009 coincides with our assumption that cooperatives report only low principal-agent problems particularly if taking into account the distinguishable intercept of the two regression models. Additionally, the positive and statistically significant coefficients obtained for affiliates of cooperatives evidently confirm this tendency.

Our regression model offers some evidence that *Landesbanken* significantly decrease their distances-to-default from 2008 to 2009, although we only find a statistical significant relationship to the distance-to-default in our regression model for 2008/2009 that may be due to a poor coverage of data from 2001 to 2007. Within this context, it is remarkable, that we suppose a high degree of principal-agent problems for *Landesbanken* as reported in Table 13.

In contrast, savings banks owned by local communities provide the highest and statistically significant (standard beta) coefficient over the period 2008 to 2009. In this case, we clearly maintain our assumption that savings banks are showing a low relevance of principal-agent problems. Moreover, savings banks apparently prefer a counter-cyclical behavior while other banking sectors are increasing their asset side of the balance sheets (for further details on risk-taking behavior of German savings banks see for instance Holl and Schertler [2009] or Schmielewski [2012]).

Quite the opposite, banks monitored by dispersed shareholders generally appear to show a higher risk appetite than other banks since they obtain the lowest and statistically significant standard beta coefficients during the observation period. Although banks held by dispersed shareholders tend to increase their distances-to-default, they consistently enter the regressions with negative and statistically significant standard beta coefficients. This observation offers strong support for our hypothesis that those banks with dispersed and low concentrated shareholders are operating their business less risk averse than other German banking sectors due to the high relevance of principal-agent problems listed in Table 13.

These high-risk taking attitudes are comparable to those of banks owned by commercial banks because they also enter our regressions with negative and statistically significant coefficients throughout the observation period. *Commercial banks* evidently accepted low distances-to-default from 2001 to 2007 as well as during the episode of the mortgage subprime crisis from 2008 to 2009, when the financial crisis reached its melting point with the

default of Lehman Brothers and the disturbances of other globally operating bank holdings. This coincides with our assumption of medium principal-agent problems of *commercial banks* reported in Table 13.

In contrast, banks with a remarkable low risk appetite controlled by insurance companies and private banks appear to adjust their distances-to-default efficiently. This risk attitude relates to positive and statistically high significant coefficients over the observation period particularly in the case of banks allied to insurance companies. Thus, these results also provide strong support for our thesis that banks with low relevance of principal-agent problems are selecting their optimal portfolio efficiently as long as bank owners are carrying out considerable monitoring capabilities. Comparing private banks and subsidiaries of insurance companies demonstrate that standard beta coefficients of private banks are lower than those for banks held by insurance companies do. In summarizing, we can clarify that due to a low relevance of principal-agent problems private banks appear to be more risk averse than banks with differing ownership structures such as banks reporting dispersed shareholders or affiliates of commercial banks.

Finally, banks dominated by International bank holdings also enter our regression models with negative standard beta coefficients. Although these coefficients are statistically significantly from 2001 to 2007, we find only weak support for our hypothesis that banks affiliated with International bank holdings emerge a higher risk appetite in the course of the financial crisis from 2008 to 2009 than other banks. Quite the opposite, contrary to the findings for the period 2001 to 2007 the standard beta coefficients of our regression model for the period of 2008 to 2009 are relatively low and not statistically significant that may be due to the moderate relevance of principal-agent problems listed in Table 13.

Lastly, the *market share* of banks negatively relates to the distance-of-default since it obtains a negative and statistically significant coefficient for the period 2001 to 2009. These findings are consistent with some research papers showing that the market share of a bank positively correlates to its risk-taking behavior (Boyd and De Nicolo [2005], Laeven and Levine [2009]). In the case of our dummy variable reflecting *exchange traded* banks, our regression models display a coefficient that is not statistically significant for the period 2001 to 2007 while it seems more likely that exchange traded banks are tied to lower distances-to-default than banks not listed on a stock exchange from 2008 to 2009.

Table 13: Assessment of German banking sectors
This table displays our assessment of German banking sectors in accordance to profit pressure, degree of incentive compensation, and monitoring capabilities of principals (DD='distance-to-default', FSA='federal state authorities', LC='local communities, σ (ROA)=sector specific standard deviation of return on assets).

Principal	Averaged DD (2001-2007)	DD 2008	σ (ROA)	Relevance of Principal-Agents Problems
Private	12.81	8.26	0.0054	Low
International bank holdings	6.38	6.70	0.0116	Medium
Dispersed shareholders	3.60	2.97	0.0274	High
FSA (Landesbanken)	6.11	3.45	0.0040	High
Commercial bank	4.59	3.02	0.0114	Medium
Insurance company*	15.43	15.17	0.0029	Medium
Federal state authorities	24.90	9.23	0.0089	Low
LC (savings banks)	8.13	8.65	0.0064	Low to medium
Members of cooperatives	5.35	5.77	0.0100	Low
Cooperatives	13.68	17.00	0.0026	Low

*law permits only low risk bearing assets (BaFin [2011])

Table 14: Ordinary least squares (OLS) regressions on percentiles of distances-to-default (DD)[13]
This table shows the standard beta coefficients of ordinary least squares (OLS) regressions over the period 2001 to 2007 and from 2008 to 2009. The dependent variable is the percentile of distances-to-default (DD). The sample covers 3,194 yearly observations from 397 banks (FSA='federal state authorities', LC='local communities). Significance levels are marked with *** (P>t) <=0.01, ** (P>t) <=0.02 and * (P>t) <=0.05.

	2001-2007			2008-2009		
	Coef.	Std. Err.	Beta	Coef.	Std. Err.	Beta
Market share	-0.036	0.0061	-0.107***	-0.013	0.0054	-0.074**
Exchange traded	-0.022	0.0263	-0.022	-0.113	0.0416	-0.118***
Member of cooperatives	-0.351	0.0296	-0.473***	-0.152	0.0438	-0.202***
FSA (Landesbanken)	-0.061	0.0667	-0.017	-0.164	0.0641	-0.093**
Local communities (savings banks)	-0.010	0.0281	-0.017	0.175	0.0411	0.300***
Dispersed shareholders	-0.454	0.0361	-0.340***	-0.253	0.0550	-0.202***
Commercial bank	-0.356	0.0385	-0.227***	-0.249	0.0572	-0.174***
Cooperatives	0.105	0.0476	0.044*	0.416	0.0749	0.184***
Insurance companies	0.284	0.0544	0.105***	0.526	0.0936	0.178***
International bank holdings	-0.282	0.0394	-0.250***	-0.012	0.0628	-0.010
Private	0.201	0.0397	0.115***	0.137	0.0612	0.081*
Intercept	0.624	0.0274		0.464	0.0395	
r-squared	0.4214			0.4457		
Adj.r-squared	0.4184			0.4369		

To conclude this section, we are able to ascertain that ownership structures of banks display a statistically significant relationship with our considered measurement of distances-to-default. Furthermore, the results confirm our assumptions on the relevancy of principal-agent problems to a high degree.

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[13] All regressions are examined by the means of STATA 11.0 with default standard errors

Conclusions

In a first stage, we rely on a theoretical model explaining that from the bank owners' viewpoint three factors of the principal-agent relationship are determining the probability of finding the optimal portfolio of risky assets such that are the ability to control bank managers, risk pooling by bank owners and bank managers, and incentives of seeking high returns.

Depending on the relevance of the emerging principal-agent problems, the ownership structure of a bank may mislead the bank manager's risk-taking behavior in such a way that she chooses an unreasonable position of risky assets that result in bank owner's disutility.

Moreover, it seems likely that the greater the profit pressure on bank managers exerted by bank owners to seek high returns the greater the probability that bank managers take excessive risky positions. Furthermore, it is intuitive that the lower the monitoring capabilities of bank owners the greater the probability of failures in choosing the optimal portfolio of risky assets from the bank owners' viewpoint. These assumptions are of major interest to the bank owners since the marginal increase of return is the lower the higher the level of risk as suggested by Markowitz (1952).

In a second stage, by comparing different kinds of ownership structures within the German banking industry we offer empirical evidence that the risk-taking attitudes of bank managers are depending on the ability to control bank managers, the risk pooling by bank owners and bank managers, and the incentives of seeking high returns. In detail, we can underline the distinguishable risk-taking behavior of bank managers that are participating different principal-ownership-structures by measuring the according distances-to-default reported for the period from 2000 to 2010.

Finally, we tend to argue that our theoretical model as well as our empirical findings could explain the ambiguous results in recent literature. Particularly, our theoretical model may contribute to the current discussions with regulatory authorities on necessary changes of the supervisory framework: If 'private banks are the better banks' due to a lower emergence of principal-agent problems these banks might be regulated to a lower degree. By contrast, legislative and regulatory authorities should increase their vigilance in terms of principal-agent problems within certain sectors of the banking industry demonstrating a high relevance of principal-agent problems.

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Institut für Volkswirtschaftslehre

Postfach 2440

D-21314 Lüneburg

Tel.: ++49 4131 677 2321

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