

# **Deposit Insurance Coverage, Ownership, and Banks' Risk-taking in Emerging Markets**

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We ask how deposit insurance systems and ownership of banks affect the degree of market discipline on banks risk-taking. Market discipline is determined by (lack of) explicit deposit insurance as well as by the credibility of non-insurance of groups of depositors and other creditors. Furthermore, market discipline depends on the ownership structure of banks and the responsiveness of bank managers to market incentives. An expected U-shaped relationship between explicit deposit insurance coverage and banks' risk-taking is influenced by country specific institutional factors, including bank ownership. We analyze specifically how government ownership, foreign ownership and other aspects of bank governance affect the disciplinary effect of partial deposit insurance systems in industrial countries and in emerging market economies. The coverage that maximizes market discipline depends on county specific characteristics of bank governance. This "risk-minimizing" deposit insurance coverage is compared to the actual coverage in a group of countries in Eastern Europe and Asia.

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## **I. Introduction**

Deposit insurance is generally considered an important part of the regulatory structure for the banking system. This regulatory structure should protect the “safety and soundness” of the banking system while providing banks with the appropriate rules and incentives to allocate credit efficiently. The double role of banks as liquidity providers and participants in credit and capital markets makes them potentially vulnerable to bank runs, since a large share of the assets cannot be liquidated quickly in case depositors want to convert their funds to cash. The limited information among depositors about the risk and value of bank assets can lead to “contagion” of bank runs (Diamond and Dybvig, 1983) from one bank to another. Contagion effects could also be caused by interbank claims on a distressed bank. The potential for contagion implies that the banking system is subject to “systemic risk” to a greater extent than other providers of credit.

Deposit insurance can limit the risk of bank runs by guaranteeing that depositors receive some, or all, of their deposited funds with reasonable speed even if their banks become insolvent or illiquid. In case of a liquidity crisis for a bank, the central bank can also act as a Lender of Last Resort (LOLR) by lending to a solvent bank facing a liquidity squeeze as a result of a run by depositors.

The flip side of the role of deposit insurance as a safeguard against bank runs and as a consumer protection device is a moral hazard problem caused by limited liability of banks’ shareholders and the reduced incentives of insured depositors to evaluate the riskiness of the banks they provide with funds. This moral hazard problem implies that banks have incentives to take on risk that can be shifted to a deposit insurance fund or to tax payers. These incentives are particularly strong if the value of the equity capital is low. Thus, deposit insurance systems can contribute to the very problem (systemic bank failure) they are designed to reduce.<sup>1</sup>

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<sup>1</sup> See, for example, Bhattacharya, et al. (1993)

One solution to the moral hazard problem would be to design a deposit insurance premium structure reflecting banks' risk-taking. A private deposit insurance market is likely to fail for reasons of both moral hazard and adverse selection, however. Furthermore, the existence of government insurance, whether explicit or implicit, limits the scope for private insurance. In some countries banks pay "risk-based" deposit insurance premia, but the premium structure is generally based on very crude proxies for risk.

Regulation of banks' behavior and asset allocation, and supervision of banks' credit allocation and risk management systems have the purpose of limiting banks' risk-taking. In addition, capital requirements can reduce risk-taking incentives by ensuring that there is always shareholder capital at risk. The effectiveness of various measures intended to influence banks' risk-taking is likely to depend on the governance systems of banks. These systems vary from country to country and sometimes from bank to bank.

While there is general agreement on the need for deposit insurance within the regulatory structure of the banking system, there is little agreement on the optimal coverage of insurance systems. This coverage depends on a number of factors. For example, uncertainty about governments' and supervisors' responses to more or less severe banking crises affects the optimal coverage. Other areas of disagreement are the importance of moral hazard incentives created by deposit insurance, the ability of market participants (depositors) to make informed decisions about the riskiness of competing banks, and the responsiveness of banks' risk-taking behavior to risk sensitive deposit interest rates and to information disclosure by banks. Aspects of bank ownership and governance affect this responsiveness.

The substantial resources devoted to the design of a Capital Adequacy Framework by central bankers and regulators in the Basel Committee indicate that there is a strong concern about incentives for excessive risk-taking. Bank managers on the other hand tend to deny that

such incentives exist. However, the incentives need not reveal themselves as deliberate risk-taking. Instead it is the competition among banks with the opportunity to finance their lending activities at a near risk-free interest rate that induces them to prefer debt financing to equity financing. Furthermore, competition for funding will not be based on banks' risk evaluation and risk management skills. Benink and Benston (2005) show how banks' equity capital relative to total assets has declined worldwide from a level similar to non-financial firms in the 20s to a level of around four percent in the late 80s when the Basel Committee began its work. During this period explicit and implicit guarantees of banks' liabilities were expanding. Implicit guarantees typically take the form of bail-outs of banks that rarely are allowed to fail.

Additional evidence of excess risk-taking is the frequency of banking crises around the world as documented by Caprio and Klingebiel (2002). Barth et al. (2006) argue that increased resources devoted to regulation and supervision and increased sophistication of supervisors have done little to reduce the incidence of banking crises. They call for increased reliance on market discipline in the regulatory framework for banks.

In this paper we ask how deposit insurance systems and governance affect the degree of market discipline on banks' risk-taking incentives. The results are then applied on a group of countries in Europe and Asia. The theoretical and the empirical frameworks are based on Angkinand and Wihlborg (2006). A key feature of that paper is the emphasis on credibility of non-insurance of groups of depositors and other creditors as a key factor determining the degree to which banks' risk-taking is disciplined by market forces. In this paper, we also investigate how the governance structures of banks, including ownership, shareholder and creditor protection, concentration, and supervisory policies, affect the credibility of non-insurance.

In Section II we review recent literature on the relationship between deposit insurance coverage and banks risk-taking, and on the impact of ownership on banks' behavior and

performance. Thereafter we lay out the theoretical framework for analysis of optimal deposit insurance coverage in Section III. The impact of bank governance on risk-taking is discussed, and the hypothesis for the empirical work is presented. Data and empirical methodology are summarized in Section IV. Empirical relationships between risk-taking proxies, deposit insurance coverage, ownership and other governance factors are presented in Section V. Deposit insurance systems in Eastern Europe and Asia are evaluated in Section VI, and implications for design of deposit insurance schemes are discussed in the concluding Section VII.

## **II. Evidence on deposit insurance, ownership, and banks' risk-taking**

Risk-taking incentives can be the cause of banking crises and are likely to be relatively strong in countries with extensive protection of depositors and other creditors. This protection can be explicit or implicit. Stronger risk-taking incentives increase the burden on regulation and supervision to control and monitor banks' risk-taking in order to reduce the likelihood of a banking crisis.

A number of empirical studies address the question of whether the existence and coverage of explicit deposit insurance schemes increase the probability of banking crises. Most studies focus on explicit coverage but in some studies implicit insurance is captured by proxies for institutional characteristics.

In cross country analyses Demirgüç-Kunt and Detragiache (1997) and Hutchison and McDill (1999) use a dummy variable for explicit deposit insurance along with a number of variables capturing the state of economies to explain the occurrence of banking crises in countries. Demirgüç-Kunt and Detragiache (2002) construct a variable that captured four different degrees of deposit insurance coverage. They find that greater coverage significantly increased the likelihood of crises but this effect is reduced significantly in countries with high

levels of supervisory and legal system quality<sup>2</sup>. Barth et al. (2004) and Cull et al. (2005) support this view with respect to rule of law but not with respect to prudential regulation and supervision.<sup>3</sup> Angkinand (2005) analyzing the impact of institutional variables on the relationship between occurrence of banking crisis and deposit insurance observes a limited but significant positive impact of a corruption variable.

While the above studies supported a positive relation between explicit deposit insurance and banking crises, Eichengreen and Arteta (2002) find in a large sample of developing countries that explicit deposit insurance schemes reduced the likelihood of banking crisis. Hoggarth et al. (2005) using a smaller sample and a shorter period do not find a significant general relationship between an explicit deposit insurance dummy and the probability of crises. However, when distinguishing between limited and unlimited deposit insurance coverage, they find that systems with limited coverage are strongly associated with a smaller probability of crisis.

Angkinand and Wihlborg (2006), linking explicit coverage and implicit protection, hypothesize and estimate a U-shaped relationship between explicit deposit insurance coverage and banks' risk-taking. They find robust evidence for such a relationship when the occurrence of banking crisis in a country during a year is viewed as ex post evidence of risk-taking controlling for macroeconomic conditions. The U-shaped relationship exists also when the ratio between non-performing loans and equity capital in countries banking systems is considered a proxy for risk-taking. Proxies for institutional quality that affect the credibility of the explicit deposit insurance system influence the U-shaped relationship. The framework of that paper will be further discussed and developed below.

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<sup>2</sup> Demirgüç-Kunt and Detragiache (2002) also construct a variable called the moral hazard index, which is found to increase the probability of banking crises. This index is built from the first principal component of deposit insurance features for no-coinsurance, foreign currency deposits covered, interbank deposits covered, type of funding, source of funding, management, membership and the level of explicit coverage.

<sup>3</sup> Barth et al. employ a new database on bank regulation and supervision described in Barth et al. (2001).

Banks risk-taking has also been analyzed on the bank level. Gropp and Vesala (2001) use proxies for banks' risk exposure to analyze risk-taking in European banks. They find that an explicit deposit insurance system is associated with a decline in banks' risk-taking incentives. Nier and Baumann (2006) test the impact of market discipline on banks' risk taking by considering both explicit and implicit aspects of depositor protection. They analyze banks' risk taking as a function of bank capital, market discipline variables, transparency measures, and a number of country and bank specific control variables. Risk-taking is measured by the share of non-performing loans relative to total loans and by provisions for non-performing loans. Market discipline is measured by the extent of deposit protection on the country level, the amount of uninsured funding, and the extent of government support on the bank level. Their results indicate that lack of explicit deposit insurance and high amounts of uninsured deposits are likely to reduce risk-taking through the impact on desired capital while the likelihood of government support reduces market discipline both directly and through the effect on desired capital.<sup>4</sup>

Hovakimian et al (2003) uses the put-option characteristics of a deposit insurance system to estimate a "fair insurance premium" in a number of countries. They analyze the extent to which this implicit measure of incentives for risk-shifting to deposit insurance funds and tax payers depends on characteristics of the deposit insurance system and institutional characteristics of each country. The "fair insurance premium" is estimated for individual banks as well as for banking systems in a number of countries.

Another measure of banks' risk-taking is the so-called Z-score developed by Boyd and Graham (1986, 1988) as a proxy for probability of failure. The Z-score incorporates a measure of

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<sup>4</sup> In another strand of literature using bank level data, market discipline is captured by the sensitivity of subordinated debt yields to changes in banks' risk-taking, as well as by the effects of changes in yield on bank behavior. Jagtiani et al (2002) analyze this issue using American bank data while Sironi (2000) studies European bank data. In both cases there was evidence that subordinated debt yields were sensitive to banks risk-taking while the impact of

the asset risk of a bank as well as the capital ratio. It has been used, for example, by Goyeau and Tarazi (1992) to assess how bank risk developed in Europe during the formative years of European monetary cooperation. We return to a discussion of these alternative measures of banks' risk taking.

The evidence reviewed so far indicates that countries' institutional characteristics should be considered when analyzing the effects of deposit insurance schemes on banks' risk taking. In this paper we incorporate characteristics of the governance of banks on the country level.

Bank governance refers to the (implicit and explicit) contractual relationships influencing the incentives of bank managers. In the corporate governance literature it is usually assumed that managers in a "good" governance system should maximize shareholders' wealth while the incentives to serve the interests of other stakeholders are provided by market forces, law, and regulation. In the literature discussed above, deposit insurance leads to a market failure with the consequence that it could be in the shareholders' interest to take on excessive risk from a social point of view.

Several studies have found that state ownership of banks lead to inefficiency and poor performance (e.g. La Porta et al., 1998). One reason is that management in these banks sometimes come under pressure to serve particular political interests. Caprio and Martinez-Peria (2000) find evidence that a greater extent of state ownership of banks is associated with a higher likelihood of banking crises in developing countries during 1980-1995. Barth et al. (2004) and Berger et al. (2005) find that state-owned banks increase the ratio of non-performing loans to total loans. However, Barth et al. do not find a significant impact of state ownership on banking crises, bank development and performance as measured by net interest margins and overhead

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changes in yield on bank behavior was less clear. Distinguin et al (2005) use banks' stock returns to evaluate whether these data were superior to ratings in predicting distress

costs. Byström (2004), on the other hand, find that the degree of state ownership is positively related to the bank failure rate prior to crises.

For the effect of foreign ownership on banks' risk taking, the findings in the literature are mixed. Demirgüç-Kunt et al (1998) and Claessens et al. (2001) find that foreign ownership of banks is associated with lower financial fragility. Barth et al. (2004) find that the degree of foreign ownership could not explain the likelihood of banking crisis but restrictions on foreign bank entry and ownership are significantly associated with a higher likelihood. The importance these restrictions are supported by Levine (2003) in a study of bank level data for 47 countries. He finds that restrictions on the entry of foreign banks, not ownership, increase interest margins.

Caprio et al. (2004) and Barth et al. (2006) analyze whether the quality of bank governance across countries is influenced by rules with respect to shareholder rights and disclosure. They use the market to book values of banks as a proxy for quality of governance. The results show that greater transparency and stronger minority shareholder rights are associated with higher market values but also that concentration of ownership substitutes for shareholder protection. Tadesse (2005), Fernandez and Gonzalez (2005), and Nier and Baumann (2006) find that greater disclosure and transparency strengthen market discipline and reduce risk-taking of banks.

The large share of foreign ownership of the banking sectors in many emerging market economies in Eastern Europe and Latin America has stimulated research on the effects of foreign ownership on banking operations there. According to Lensink and Hermes (2006) the entry of foreign banks improves the performance of domestic banks although costs increase as well. Lensink and Naaborg (2006) focus on the transition economies and the expanding foreign ownership of banks, while Crystal et al. (2001) study Latin American experiences. The results indicate that foreign banks grow faster than domestic banks, and that they have greater loss

absorption capacity. Foreign banks bring benefits to the domestic banking sector by bringing in technology and expertise in risk management. They also increase competition, thereby forcing domestic banks to increase efficiency. It has also been argued, however, that the intensified competition could induce weak domestic banks to take more risk.

### **III. Credibility of non-insurance, bank governance and market discipline in banking**

In this section we first summarize the argument in Angkinand and Wihlborg (2006)--from here on AW(2006)--leading to the hypothesis that the relationship between risk-taking incentives and explicit deposit insurance coverage is likely to be U-shaped such that (excess) risk-taking is minimized at a positive but partial deposit insurance coverage. Institutional factors influencing the strength of implicit insurance are also considered. Thereafter, we develop a hypothesis for the impact of the quality of bank governance on the relationship between deposit insurance coverage and banks' risk taking.

Both policy makers and banks' creditors recognize that the latter are implicitly guaranteed to some extent. The absence of explicit guarantees leads to strong expectations that governments and regulators in times of crises will respond by issuing blanket guarantees of all creditors of banks or by bailing them out in other ways. Thus, non-insurance of all creditors is not credible.

The complete absence of guarantees of all creditors is not credible in banking for several reasons. First, banking crises tend to occur without much warning and, as a result, policy makers must react very quickly to stave off threats to the financial system. Second, an important function of the banking system is to supply liquidity, and lack of trust in the banking system can rapidly become very costly. Central banks can provide liquidity assistance to banks in distress, but the difficulty of distinguishing between liquidity- and insolvency crises in combination with the fear

of contagion tends to compel governments to issue blanket guarantees of all creditors or to bail-out banks through, for example, rapid recapitalization. Third, banks are opaque with the implication that one bank's distress can lead to runs on healthy banks. Fourth, the failure of one bank can have systemic implications through interbank clearing and settlement systems.

Many countries have introduced partial deposit guarantee schemes in order to reduce the risk of runs of such magnitude that solvent banks must be closed while retaining an element of market discipline. There is little empirical evidence, however, with respect to the relation between the extent of the coverage of explicit deposit insurance and the strength of implicit guarantees of uninsured creditors.

The main argument put forward in AW (2006) is that market discipline discouraging risk-shifting and thereby excessive risk-taking requires (i) non-insurance of groups of creditors (or parts of their deposits), and (ii) that the non-insurance is credible. They also argue that (iii) the credibility of non-insurance of those not covered by deposit insurance schemes increases as the coverage of explicit insurance schemes expands. The greater the coverage of explicit schemes is, the lower is the probability that governments and supervisors must intervene rapidly in distress situations to guarantee the claims of non-insured creditors. We argue that the relation between the coverage of explicit insurance and the credibility of non-insurance depends on institutional and political factors including bank ownership.

The arguments above are illustrated in Figure 1. The horizontal axis depicts the extent of explicit insurance coverage (EC) of deposits and other claims on banks holding other characteristics of the deposit insurance system constant. On the vertical axis is the incentive of banks to take excessive risk (RT) holding bank capital, institutional factors and the governance system constant. We interpret risk-taking (RT) as the probability of a bank's capital buffer being exhausted within a certain timeframe. In other words, market discipline declines and moral

hazard incentives become stronger along the vertical axis. We distinguish between excessive risk-taking caused by explicit deposit insurance ( $RT_{\text{Expl}}$ ) and excessive risk-taking caused by lack of credibility of non-insurance ( $RT_{\text{Impl}}$ ).

In figure (1), the expectation that  $\delta RT_{\text{Expl}} / \delta EC > 0$  is described by the upward sloping line denoted “Explicit”. It shows that market discipline declines and risk-taking (RT) increases as explicit insurance coverage (EC) expands at a constant degree of credibility of non-insurance.

Lack of credibility of non-insurance (CNI) of creditors implies a degree of implicit insurance described by the line denoted “Implicit”. The line shows how risk-taking incentives caused by implicit insurance decline with increasing explicit coverage as a result of increased credibility of non-insurance ( $\delta RT_{\text{Impl}} / \delta EC < 0$ ). AW (2006) discusses this relationship in greater detail.

The total effect on risk-taking of explicit insurance coverage (EC) is described by the vertical summation of the curves “Explicit” and “Implicit” in Figure 1. The total effect on risk-taking is shown as a U-shaped curve.

The U-shaped curve in Figure 1 is not a mathematical necessity. Intuitively, the line “Explicit” must be characterized by decreasing effects on risk-taking of reduced explicit coverage. In essence, there are “diminishing returns” in terms of market discipline when explicit coverage is reduced from full coverage and no market discipline. In other words, a relatively small group of (credibly) uninsured creditors can contribute substantially to market discipline. Similarly, starting from zero explicit coverage and very strong implicit protection of creditors, incentive effects of a declining implicit protection are decreasing as explicit coverage increases and credibility of non-insurance increases. The hypotheses below are based on these

assumptions, but institutional characteristics of countries could affect the shape of the relationship.

[FIGURE 1 here]

In AW (2006) hypotheses are developed for the impact of institutional variables that may shift the lines “Explicit” and “Implicit” in the figure. In particular, it is argued that the line “Implicit” would shift down and flatten out by institutions contributing to credibility of non-insurance. Such a shift is shown in the figure by the line “Implicit × institution”. The institutional factors considered in AW (2006) are Powers and Procedures for Prompt Corrective Action, Rule of Law, Corruption, and Powers of Supervisors. The three first factors influencing implicit protection, in particular, are expected to shift the line “Implicit” as described in Figure 1.

The line “Explicit” can also be affected by institutional factors. Specifically, the credibility of the deposit insurance requires that depositors are convinced that they will be compensated within a reasonable time-frame in case their bank fails. In countries with weak political and legal institutions, this credibility cannot be taken for granted.

#### *Risk taking and bank governance.*

We turn now to bank governance. The question asked is how quality of governance in banks affects the relationship between explicit deposit insurance coverage (EC) and risk-taking (RT). By high quality of governance we mean that the weight of shareholder wealth maximization in the objective of a bank’s management is high.

In an efficient corporate governance system, shareholder’s wealth maximization will also lead to the maximization of creditors’ stake in a firm through the market discipline exerted by creditors. In the case of banks, however, implicit and explicit insurance of creditors can lead to a conflict of interest between shareholders and creditors. This conflict of interest manifests itself in

the incentives for excessive risk-taking as discussed above. These incentives are relatively strong if equity capital is low. Excessive risk-taking reflecting moral hazard occurs as a result of limited liability of shareholders, and lack of market discipline imposed by banks' creditors. The excess risk-taking implies a wealth transfer from creditors (or insurers of creditors) to shareholders.

High quality of bank governance implies that shareholders' objectives have a large weight in managers' incentives. In Figure 1, shareholders prefer high risk-taking at low and high levels of EC. Thus, we expect greater quality of governance to induce more risk-taking at low and high levels of EC in Figure 1. At an intermediate level of EC, shareholders' incentives to take excessive risk are relatively low as a result of market discipline exerted by creditors. Thus, higher quality of governance reduces risk-taking in an intermediate range of EC. Overall, higher quality of bank governance is expected to lead to a more pronounced U-shape for the relationship between risk-taking and explicit deposit insurance coverage.

To strengthen the argument further, assume that shareholder wealth maximization plays little or no role for bank managers. The moral hazard incentives caused by limited liability of shareholders are then weak or irrelevant. It is safe to assume, however, that there is a degree of stigma to being the manager of a failed bank, but this stigma is reduced for managers of banks with relatively high explicit or implicit coverage of deposit insurance. Furthermore, the greater the explicit or implicit coverage, the less concerned are depositors and other insured creditors about bank failure. Under these assumptions the U-shaped curve describing risk-taking incentives at different levels of explicit coverage is flatter when shareholders have relatively low weight in managers' objective (not shown). At an intermediate level of EC, where shareholders have little or no incentive to take excessive risk, lower quality of governance leads to increased risk-taking by management.

Hypotheses with respect to quality of bank governance: *The relationship between explicit deposit insurance coverage and risk-taking is described by a flatter curve for banks with relatively low quality of governance from shareholders' point of view. Thus, we expect risk-taking to be higher at very low and very high levels of explicit coverage in banks with relatively high quality of governance. At intermediate levels of explicit coverage where market discipline is potentially strong, we expect risk-taking to decrease with higher quality of bank governance.*

This Hypothesis implies that governance variables interact with the variable describing explicit deposit insurance coverage to determine risk-taking incentives. The empirical specification allows for such interaction as well as independent effects of governance quality on risk-taking.

The variables used to capture the quality of governance are the ownership variables, and shareholder and creditor rights. The ownership variables are the shares of state and foreign ownerships in the banking system. State ownership is expected to lower the quality of governance by reducing the weight of shareholder wealth maximization in managers' objectives. Foreign ownership is expected to strengthen the weight of shareholder wealth maximization in the objective. The influence of state and foreign ownership is obviously more complicated as will be discussed below but our hypotheses are as stated.

Other characteristics of deposit insurance system than the coverage are disregarded. Such characteristics could contribute to the level of risk-taking but, since our main concern is with the interaction between deposit insurance coverage and governance variables, they can be left out of the analysis. AW (2006) show that the U-shaped relationship between coverage and explicit deposit insurance coverage is not affected by the inclusion of other characteristics.

The hypotheses are to be tested on country data. There are two groups of countries. One consists of all countries in our data set (see Table 1). The other groups are emerging market countries alone. The dependent variable is a proxy for risk-taking while the independent variables include a proxy for explicit deposit insurance coverage, proxies for the quality of bank governance on the country level, and country specific control variables reflecting macroeconomic and institutional conditions and characteristics.

#### **IV. Model Specification and Data**

We use three proxies to capture risk-taking: the ratio of non-performing loans relative to capital in the banking system (NPL/CAP), the standard deviation of non-performing loans relative to the average level of capital (std NPL/Avg CAP) during a period, and the Z-score as a proxy for “distance to default”. To analyze the impact of deposit insurance coverage and governance variables we control for a number of time specific macroeconomic variables that may contribute to crises and loan losses. Evidence of excess risk-taking caused by weak market discipline is that risk-taking depends on the coverage of the deposit insurance system. In other words, there is no specific proxy for excessive risk-taking.

There are pros and cons with each of the proxies for risk-taking. If we perceive risk-taking as choosing a certain probability of default (distance to default), the Z-score is conceptually the most appropriate proxy.<sup>5</sup> It incorporates a measure of asset side risk as well as the equity capital buffer. Its drawback is that the return on assets includes only provisions for credit losses while non-performing loans is a proxy for total credit losses. Furthermore, the Z-score includes the return or loss on all activities of the financial firm while non-performing loans

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<sup>5</sup> The Z-score for a period is defines as (the Average Return on Assets (ROA)/standard deviation of ROA) +(the Equity to Assets ration/standard deviation of ROA)

specifically refers to the banking side of the firm. This is the part of a financial firm presumably enjoying the benefits of deposit insurance.<sup>6</sup>

Choosing a certain level of expected non-performing relative to capital can be seen the most important part of choosing a probability of default. The expected level would depend on its standard deviation, however. Apart from the Z-score, we do not have a measure that includes both the expected level of non-performing loans and their standard deviation. Therefore we use the two aspects of risk-taking as different dependent variables using actual non-performing loans as a proxy for expected non-performing loans

The ratio of non-performing loans to total loans (NPL), the ratio of equity capital to total assets (CAP), and the return on assets (ROA) is obtained from the IMF's Financial Stability Reports wherein the IMF has published own measures on the country level since 1997.<sup>7</sup> Since we do not have data for non-performing loans relative to total assets we measure NPL/CAP as the ratio of non-performing loans relative to total loans divided by the ratio of capital to total assets. The standard deviation is calculated using the annual data for the whole period 1997-2003.

An “unobserved effects panel data model” is employed in the NPL/CAP regressions. Cross-section regressions are also run for NPL/CAP, as well as for  $\text{std}(\text{NPL}/\text{CAP})/\text{Avg}(\text{CAP})$  and the Z-score.<sup>8</sup>

$$\text{NPL}_{i,t} = \alpha + \delta_1 \text{EC}_{i,t-1} + \delta_2 (\text{EC}_{i,t-1})^2 + \gamma_j z_{j,i,t-1} + \beta_k x_{k,i,t-1} + \varepsilon_{i,t-1}$$

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<sup>6</sup> We do not use a “fair insurance premium” suggested by Hovakimian et al (2003) for several reasons. Its validity depends on strong assumptions with respect to the allocation of losses for a distressed bank. It also has the drawback that it is based on the market value of all activities of a financial firm. The explanatory variables used below had little explanatory value for this premium in AW (2006).

<sup>7</sup> The NPL data and bank capital data in the IMF's Financial Stability reports are based on “National authorities and IMF staff estimates.”

<sup>8</sup> The Hausman test suggests the use of the random effects over fixed effects models (see section 5). In addition, this paper emphasizes effects of corporate governance and institutional variables which do not vary much over time, implying that the fixed effects could lead to imprecise estimates (see Wooldridge, 2002, chapter 10).

Here NPL stands for all the proxies for risk-taking used as dependent variables. EC is the explicit deposit insurance coverage.  $z_j$  is the different proxies for ownership and the quality of bank governance, which are obtained from various sources (discussed below). Macroeconomic control variables are represented by  $x$ . In order to test the Hypotheses discussed above, proxies for governance quality are allowed to interact with the coverage of explicit deposit insurance variable (i.e.  $EC_{i,t} \times z_{j,i,t}$ ).

The proxy for EC as well as all independent variables enter with a lag to avoid a potential simultaneity problem caused by political decisions to adopt explicit deposit insurance schemes or alter the coverage limits as responses to credit losses. Furthermore, the observations of NPL and distance to default in a period are based on decisions made in earlier periods.  $x$  is a  $k$ -element vector of macroeconomic and financial variables, including real GDP per capita, the real GDP growth rate, the ratio of money supply to international reserves, the ratio of domestic credit provided by banking sector to GDP, the ratio of the current account to GDP, the inflation rate, and the real interest rate. These are a standard set of control variables used in the reviewed literature. By using the same variables, our results become comparable to those in the literature where the quadratic relationship is not considered.

In a panel analysis, error terms are likely to be correlated over time and across countries, and unobserved country-specific components are likely to be correlated with the observable country characteristics or explanatory variables, which could lead to biased coefficient estimates. Robust and clustering standard errors correct the covariance matrix for estimates of heteroskedasticity and allow any type of correlation among the observations across time within each country. We also test for the robustness of results by using the conditional random effects logit models that correct for unobserved heterogeneity problem.

We examine the impact of explicit deposit insurance coverage and banks' governance structures on banks' risk-taking in cross-section time series analysis as well as in cross section analysis using a sample of more than 100 countries during the period 1997-2003. Emerging markets include 41 countries listed in Table 1.

Data for deposit insurance coverage for Eastern Europe and Asia are presented in table 1. These data are taken from the Database of Deposit Insurance Around the World published by Demirgüç-Kunt et al. (2005), at the World Bank. In this table, "coverage limit" is the maximum coverage per deposit account within each deposit insurance system. The ratio between this coverage limit and the per capita deposit size (coverage per average deposit), denoted *covdep*, represents our primary proxy for explicit deposit insurance coverage.

AW (2006) used four different specifications of explicit deposit insurance coverage (EC). Results were not sensitive to the choice of specification. The one used here is the natural logarithm of  $(1+covdep)$ , *lncovdep*.

Turning to governance variables, we use the *Real GDP per Capita* to capture a country's general institutional quality. This variable is highly correlated with other country specific institutional quality variables like *Rule of Law*, and (lack of) *Corruption*. As noted in La Porta et al. (1998, 2002), poorer countries generally have weaker governance structures. An advantage of GDP/capita is that there is data for all countries.

One group of governance variables refers to ownership of banks. *State-* and *Foreign-Ownerships* are defined as the share of bank assets held by banks owned more than 50 percent by governments or foreigners (banks). The ownership data comes from the World Bank database of

Bank Regulation and Supervision (See Barth et al. 2004 and 2006). We use data from both surveys in 1999 and 2001 to increase the variation of these variables.<sup>9</sup>

Another group of governance variables includes proxies for stakeholder rights, and market monitoring. *Shareholder Rights* and *Creditor Rights* data are those of La Porta et al. (1998). The index of shareholder rights ranges from 0 to 6 with a higher value reflecting stronger protection of minority shareholders against managers or dominant shareholders. The index of creditor rights range from 0 to 4 with a higher value reflecting greater protection of secured creditors in particular in reorganization and liquidation processes. Other proxies for market monitoring can be found in Barth et al (2006). The correlation between those variable and the shareholder rights variable used here is high and the choice among them do not have much impact on the results. We use the proxy that allows us to include as many countries as possible in the analysis.

The equity to total asset ratio (CAP/TA) can also be considered a governance variable, since it affects shareholders incentives. This variable is included because the risk-taking incentives of shareholders are reduced with increased equity financing. The moral hazard incentives are expected to increase equity capital approaches zero. Thus, an indication that the moral hazard problem is a reality is that risk-taking is decreasing as (CAP/TA) increases. If there is no moral hazard, the CAP/TA ratio can be expected to be relatively high in relatively risky firms. Furthermore, there is possibly interaction between the EC variable and CAP/TA, since the moral hazard incentives are expected to particularly high if EC is very low or very high, and if CAP/TA is low.

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<sup>9</sup> We use 1999 survey for the period until 1999 and use 2001 survey for the period of 2000-2003 for the state and foreign ownership variables. For some countries that do not report the data in both surveys, we use the data wherever is available.

Descriptions of all variables used in the analysis are presented in the Data Appendix. The correlations among governance and institutional variables are reported in Table 2.

## **V. Empirical Results with respect to deposit insurance coverage, ownership and governance.**

Table 3 shows results for regressions without interactive variables, while Table 4 includes interactions. Tables 3.a.and 4.a.refers to all countries, while Tables 3.b and 4.b presents the results for emerging markets. The four different proxies for risk-taking are listed horizontally in each table. The first NPL/ CAP column (first two in Table 3) shows results of panel analysis. The other three columns are the results of cross section analyses. In the cross section analysis averages are taken for the whole period with one exception. The equity to total assets (CAP/TA) in the cross section analysis is the initial value for the period in order to avoid simultaneity with risk-taking. In the panel analysis, CAP/TA like all other variables are lagged one period.

In all tables, coefficients marked with an asterisk are significant on the 10 percent level at least. The coefficients marked with a # have estimates that exclude zero within one standard deviation. We consider this weak evidence of a relationship but nevertheless evidence worth taking note of.

Turning first to the issue of a quadratic relationship between EC and risk-taking in Table 3 we can observe that the sign for the deposit insurance coverage (covdep) is negative in the first four columns as expected, and the sign of the squared term is positive in these columns. Most of these coefficients are significant or weakly significant. These results confirm the robust evidence with respect to a U-shaped relationship found in AW (2006). Turning to the Z-score we expect the opposite sign since this variable measures “distance to default”. In Table 3.a. for all countries

the signs are as expected and at least weakly significant. The quadratic term is significant in all five columns. In Table 3.b. for emerging markets, the sign for covdep is contrary to the hypothesis but not significant at all.

The sign for CAP/TA is negative in the first four columns as expected under conditions of potential moral hazard. In the Z-score column the coefficients for Cap/TA are not significant and for emerging markets the sign is contrary to the hypothesis.

State ownership seems to cause an increase in risk-taking by all measures but the significance level in the Z-score analysis is very low. The sign foreign ownership is also predominantly positive (negative for the Z-score) but there is no significance except in the Z-score column in Table 3.a..

Increasing shareholder rights seems to reduce risk-taking and the coefficients are significant in both 3,a and 3.b when NPL/CAP is the dependent variable.

Creditor rights are very far from significant in these tables. This variable is excluded in the remainder of the analysis.

In Table 4 where interaction terms are included, the pattern for the non interactive term is very similar to that in Tables 3. a and b. except that the signs for CAP/TA are now positive as expected under moral hazard for all countries as well as for emerging markets alone. The coefficients are not significant, however.

Turning to the interaction variables, most of the coefficients are not significant but the state ownership and the shareholder rights interactions are significant in the NPL/CAP panel regression, For emerging markets the same interactions are significant or weakly significant in the Z-score regression as well. Shareholder rights have a significant or weakly significant impact in the cross section NPL/CAP regressions. Interactions with CAP/TA were

also included but since this interaction was not significant in any regression it has been excluded in the regressions presented here.

The presence of interaction terms with the squared covdep make interpretations less obvious. The interaction terms modify the shape of the relationship between EC and risk-taking depending on country specific values for ownership and shareholder rights variables. Therefore we draw figures to show how the expected U-shaped relationship is modified by the interactions. Figure 2 shows how state ownership and shareholder rights affect the quadratic relationship in emerging markets based on the panel and cross-section NPL/CAP regressions in Table 4.b. The impact of foreign ownership is not presented since the results for this variable are quite weak.

In Figure 2, panel a the U-shaped relationship for mean values of all variables including state ownership is shown by the fully drawn line. The dotted line shows that the relationship is steeper for high values of EC when state ownership is high and flatter when state ownership is low. This result is contrary to the hypothesis that improved governance under private ownership causes more risk taking at high and low values of EC. The results here indicate that the relationship is flatter for low values of state ownership.

In panel b shareholder rights are varied. The figure for the panel regression shows that increasing shareholder rights shifts risk taking down for low values of EC in particular. The hypothesized increased steepness associated with good governance can be observed for high values of EC but for low values the opposite holds. The figure based on coefficients for the panel regression on the right reveal the same kind of results but the shifts are more extreme. In fact the shape of the EC-NPL/CAP relationship seems to shift from downward sloping for low values of shareholder rights to upward sloping for higher values of shareholder rights. This means that market discipline on risk taking is strengthened by greater explicit insurance coverage in

countries with weak shareholder rights and weakened by greater coverage in countries with stronger shareholder rights.

In order to see how the risk minimizing explicit deposit insurance coverage depends on country specific factors we turn to Table 5 where we have calculated the risk minimizing coverage for a number of emerging markets in Asia and Europe. Presumably this risk minimizing coverage is the coverage that maximizes the impact of market discipline on banks' risk-taking. According to the regression results, the risk minimizing coverage depends on state ownership, foreign ownership and shareholder rights although all the relations are not statistically significant in the previous tables.

In Table 5 the first column after the country name column shows the actual ratio for deposit insurance coverage relative to the average deposit size (covdep) in each country in 2003. The next four columns shows the ratio that would minimize risk-taking according to the results in the different regressions in table 4.b. The results in the two NPL/CAP columns and the Z-score column to the right are fairly consistent in terms of ranking of the different countries. The covdep that would minimize the standard deviation looks very different, however. The Z-score is affected by the standard deviation as well as return on assets and the capital ratio. The observation that the pattern across countries for the Z-score is consistent with the pattern for NPL/CAP indicates that the standard deviation plays a lesser role in determination of probability of default.

Considering the panel analysis of NPL/CAP the one providing the most reliable estimates of coefficients, we can compare the covdep ratios that minimize risk-taking according to this regression with the actual covdep ratios in the different countries. According to this comparison Indonesia, Malaysia and Thailand with full coverage should reduce the explicit deposit insurance coverage. Among the Asian countries, Singapore with no deposit insurance and the Philippines

should raise the coverage. In eastern Europe there are a number of countries with very high coverage that should reduce it while Slovenia should increase its coverage. South Korea, the Czech Republic, Estonia Hungary, Latvia and Slovakia seem to offer deposit insurance coverage close to the risk-minimizing one.

## **VI. Summary and Conclusions**

Building on research showing that there generally exists a partial deposit insurance system that maximizes the impact of market discipline on banks' risk-taking, we have analyzed how country specific conditions with respect to ownership and governance of banks interact with deposit insurance systems to determine the impact of market discipline on banks' risk-taking. The proxies we use for risk-taking are based on data for non-performing loans and capital, as well as a Z-score based on accounting data. Using data for 100 countries including 41 emerging markets we focus the analysis on the latter group.

The results indicate that the U-shaped relationship between the proxies for risk-taking and explicit deposit insurance coverage is robust when governance variables are introduced. State ownership and shareholder rights seem to have a significant effect on risk-taking through market discipline while foreign ownership does not. Countries in Asia and Eastern Europe vary considerable in their deposit insurance coverage and according to our results some countries would benefit by increasing the coverage while other countries should reduce the coverage.

## Data Appendix

Variable	Description	Source
CAP/TA	bank capital to total asset	Financial Stability Report, IMF and the World Development Indicator (WDI)
NPL/CAP	Bank nonperforming loans to total loans divided by bank capital to assets	Financial Stability Report, IMF and WDI
Std(NPL)/Avg(CAP)	The standard deviation of bank nonperforming loans to total loans divided by the average value of bank capital to assets	Financial Stability Report, IMF and WDI
Z-Score	The natural log value of the Z-score, which is the ratio of the average equity ratio plus the average ROA relative to the standard deviation of ROA	Authors' calculation
Real GDP/Cap	The natural log value real GDP per capita (constant 2000 US\$)	WDI
Real GDP Growth	Real GDP growth rate (annual %)	WDI
M2 to Reserve	The ratio of money and quasi money (M2) to gross international reserves	WDI
Inflation	The natural log difference of the Consumer Price Index	WDI
Real Interest Rate	Real interest rate (%)	WDI
Covdep	The natural log value of the ratio of the maximum deposit insurance coverage limit per deposits per capita.	Demirgüç-Kunt et al. (2005)
Government Ownership	The fraction of the banking system's assets that are 50% or more government owned.	The World Bank Survey of Bank Regulation and Supervision, compiled by Barth et al., 2004
Foreign Ownership	The fraction of the banking system's assets that are 50% or more foreign owned.	The World Bank Survey of Bank Regulation and Supervision, compiled by Barth et al., 2004
Shareholder rights	An index aggregating six characteristics of shareholder rights: proxy by mail allowed, shares not blocked before meeting, cumulative voting or proportional representation allowed, oppressed minorities in place, percentage of share capital to call an extraordinary meeting, and preemptive right to new issues. The index ranges from 0 to 6 with a higher value indicating the increase in shareholder protection.	La Porta et al. (1998) and Pistor et al (2000)
Creditor rights	An index aggregating four characteristics of creditor rights: no automatic stay on secured assets, secured creditors paid first, restrictions on going into reorganization, and management does not stay in reorganization. The index ranges from 0 to 4 with a higher value indicating the increase in creditor protection.	La Porta et al. (1998) and Pistor et al (2000)

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**Table 1. Deposit Insurance Coverage and Governance of Banks**

	NPL/Total Loans (average, %)	Cap/TA (average, %)	Coverage Limit as of 2003 (Local Currency)	Coverage Limit as of 2003 (dollars)	Coverage Limit /Deposit per Capita as of 2003	Government Ownership in 2001	Foreign Ownership in 2001	Shareholder rights	Creditor rights
<b>East and Southeast Asia</b>									
Indonesia	30.8	7.2	Full	Full	Full	44	7	2	4
South Korea	5.5	4.3	50 Mil Won	41,925	4.49	39.97	29.54	2	3
Malaysia	14.6	8.6	Full	Full	Full	0	19	4	4
Philippines	19.0	13.9	P 100,000	1,800	3.76	11.17	14.95	3	0
Singapore	3.8	9.5	0	0	0	0	50	4	4
Thailand	23.1	7.5	Full	Full	Full	30.64	6.77	2	3
<b>Central and Eastern Europe</b>									
Bulgaria	14.4	14.1	BGL 15,000	8,654	10.87	17.6	74.56	4	3
Czech Republic	17.4	6.5	CZK 810,025	31,575	5.10	3.8	90	3	3
Estonia	1.1	14.9	EKK 100,000	8,058	3.13	0	98.9	3.75	4
Hungary	3.9	8.9	HUF 3,000,000	1,4429	4.02	9	88.8	3	3.75
Latvia	4.7	6.8	LVL 3,000	5,545	4.07	3.2	65.2	3.5	4
Lithuania	11.0	10.3	LTL 45,000	16,293	12.05	12.16	78.19	3.75	3
Poland	16.1	7.6	PLN 106,304.2	28,418	13.58	23.5	68.7	3	2.25
Romania	8.3	9.5	ROL 125,222,000	3,842	12.30	41.8	47.3	3	4
Slovakia	17.7	7.6	SKK 925,498.3	25,260	7.39	4.4	85.5	2.5	4
Slovenia	6.2	11.1	SIT 5,100,000	26,931	3.38	12.2	20.6	2.5	4
<b>Other Emerging Market Economies</b>									
Argentina	17.9	11.4	Arg \$ 30,000	10,327	13.31	31.9	31.8	4	1
Brazil	7.0	12.4	Reais 20,000	6,925	8.7	32	29.9	3	1
Chile	1.6	7.4	CLP 2,256,000	3,764	2.01	13.3	46.8	5	2
Colombia	9.4	10.7	20000000	7,192	16.82	18.3	21.5	3	0
Ecuador	18.2	12.1	Full	Full	Full	14	7	2	4
Egypt	16.6	5.2	0	0	0	64.7	13.3	2	4
India	12.6	5.7	Rs 100,000	2193	7.34	75.27	7.3	5	4
Israel	9.1	7.0	0	0	0	46.1	1.2	3	4
Jordan	16.5	6.6	JD 10,000	14104	7.22	0	64.3	1	-
Mexico	7.1	9.4	32,262,340 Pesos	2871337	Full	0	82.7	1	0
Nigeria	15.4	8.6	N 50,000	366	5.06	4.65	0	3	4
Pakistan	18.9	5.0	0	0	0	53.79	20.07	5	4
Peru	10.8	9.2	S 68,474	19773	37.64	0	42.48	3	0
Russia	9.2	13.6	100,000 rubles	3,395	5.16	35.5	8.8	5.5	2.5
South Africa	3.5	8.0	0	0	0	0	7.7	5	3
Turkey	12.3	9.1	Full	Full	Full	31.82	3.47	2	2
Ukraine	28.1	14.8	UAH 1,500	281	1.19	12	10.5	2.5	4
Venezuela	6.7	13.9	Bs 10,000,000	6,258	10.3	6.86	43.22	1	-
Zimbabwe	10.0	8.9	Zimbabwe \$ 200,000	3640	1.12	6.09	28.02	3	4
Minimum	1.10	4.34				0	1.2	1	0
Mean	11.75	9.53				19.02	39.5	3.18	3.02
Maximum	26.23	14.89				75.27	98.9	5.5	4

† converted using the exchange rates at the end of 2003

Table 2. Correlation for Governance and Institutional Variables

	Real GDP/ Cap	Real GDP Growth	M2 to Reserve	Inflation	Real Interest Rate	Capital/TA	Covdep	(Covdep × Covdep)	State Ownership	Foreign Ownership	Shareholde r rights
Real GDP Growth	0.103										
M2 to Reserve	-0.108	0.003									
Inflation	-0.002	0.177	-0.054								
Real Interest Rate	0.302	0.259	0.488	0.052							
Capital/TA	0.406	-0.047	0.375	-0.411	0.272						
Covdep	0.421	0.037	0.166	-0.125	0.192	0.567					
(Covdep × Covdep)	-0.387	-0.022	-0.128	0.094	-0.117	-0.512	-0.988				
State Ownership	0.188	-0.212	-0.008	0.031	0.238	0.206	0.121	-0.094			
Foreign Ownership	-0.149	-0.143	0.458	-0.060	0.194	0.045	-0.049	0.054	0.366		
Shareholder rights	0.201	-0.016	0.241	0.117	0.367	0.039	0.030	0.009	0.301	0.263	
Creditor rights	0.370	0.242	0.458	-0.046	0.331	0.275	0.516	-0.495	-0.124	0.092	0.103

**Table 3 Deposit Insurance Coverage and Bank Ownership**

**3a. All Countries**

Dependent Variable	NPL/CAP	NPL/CAP	Avg(NPL/CAP)	Std(NPL)/ Avg(CAP)	Z-score
Model	Panel	Panel	Cross-Section	Cross-Section	Cross-Section
	(1)	(2)	(3)	(4)	(5)
Real GDP/Cap	-0.334** (0.001)	-0.377** (0.000)	-0.518** (0.000)	-0.139** (0.011)	0.079 (0.430)
Real GDP Growth	-2.965* (0.051)	-2.794** (0.043)	-6.969# (0.201)	-3.321# (0.308)	5.366 (0.439)
M2 to Reserve	-0.135 (0.362)	-0.118 (0.390)	-0.012 (0.929)	-0.047 (0.417)	0.212# (0.205)
Inflation	0.996** (0.029)	0.829* (0.074)	-2.802** (0.008)	-0.425 (0.494)	-1.122 (0.413)
Real Interest Rate	1.731** (0.001)	1.711** (0.000)	-0.242 (0.773)	-0.387# (0.228)	-1.961# (0.158)
Capital/TA	-6.981** (0.000)	-7.301** (0.000)	-7.296** (0.003)	-1.983* (0.057)	1.278 (0.630)
Covdep	-0.329# (0.198)	-0.333# (0.151)	-0.306# (0.168)	-0.199# (0.140)	0.447# (0.109)
(Covdep × Covdep)	0.096* (0.064)	0.096** (0.043)	0.106* (0.086)	0.075** (0.036)	-0.159** (0.033)
State Ownership	0.917* (0.082)	0.832# (0.110)	1.228** (0.014)	0.192 (0.470)	-0.106 (0.869)
Foreign Ownership	0.009 (0.985)	0.090 (0.854)	0.397 (0.431)	0.183 (0.484)	-0.855** (0.037)
Shareholder Rights	-0.169** (0.034)	-0.190** (0.010)	-0.203** (0.027)	-0.007 (0.887)	-0.017 (0.878)
Creditor Rights	0.041 (0.696)				
Constant	0.566 (0.420)	0.899# (0.142)	1.850** (0.001)	0.714* (0.064)	3.801** (0.000)
R2	0.455	0.458	0.634	0.474	0.430
N	242	251	52	52	52
Chi-Square/F-Statistics	124.054	116.901	8.68	5.21	4.00
Prob>Chi-Square (Prob>F-stat)	0.000	0.000	0.000	0.000	0.001

This table reports the estimation results of the impact of corporate governance on banks' risk-taking. Corporate governance variables are captured by the real GDP per capita, the extent of state and foreign ownerships of banks, and shareholder and creditor rights. The panel of NPL/CAP regressions is estimated using the random country effects model; the chi-square is reported for overall model fit. The cross-section regressions are estimated using OLS with the robust standard error; the F-statistics is reported for overall model fit. \*, \*\* indicate the significance levels of 10%, and 5% respectively. # indicates the coefficient value zero that falls outside one standard deviation of the estimate. The numbers in parentheses are p-values.

### 3b. Emerging Market Economies

Dependent Variable	NPL/CAP	NPL/CAP	Avg(NPL/CAP)	Std(NPL)/ Avg(CAP)	Z-score
Model	Panel	Panel	Cross-Section	Cross-Section	Cross-Section
	(1)	(2)	(3)	(4)	(5)
Real GDP/Cap	-0.419** (0.002)	-0.465** 0.000	-0.393** (0.015)	-0.234* (0.063)	-0.110 (0.712)
Real GDP Growth	-3.150* (0.061)	-2.963* (0.052)	-2.354 (0.759)	-8.530# (0.123)	0.957 (0.937)
M2 to Reserve	-0.308# (0.152)	-0.258# (0.195)	-0.014 (0.959)	-0.113 (0.543)	-0.082 (0.834)
Inflation	1.443** (0.000)	1.154** (0.007)	-2.038# (0.188)	-1.283# (0.214)	-2.065 (0.361)
Real Interest Rate	1.423** (0.010)	1.494** (0.003)	-0.459 (0.699)	-0.223 (0.729)	-0.276 (0.861)
Capital/TA	-6.892** (0.013)	-7.239** (0.005)	-6.948# (0.198)	-1.257 (0.487)	-1.226 (0.785)
Covdep	-0.519* (0.092)	-0.494* (0.075)	-0.154 (0.706)	-0.345# (0.291)	-0.142 (0.826)
(Covdep × Covdep)	0.129** (0.047)	0.123** (0.036)	0.043 (0.621)	0.105# (0.134)	-0.036 (0.798)
State Ownership	1.402** (0.020)	1.252** (0.034)	0.893# (0.141)	0.304 (0.498)	-0.454 (0.655)
Foreign Ownership	0.171 (0.763)	0.240 (0.661)	-0.166 (0.786)	0.296 (0.438)	-0.551 (0.484)
Shareholder Rights	-0.207* (0.083)	-0.221** (0.030)	-0.292** (0.017)	-0.002 (0.982)	0.018 (0.909)
Creditor rights	-0.033 (0.773)				
Constant	0.445 (0.582)	0.656 (0.406)	2.158** (0.012)	0.793# (0.200)	3.576** (0.012)
R2	0.336	0.338	0.612	0.422	0.277
N	156	165	32	32	32
Chi-Square/F-Statistics	87.013	83.245	8.25	33.33	1.11
Prob>Chi-Square	0.000	0.000	0.000	0.009	0.402

This table reports the estimation results of the impact of corporate governance on banks' risk-taking for a sample of emerging market economies. Corporate governance variables are captured by the real GDP per capita, the extent of state and foreign ownerships of banks, and shareholder and creditor rights. The panel of NPL/CAP regressions is estimated using the random country effects model; the chi-square is reported for overall model fit. The cross-section regressions are estimated using OLS with the robust standard error; the F-statistics is reported for overall model fit. \*, \*\* indicate the significance levels of 10%, and 5% respectively. # indicates the coefficient value zero that falls outside one standard deviation of the estimate. The numbers in parentheses are p-values.

Table 4 Deposit Insurance Coverage, Ownership, and Interactions

4a. All Countries

Dependent Variable	NPL/CAP	Avg(NPL/CAP)	Std(NPL)/ Avg(CAP)	Z-score
	Panel	Cross-Section	Cross-Section	Cross-Section
	(1)	(2)	(3)	(4)
Real GDP/Cap	-0.371** (0.000)	-0.531** (0.000)	-0.124** (0.020)	0.056 (0.608)
Real GDP Growth	-2.886** (0.037)	-3.036 (0.592)	-2.425 (0.459)	4.562 (0.526)
M2 to Reserve	-0.127 (0.357)	-0.002 (0.985)	-0.032 (0.562)	0.183# (0.309)
Inflation	0.830* (0.092)	-2.202* (0.054)	-0.191 (0.743)	-1.284 (0.339)
Real Interest Rate	1.597** (0.001)	-0.230 (0.772)	-0.355# (0.240)	-1.944# (0.160)
Capital/TA	-7.435** (0.000)	-8.344** (0.002)	-2.143* (0.064)	1.532 (0.553)
Covdep	-0.305# (0.185)	-0.382* (0.076)	-0.219* (0.067)	0.408# (0.173)
(Covdep × Covdep)	0.026 (0.671)	0.102# (0.203)	0.067# (0.102)	-0.190** (0.044)
State Ownership	0.302 (0.630)	1.641* (0.054)	-0.148 (0.529)	0.137 (0.870)
Foreign Ownership	0.064 (0.914)	0.830# (0.245)	0.465# (0.139)	-1.504** (0.003)
Shareholder Rights	-0.258** (0.003)	-0.347** (0.009)	-0.046 (0.390)	-0.008 (0.958)
State Ownership × (Covdepint × Covdepint)	0.117** (0.015)	-0.153# (0.178)	0.071# (0.245)	-0.055 (0.776)
Foreign Ownership × (Covdepint × Covdepint)	0.017 (0.663)	-0.087# (0.277)	-0.050# (0.194)	0.134# (0.113)
Shareholder Rights × (Covdepint × Covdepint)	0.015* (0.096)	0.028# (0.151)	0.005 (0.554)	0.006 (0.828)
Constant	1.149* (0.070)	2.101** (0.002)	0.806** (0.019)	3.889** (0.000)
R2	0.472	0.699	0.564	0.481
N	251	52	52	52
Chi-Square/F-Statistics	205.137	9.15	4.97	4.36
Prob>Chi-Square	0.000	0.000	0.000	0.000

This table reports the estimation results of the impact of corporate governance on banks' risk-taking and how it depends on deposit insurance coverage. Corporate governance variables are captured by the real GDP per capita, the extent of state and foreign ownerships of banks, and shareholder and creditor rights. The panel of NPL/CAP regressions is estimated using the random country effects model; the chi-square is reported for overall model fit. The cross-section regressions are estimated using OLS with the robust standard error; the F-statistics is reported for overall model fit. \*, \*\* indicate the significance levels of 10%, and 5% respectively. # indicates the coefficient value zero that falls outside one standard deviation of the estimate. The numbers in parentheses are p-values.

#### 4b. Emerging Market Economies

Dependent Variable Model	NPL/CAP	Avg(NPL/CAP)	Std(NPL)/ Avg(CAP)	Z-score
	Panel	Cross-Section	Cross-Section	Cross-Section
	(1)	(2)	(3)	(4)
Real GDP/Cap	-0.400** (0.002)	-0.342** (0.042)	-0.159# (0.157)	-0.280# (0.318)
Real GDP Growth	-3.122** (0.042)	1.365 (0.861)	-5.272# (0.309)	4.791 (0.684)
M2 to Reserve	-0.277# (0.168)	-0.012 (0.964)	-0.022 (0.907)	-0.378 (0.377)
Inflation	1.220** (0.009)	-1.052 (0.542)	-0.710 (0.465)	-2.659# (0.184)
Real Interest Rate	1.259** (0.012)	-0.412 (0.743)	-0.353 (0.572)	0.236 (0.870)
Capital/TA	-7.577** (0.003)	-7.019# (0.163)	-1.965 (0.379)	0.850 (0.863)
Covdep	-0.413# (0.171)	-0.414 (0.330)	-0.263 (0.438)	0.713 (0.347)
(Covdep × Covdep)	0.016 (0.848)	-0.064 (0.523)	0.077# (0.229)	-0.086 (0.512)
State Ownership	0.370 (0.590)	0.361 (0.681)	-0.046 (0.920)	-0.429 (0.699)
Foreign Ownership	-0.078 (0.914)	-0.317 (0.693)	0.511# (0.244)	-1.449* (0.083)
Shareholder Rights	-0.320** (0.007)	-0.569** (0.001)	-0.059 (0.548)	-0.115 (0.607)
State Ownership × (Covdepint × Covdepint)	0.159** (0.012)	0.087 (0.510)	0.045 (0.644)	0.054 (0.801)
Foreign Ownership × (Covdepint × Covdepint)	0.041 (0.409)	0.049 (0.639)	-0.057 (0.348)	0.246** (0.030)
Shareholder Rights × (Covdepint × Covdepint)	0.019* (0.053)	0.054** (0.020)	0.008 (0.625)	0.036# (0.257)
Constant	1.070# (0.222)	3.003** (0.005)	1.058# (0.106)	3.746** (0.013)
R2	0.392	0.708	0.516	0.450
N	165	32	32	32
Chi-Square/F-Statistics	117.706	10.06	1.95	3.00
Prob>Chi-Square	0.000	0.000	0.095	0.017

This table reports the estimation results of the impact of corporate governance on banks' risk-taking and how it depends on deposit insurance coverage. Corporate governance variables are captured by the real GDP per capita, the extent of state and foreign ownerships of banks, and shareholder and creditor rights. The panel of NPL/CAP regressions is estimated using the random country effects model; the chi-square is reported for overall model fit. The cross-section regressions are estimated using OLS with the robust standard error; the F-statistics is reported for overall model fit. \*, \*\* indicate the significance levels of 10%, and 5% respectively. # indicates the coefficient value zero that falls outside one standard deviation of the estimate. The numbers in parentheses are p-values.

**Table 5. Comparing Actual and Risk-minimizing Explicit Deposit Insurance Coverage (2003)**

Column (1) shows the actual levels of coverage per average deposit, *Covdep*. The remaining columns show the level of *covdep* that minimizes banks' risk-taking according to results presented in Rtable 4 b for emerging markets.

Country	Coverage Limit /Deposit per Capita as of 2003	(1) <i>Covdep</i> minimizing NPL/CAP  (based on the Panel regression, column 1, Table 4b)	(2) <i>Covdep</i> minimizing NPL/CAP  (based on the Cross-Section regression, column 2, Table 4b)	(3) <i>Covdep</i> minimizing Std(NPL)/Avg(CAP)  (based on the Cross-Section regression, column 3, Table 4b)	(4) <i>Covdep</i> maximizing Z-score  (based on the Cross-Section regression, column 4, Table 4b)
Indonesia	Full	4.1	10.0	2.4	Full
South Korea	4.49	3.9	8.0	3.1	84.4
Malaysia	Full	6.7	2.6	2.9	29.1
Philippines	3.76	7.3	4.9	2.9	Full
Singapore	0	5.2	2.2	4.2	6.2
Thailand	Full	6.0	15.0	2.6	Full
Bulgaria	10.87	2.9	1.7	5.0	3.1
Czech Republic	5.10	4.9	3.1	12.3	3.3
Estonia	3.13	4.0	2.0	13.0	2.4
Hungary	4.02	4.3	3.0	10.5	3.3
Latvia	4.07	5.0	2.6	5.8	4.8
Lithuania	12.05	3.4	2.0	6.1	3.2
Poland	13.58	3.4	2.9	5.3	4.8
Romania	12.30	2.6	2.7	3.2	8.2
Slovakia	7.39	6.0	4.8	13.1	4.2
Slovenia	3.38	8.5	8.4	3.3	Full

Figure 1a. Hypothesized relationships between explicit deposit insurance coverage (EC) and risk-taking (RT) and the impact of institutional and banks' ownership variables.

This figure shows the relationship between market discipline as measured by Risk-taking (RT) and Explicit Deposit Insurance Coverage (EC). The line Explicit is drawn at a constant degree of credibility of non-insurance (CNI). The line Implicit is drawn at a constant level risk taking caused by explicit deposit insurance coverage. The two lines are added vertically.

The line Implicit  $\times$  Institution shows how the curve Implicit shifts as a result of institutions (and bank ownerships and financial supervisions) enhancing the CNI. The top dotted line is the vertical sum of Explicit and Implicit. The lower dotted line is the vertical sum of Explicit and Implicit  $\times$  Institution

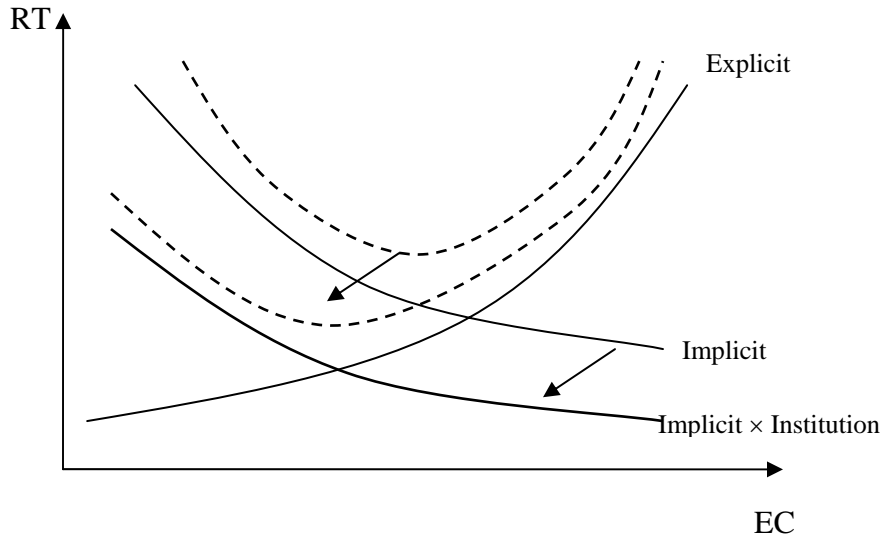


Figure 1b the U-shape relationship and the impact of bank corporate governance

Good quality of corporate governance implies that shareholders' objectives have a large weight in managers' incentives.

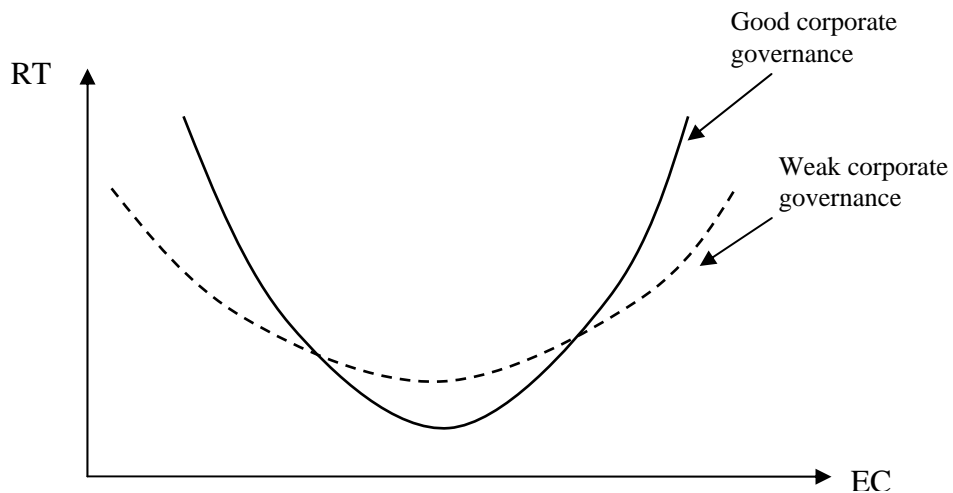
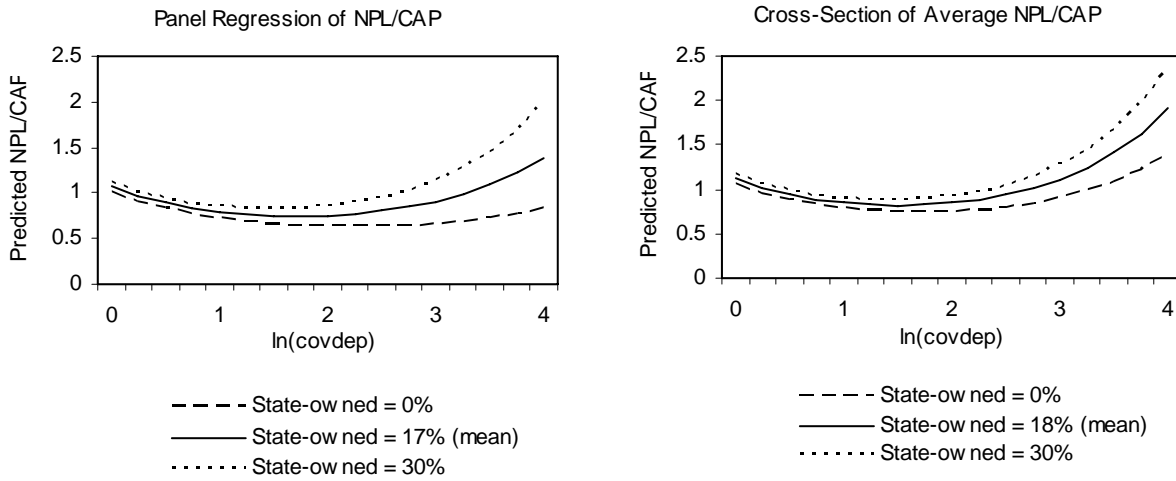


Figure 2 Risk-taking at different levels of deposit insurance coverage and corporate governance in emerging markets

Figures below plot the predicted values of NPL/CAP at different levels of coverage limit of deposit per capita. The predicted values are calculated by varying the levels of government ownership and shareholder rights and using the mean values of other independent variables. The figures are based on results in Table 4.b.

2a. State Ownership



2b. Shareholder Rights

