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Deposit Insurance Coverage, Ownership, and Banks' Risk-Taking
in Emerging Markets

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Abstract:
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 the extent 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 shareholder rights affect the disciplinary effect of partial deposit insurance systems in a cross-section analysis of industrial and emerging market economies, as well as in emerging markets alone. The coverage that maximizes market discipline depends on country-specific characteristics of bank governance. This "risk-minimizing" deposit insurance coverage is compared to the actual coverage in a group of countries in emerging markets in Eastern Europe and Asia.

1. Introduction

Deposit insurance is generally considered an important part of the regulatory structure for the banking system. This structure should protect the "safety and soundness" of the banking system while providing banks with the appropriate rules and incentives to allocate credit and liquidity efficiently. An important role of deposit insurance within the regulatory structure is to 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 fail and must be shut down (Diamond and Dybvig, 1983).

The flip side of the role of deposit insurance as a safeguard against bank runs, as well 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 their banks. 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 equity capital is low. Thus, deposit insurance systems can contribute to the very problem (systemic bank failure) they are designed to reduce.[1]

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

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total assets has declined worldwide from a level of 20-30 percent in the 20s, close to that in non-financial firms, to a level 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.

Additional evidence of excess risk-taking is the frequency of banking crises around the world as documented by Caprio et al. (2005). 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 important aspects of ownership of banks separately and interactively affect market discipline and its impact on banks' risk-taking incentives. We argued in Angkinand and Wihlborg (2006) that banks' incentives to shift risk are likely to be minimized by a deposit insurance system offering partial coverage because market discipline is likely to be weak at high as well as low levels of deposit insurance coverage. The weak discipline at low levels is caused by high likelihood that governments find themselves compelled to issue blanket guarantees to creditors of distressed banks, or to bail them out. Risk-shifting and risk-taking incentives are likely to be influenced by bank managers' objectives relative to shareholders' as well. The empirical analysis in this paper focuses on the interaction between depositor protection and aspects of bank ownership. Specifically, we ask whether the coverage of explicit deposit insurance systems that minimizes risk-taking depends on state and foreign ownership of banks, and on shareholder and creditor protection.

Emerging market economies are emphasized in the empirical analysis since the variety of ownership structures is particularly great in these countries. Furthermore, banks tend to dominate

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[1] See, for example, Bhattacharya, et al. (1993)

the financial systems in most of these countries, and many of them have recently liberalized and privatized domestic banking systems.

In Section 2 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 risk-taking and deposit insurance coverage in Section 3. The impact of bank governance on risk-taking is discussed, and the hypothesis for the empirical work is presented. Proxies for risk-taking, deposit insurance coverage, and governance are explained in Section 4 where the empirical methodology is also laid out. Empirical relationships between risk-taking proxies, deposit insurance coverage, ownership and other governance factors are presented in Section 5. Implications for deposit insurance coverage in emerging markets are drawn in Section 6. Section 7 offers a brief summary and concluding remarks.

2. Evidence on deposit insurance, ownership, and banks' risk-taking

Banks' incentives to shift risk to guarantors of their creditors 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 banking crises.

One solution to the moral hazard problem caused by creditor protection 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.

A number of empirical studies using different proxies for risk-taking address the question of whether the existence and coverage of explicit deposit insurance schemes reduce market discipline and encourage banks to take excessive risks. Most studies focus on explicit coverage but in some studies implicit insurance is captured by proxies for institutional characteristics.

In cross country analyses Hutchison and McDill (1999), Demirgüç-Kunt and Detragiache (2002), and Barth et al. (2004) find that explicit deposit insurance increases moral hazard incentives and results in increasing financial fragility and, as a result, in increasing likelihood of banking crises. Demirgüç-Kunt and Detragiache construct a variable that captures different degrees of deposit insurance coverage. They find that greater coverage significantly increases the likelihood of crises but this effect is reduced significantly in countries with high levels of supervisory and legal system quality.[2] Barth et al. (2004) support this view with respect to rule of law but not with respect to prudential regulation and supervision.[3]

Eichengreen and Arteta (2002), Hoggarth et al. (2005), and Angkinand et al. (2007) find that the relationship between banking crisis and deposit insurance coverage is sensitive to model specification. Eichengreen and Arteta find that explicit deposit insurance schemes reduce the likelihood of banking crises in developing countries. Hoggarth et al. using a smaller sample and shorter period do not find a significant 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 crises. Angkinand et al. (2007) find that the impact of explicit deposit insurance is sensitive to different definitions and proxies of banking crises.

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[2] 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.

[3] Barth et al. employ a new database on bank regulation and supervision described in Barth et al. (2004, 2006).

The influence of deposit insurance on banks' risk-taking incentives has also been analyzed on the bank level. Gropp and Vesala (2004) and Nier and Baumann (2006) use provisions for non-performing loans and the standard deviation of equity returns as proxies for banks' risk exposure. The former study presents evidence that implicit protection of banks' creditors is relatively high in countries with low explicit protection and that high explicit coverage is associated with relatively low risk-taking in European banks. Nier and Baumann analyze the impact of market discipline 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. Market discipline is measured by the extent of depositor 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 equity capital while the likelihood of government support reduces market discipline both directly and through the effect on desired capital.

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. Explicit coverage, as well as other characteristics of deposit insurance systems, seems to contribute to the "fair insurance premium".

The evidence with respect to implicit protection of banks' creditors indicates that institutional characteristics affect the credibility of deposit insurance systems. In this paper we

are particularly interested in institutions that influence bank managers' and shareholders' incentives in response to implicit and explicit depositor protection. Thereby, we enter the area of corporate governance in the banking.

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 maximize shareholders' wealth while the incentives to serve the interests of other stakeholders are provided by market forces, law, and regulation. Empirical evidence in Saunders et al. (1990) indicates that banks, wherein managers have large stakes (i.e. own stocks), are more willing to take risk.

Several studies have found that state ownership of banks lead to inefficiency and poor performance (e.g. La Porta et al., 2002). One reason is that management in these state-owned banks sometimes comes under pressure to serve particular political interests. In cross country analyses, 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 the period 1980-1995. Barth et al. (2004) find that state-owned banks increase the ratio of non-performing loans to total loans, but do not find a significant impact of state ownership on banking crises, bank development and performance as measured by net interest margins and overhead costs. Using bank level data, Berger et al. (2005) and Iannotta et al. (2007) find that state-ownership of banks is associated with relatively high risk taking as measured by the ratio of non-performing loans to total loans, the standard deviation of bank's asset returns, and Z-scores.

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. Many studies using cross-country data compare the performance of foreign banks with domestic banks and find that foreign banks operating in

developing nations are more efficient and competitive than domestic banks (e.g. Claessens et al. 2001). According to Lensink and Hermes (2004) the entry of foreign banks improves the performance of domestic banks although costs increase as well. Lensink and Naaborg, (forthcoming) 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. For the effect of foreign ownership on banks' risk taking, Demirgüç-Kunt et al. (1998) find that the presence of foreign banks is associated with lower financial fragility. On the other hand, 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.

These studies of foreign ownership of banks support the argument that 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 risks. For instance, Leye Yeyati and Micco (2007) find that foreign banks are associated with higher risks, measured by the Z-score, than domestic banks in a sample of Latin American banks.

Barth et al. (2006) and Caprio et al. (2007) 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.

3. Credibility of non-insurance, bank governance and market discipline in banking

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 in times of banking distress or crises, governments and regulators will respond by issuing blanket guarantees to all uninsured creditors and depositors of banks or by bailing them out in other ways. Thus, the non-insurance of depositors and other creditors is not credible.

There are several reasons why an absence of guarantees of all creditors is not credible in banking. First, a banking crisis tends 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. What is an appropriate level of deposit insurance coverage? As indicated by the studies reviewed, the answer depends on a number of institutional factors that influence the credibility of non-insurance.

Our hypotheses are based on the proposition that the degree of implicit protection of banksä creditors depends on the level of explicit deposit insurance coverage. The credibility of non-insurance falls as explicit coverage declines and, therefore, there is a level of partial depositor protection that minimizes risk-shifting incentives (Angkinand and Wihlborg, 2006). In this paper, we also argue that the risk-minimizing deposit insurance coverage level is affected by governance characteristics of the banking system.

Figure 1 describes the relationship between explicit deposit insurance coverage (EC) on the horizontal axis and risk-taking (RT) in the banking system on the vertical axis. We interpret risk-taking (RT) as the probability of a bank's capital buffer being exhausted within a certain timeframe. If risk-taking depends on the degree of protection of depositors, market discipline is insufficient to prevent bank managers from shifting risk to a deposit insurance fund or the tax payers. In other words, market discipline imposed by banks' creditors declines, and moral hazard incentives become stronger along the vertical axis.

We distinguish between excessive risk-taking caused by explicit deposit insurance (RT_{Expl}) and excessive risk-taking caused by lack of credibility of non-insurance (RT_{Impl}). In Figure 1, the expectation that $\delta RT_{Expl} / \delta EC > 0$ 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. Other characteristics of the deposit insurance system and other factors affecting incentives to take risk are also held constant along the line. These factors include institutional and macroeconomic factors.

Lack of credibility of non-insurance 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 ($\delta RT_{Impl} / \delta EC < 0$).

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. This relationship indicates that risk-taking is minimized at a positive and partial insurance coverage level where market discipline is at its strongest.

The U-shaped curve in Figure 1 is not a mathematical necessity. Intuitively, along the line "Explicit", there are "diminishing returns" in terms of market discipline effects on risk-taking when explicit coverage is reduced from full coverage. Similarly, there are diminishing returns in terms of market discipline effects on risk-taking when implicit coverage is reduced as we go to the right in the figure. Thus, a relatively small group of (credibly) uninsured creditors can contribute substantially to market discipline.

[Insert Figure 1 here]

The hypothesis that there is a U-shaped relationship between explicit coverage and risk-taking is, as noted, not general since institutional characteristics of countries could affect the shape of the relationships. Assume for example, that the explicit deposit insurance system has low credibility. If so, the line "Explicit" becomes flatter. Furthermore, the implicit protection would depend less strongly on the explicit coverage. Therefore, the line "Implicit" would become flatter as well. The sum of the two lines may be flat, upward sloping or downward sloping depending on the position and shape of the relationships. The credibility of the explicit system is, therefore, an important assumption. In countries with particularly weak political and legal institutions, this credibility cannot be taken for granted.

If institutional characteristics of a country contribute to credibility of non-insurance the line "Implicit" would shift down and flatten out. Such a shift is shown in Figure 1 by the line

"Implicit × Institution". In Angkinand and Wihlborg (2006) the hypothesis that credibility of non-insurance is enhanced by Powers and Procedures for Prompt Corrective Action, Rule of Law, (Lack of) Corruption, and Powers of Supervisors was tested. The results indicated that credibility of non-insurance can be enhanced by these institutional factors but the effects seemed to be weak.

Risk taking and bank governance.

We turn now to bank governance. The question asked is how the 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's 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. However, in the case of banks this market discipline is weak at very low or high levels of explicit deposit insurance coverage as described in Figure 1. Therefore, the conflict of interest between shareholders and creditors caused by limited liability can manifest itself as incentives for risk-shifting and excessive risk-taking at these low and high levels of coverage. These incentives are particularly strong if equity capital is low. The excess risk-taking implies a wealth transfer from creditors (or insurers of creditors) to shareholders.

The conflict of interest between shareholders and creditors of banks and the problem of excessive risk-taking depend on the governance structure of banks. High quality of bank governance implies that shareholders' objectives have a large weight in managers' incentives. Managers' interest, on the other hand, can be assumed to be more oriented towards their own reputation and job security. It is safe to assume that there is a degree of stigma to being the manager of a failed bank. Therefore, managers can be expected to be less willing to take risk if

their own interests weigh stronger than shareholders'. In Figure 1, shareholders prefer relatively high risk-taking at low and high levels of EC. Thus, we expect greater quality of governance from the point of view of shareholders to induce relatively more risk-taking at low and high levels of EC. At an intermediate level of EC, shareholders' incentives to take risk are relatively weak as a result of market discipline exerted by creditors. Thus, higher quality of governance has relatively little effect on risk-taking in an intermediate range of EC. In this range, where market discipline on risk-taking is strong, shareholders might actually prefer less risk-taking than managers. Overall, higher quality of bank governance from a shareholder perspective is expected to lead to a more pronounced U-shape for the relationship between risk-taking and explicit deposit insurance coverage (Figure 2).

[Insert Figure 2 here]

Hypothesis with respect to quality of bank governance: *The relationship between explicit deposit insurance coverage and risk-taking is described by a flatter U-shaped 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 remain unchanged or even 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 ownership variables, and shareholder and creditor rights. The ownership variables are the shares of state and foreign ownerships in the banking system.

We expect that the U-shaped relationship will be more pronounced for countries with relatively low shares of state-owned banks, high shares of foreign owned banks, strong shareholder rights and strong creditor rights. These governance characteristics are expected to be reflected in higher quality of bank governance. In state-owned banks, bureaucrat managers are likely to have incentives that are not aligned with shareholders' wealth maximization. Managers' goals and credit allocation policies might be dictated by political objectives making them less sensitive to market signals.

Foreign-owned banks are expected to have superior information and risk management technologies, as well as greater transparency in emerging market economies. Therefore, market discipline is expected to be relatively effective for foreign-owned banks. Foreign ownership is expected to affect the governance of banks in emerging markets and developing countries in particular.

Legally imposed and enforced shareholder rights are expected to improve the governance structures of banks from a shareholder perspective. For creditor rights we do not expect an obvious relation with quality of governance. However, creditor rights lower the costs of enforcing loan contracts. Therefore, we expect strong creditor rights to reduce the risk banks are exposed to at any level of deposit insurance coverage.

Ownership can affect risk-taking through other channels than quality of governance. In particular, state ownership is expected to be associated with a relatively high level of implicit protection, regardless of existing explicit coverage. If so, the Implicit curve in Figure 1 becomes flatter with increasing state ownership and the risk-minimizing explicit coverage becomes higher.

The impact of foreign ownership on risk-taking, on the other hand, would depend on governance characteristics in the home country as well as in the host country. Although we

expect that an acquiring bank has superior governance relative to a target bank, foreign acquisitions can be associated with a variety of expansion strategies. For this reason, foreign ownership can affect risk-taking in other ways than improvement of governance. We return to this issue when results are discussed in Section 5.

4. Variable definitions and model specification

We examine the impact of explicit deposit insurance coverage and banks' governance structures on banks' risk-taking in a cross-section time-series, as well as cross-section analysis using country-level data. One advantage of country level data is that we can get better information about non-performing loans through the IMF's Financial Stability Reports relative to data available on the bank level. The IMF data reflects information the IMF has gathered in addition to the data published by banks themselves.

The number of countries in our sample is limited by the availability of data on banking systems from the IMF's Financial Stability reports and by data on shareholder rights in particular. Starting out with data for more than 100 countries, of which 41 are emerging markets, the sample is reduced to 52 countries: 14 industrial, 32 emerging market, and 6 developing countries. We test the hypothesis described above for two groups of countries. One consists of all countries in our data set, and the other group is emerging market countries alone. The list of emerging market economies in the sample is shown in Table 1.

We use three proxies for 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 (STDNPL/CAP), and a Z-score as a proxy for "distance to default". There is no specific proxy for excessive risk-taking. Evidence of excess risk-taking caused by weak market discipline is that risk-taking depends on the deposit insurance coverage and possibly other variables affecting implicit protection of banks' creditors.

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Much of the literature reviewed above used an occurrence of banking crisis as evidence of high risk-taking. One reason not to use this proxy to test the specific hypotheses here is that a banking crisis in a country with low explicit coverage could be the result of bank runs rather than low credibility of non-insurance. Furthermore, this proxy requires data for a long time period while our data for governance characteristics cover relatively few years.

There are pros and cons with each of the proxies for risk-taking employed here. If we perceive risk-taking as choosing a certain probability of default (distance to default), the Z-score is conceptually an appropriate proxy.[4] It incorporates a measure of asset side risk, as well as the equity capital buffer. However, since we use accounting data to construct Z-scores the return on assets and the equity ratio incorporates only provisions for credit losses as opposed to full losses. Non-performing loans, on the other hand, is a proxy for total credit losses, and changes in this variable tend to dominate as the direct cause of banking crises. Another drawback of the Z-score is that it includes the return or loss on all activities of a financial firm while non-performing loans specifically refer to traditional banking activities. These activities are presumably those that enjoy the benefits of deposit insurance.[5]

Choosing a certain level of expected non-performing loans relative to capital can be seen to be the most important part of choosing a probability of default. However, the probability of default associated with a certain level of expected non-performing loans depends on their standard deviation as well. We do not have a risk-measure that includes both the expected level of non-performing loans and their standard deviation. Therefore, we use both non-performing

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[4] The Z-score is defined as (the Average Return on Assets (ROA)/standard deviation of ROA) + (the Equity to Assets ratio/standard deviation of ROA). We calculate Z-scores using annual data for from the IMF's Financial Stability Reports. See Boyd and Graham (1988) and Goyeau and Tarazi (1992). Since the Z-score requires several years of data to construct one observation, we cannot obtain a time series of this variable for each country.

[5] We do not use a "fair insurance premium" suggested by Hovakimian et al (2003) for several reasons. Its validity in cross-country analysis depends on strong assumptions with respect to the allocation of losses and bankruptcy costs for distressed bank.

loans relative to capital (NPL/CAP) and their standard deviation relative to capital (STDNPL/CAP) as separate dependent variables reflecting the two aspects of risk-taking.

The ratio of non-performing loans to total loans (NPL), the ratio of equity capital to total assets (CAP/TA), and the return on assets (ROA) are obtained from the IMF's Financial Stability reports wherein the IMF has published these banking data on the country level since 1997.[6] Since the IMF data for non-performing loans are measured relative to total loans, while equity is measured relative to capital, we have to 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 deviations of NPL and ROA (to estimate the Z-score) are calculated using the annual data for the whole sample period. Therefore, regressions with STDNPL/CAP and Z-score as dependent variables can only be estimated in cross-section. Regressions with NPL/CAP as proxy for risk-taking are estimated in cross-section, as well as in a cross-section time-series model.

To analyze the impact of deposit insurance coverage and governance variables on proxies for risk taking, we control for a number of macroeconomic variables that may contribute to risk taking and thereby to loan losses. The model specification is as follows in cross-section while time subscripts are added in the cross-section time-series model:[7]

$$Risk_i = \alpha + \beta_1 EC_i + \beta_2 (EC_i)^2 + \gamma_j Governance_{j,i} + \delta_j (EC_i^2 \times Governance_{j,i}) + \theta_k Macro_{k,i} + \varepsilon_i$$

Risk stands for one of the three proxies for risk-taking. *EC* is the explicit deposit insurance coverage, which is entered in the quadratic functional form. Our hypothesis of a U-shaped relationship between risk-taking and the degree of explicit protection is supported if the estimated coefficient for the squared term (β_2) is positive and significant, and if the estimated

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[6] The NPL data and bank capital data in the IMF's Financial Stability reports are based on "National authorities and IMF staff estimates".

[7] The empirical formulation for the cross-section time-series model is similar to the formulations in, for example, Demirguc-Kunt and Detragiache (2002) and Barth et al (2004). To test for our specific hypotheses we have added

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coefficient for the linear term (β_1) is negative and significant. *Governance$_j$* stands for the different proxies for ownership and the quality of bank governance, which are obtained from various sources (discussed below). *Governance* also includes a measure of general institutional quality and the banking system's capital ratio (CAP/TA) of each country. In order to test the hypotheses discussed above, governance variables are allowed to interact with the coverage of explicit deposit insurance variable. *Macro$_k$* refers to a set of economic control variables, including the real GDP growth rate, the ratio of money supply to international reserves, the inflation rate, and the real interest rate.[8]

The cross-section regression is estimated using the Ordinary Least Squares (OLS), while the random effects model is used in the cross-section time-series regression.[9] Several country variables have little time variation; therefore, country fixed effects cannot be identified. We also use the robust and clustering standard errors to correct for the covariance matrix for estimates of heteroskedasticity and allow any type of correlation among the observations across time within each country.

In the cross-section time-series model, the proxy for EC as well as all independent variables are lagged one period in order to reduce a potential simultaneity problem caused by political decisions to adopt explicit deposit insurance schemes or to alter the coverage limits in response to credit losses. In the cross-section regressions, each independent variable with the exception of the capital ratio (CAP/TA) is an average value for the whole sample period. There is some variation across countries in the number of years included in the sample as a result of differences in availability. CAP/TA in cross-section regressions is represented by its initial value

the quadratic term for deposit insurance coverage and the interaction between this quadratic term and governance variables.
[8] 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.
[9] The Haussman test suggests the use of the random effects over fixed effects models.

for the sample period. Thereby, the possibility that CAP/TA depends on risk-taking rather than vice versa is minimized.

We turn next to a description of variables for explicit deposit insurance coverage (EC) and governance variables. Data for these variables for emerging markets in Central & Eastern Europe and Asia are presented in Table 1.

[Insert Table 1 here]

Deposit insurance data are taken from *the Database of Deposit Insurance around the World* published by Demirgüç-Kunt et al. (2005), at the World Bank. In Table 1, "coverage limit" is the maximum coverage per deposit account within each deposit insurance system. The ratio between this coverage limit and the average deposit size per capita is denoted covdep. The natural logarithm of (1+covdep) denoted lncovdep, represents our proxy for EC.[10] The ln form is used because there is relatively small number of countries with very high covdep ratios. The countries with full deposit insurance coverage are given the value 4 for lncovdep.[11]

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 the 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 in our sample.

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

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[10] Angkinand and Wihlborg (2006) used four different specifications of EC. Results were not sensitive to the choice of specification.
[11] 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 are not included.

governments or foreign banks. The ownership data comes from the World Bank *Database of Bank Regulation and Supervision* (See Barth et al., 2004 and 2006).

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 variables and the shareholder rights variable used here is high and the choice among them does not have much impact on the results. We use only shareholder rights, since data for this variable exists for the largest number of countries.

The capital to total asset ratio (CAP/TA) can also be considered a governance variable. This variable is included because the risk-taking incentives of shareholders are reduced with increased equity financing assuming that CAP/TA can be considered exogenous to some extent. The existence of capital requirements implies that there is an exogenous component to this variable. The moral hazard incentives are expected to increase when equity capital approaches zero.

The extent to which capital requirements are binding would depend on the quality of supervision of banks. There exist proxies for effectiveness of supervision as well. Barth et al. (2006) has developed an index for the power of supervisors to influence banks behavior. We included this index in the empirical analysis, but since its level of significance was consistently low it is not included in the results presented below.

Descriptions and sources 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.

[Insert Table 2 here]

5. Empirical results

Tables 3-4 show results for regressions without interactive variables, while Tables 5-6 includes interactions. Tables 3 and 5 present the results for All Countries, while Tables 4 and 6 refer to Emerging Markets. The three different proxies for banks' risk-taking are listed as column heads. The first NPL/CAP column (first two in Tables 3 and 4) shows results of the panel analysis. The other three columns are the results of cross section analyses for the three risk proxies NPL/CAP, STDNPL/CAP and the Z-score. In all tables, coefficients marked with an asterisk are significant on at least the 10 percent level. 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 explicit deposit insurance coverage and risk-taking, we can observe in Tables 3 and 4 that the sign for the deposit insurance coverage (lncovdep) 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. Turning to the Z-score we expect the opposite signs for both terms since this variable measures "distance to default". The results for All Countries are as expected (column 5, Table 3), while for Emerging Markets the sign for the linear term is contrary to the hypothesis but not significant at all (column 5, Table 4). Taken together, the evidence favors the existence of a quadratic relationship between explicit depositor protection and risk-taking.

In both Tables 3 and 4, the sign for CAP/TA is negative in the first four columns as expected under conditions of potential moral hazard. The coefficients for CAP/TA are not significant in the Z-score regressions.

State ownership seems to be associated with relatively high values of NPL/CAP, but the Z-score does not seem to be affected by state ownership in Tables 3 and 4. On the other hand, foreign ownership is significant in the Z-score regression for All Countries (column 5, Table 3), but not in the NPL/CAP regressions. Contrary to expectations, the sign for foreign ownership in the Z-score regressions in both Tables 3 and 4 is negative indicating higher risk-taking in banking systems with more foreign ownership. We have reservations with respect to this result since Z-scores do not include NPLs.

Increasing shareholder rights seems to reduce risk-taking and the coefficients are significant in both Tables 3 and 4 when NPL/CAP is the dependent variable. Creditor rights seem irrelevant for risk-taking in these tables. This variable is excluded in the remainder of the analysis.

[Insert Tables 3 and 4 here]

In Tables 5 and 6 interaction terms are included in order to test the hypothesis with respect to the interaction between governance quality and deposit insurance coverage. Interactions with CAP/TA were also included but since these interactions were not significant in any regression we excluded these interactions in the regressions presented here.

The results with respect to the non-interactive terms is similar to the results in Tables 3 and 4 but the impact of some governance variables seem to shift from the stand-alone variable to the interaction term. The significantly negative sign for shareholder rights is robust and its interaction term is significant (or weakly significant) in the NPL/CAP regressions both for All

Countries and for Emerging Markets. The significance of state ownership and lncovdep squared in the panel regressions of NPL/CAP, however, is shifted to the interaction term.

There is one substantial difference in results for Emerging Markets in Table 6 relative to Table 4: foreign ownership and its interaction with lncovdep squared become significant in the Z-score regressions. They also become near-significant in the cross-section NPL/CAP regression for All Countries in Table 5 relative to Table 3. The signs are consistent indicating greater risk-taking with foreign ownership, as well as flatter curvature. These results are contrary to the hypothesis based on a link between foreign ownership and quality of bank governance.

[Insert Tables 5 and 6 here]

The presence of interaction terms with the squared lncovdep makes interpretations of results relative to hypotheses less obvious. The interaction terms modify the shape of the relationship between deposit insurance coverage and risk-taking depending on country specific values for ownership and shareholder rights variables. Therefore we draw figures to better understand how the expected U-shaped relationship is modified by the interactions.

The illustrations in figures focus on Emerging Markets. Figure 3 shows how state ownership and shareholder rights affect the quadratic relationship in these countries based on the panel and cross-section analyses of NPL/CAP. The interaction terms of these two variables are significant or weakly significant in the NPL/CAP regressions in Table 6. In Figure 4, the impact of foreign ownership is presented based on the Z-score regression, since foreign ownership has a significant effect only in the Z-score regression.

In both Figures 3 and 4, the fully drawn line shows the relationship between a proxy for risk taking and deposit insurance coverage based on the mean values of all other variables. The relationships for NPL/CAP regressions shown in Figure 3 are U-shaped, suggesting that there is a partial or intermediate deposit insurance coverage level that minimizes risk-taking incentives.

Note that the Z-score measures the distance to default and the hypothesis with respect to Z-scores is an inverted U-shape. For Emerging Markets the curve is downward sloping indicating that risk-taking as measured by Z-scores increases with explicit deposit insurance coverage (Figure 4). Thus, the implicit protection of depositors may be weaker in these countries. The higher level of risk-taking as measured by NPL/CAP at full coverage relative to at no coverage in Figure 3 is consistent with this interpretation.

The dotted lines take into account the impact of ownership and governance variables on the relationship between explicit coverage and risk-taking. The dotted lines show the relationships for relatively high levels of the different variables while the dashed lines shows the relationships at relatively low values for the variables.

For the impact of state ownership, the figures in Panel 3a shows that a higher (lower) share of state-ownership in a national banking system is associated with higher (lower) NPL/CAP at any level of deposit insurance coverage. The curvature is not consistent with our hypothesis, however, since we expected that a low level of state ownership should make bank managers more sensitive to incentive effects of explicit and implicit insurance.

Panel 3b shows the effect of strong and weak shareholder rights on the U-shaped relationship. Strong shareholder rights are generally associated with lower risk-taking and the curvature is more pronounced for strong shareholder rights as suggested by our hypothesis. However, in the cross-section regression for NPL/CAP stronger shareholder rights shift the relationship from downward sloping for weak rights to upward sloping for strong rights. Thus, it seems that incentive effects of explicit coverage are relatively strong with strong shareholder rights while the incentive effects of implicit depositor protection are strong in Emerging Market countries with weak shareholder rights. One can speculate that in countries where managers are relatively powerful relative to shareholders, the same managers have strong links to or influence

on governments offering strong implicit protection. Thus, non-insurance is not credible in this group of countries.

[Insert Figure 3 here]

In Figure 4 we present the effects of foreign ownership on the relationship between explicit depositor protection and the Z-score for All Countries and for Emerging Markets. As noted, the expected inverted U-shape is supported for All Countries but not for Emerging Markets. The main result that both country groups in Figure 4 have in common is that foreign ownership reduces the Z-scores (increased risk-taking) in countries with low explicit coverage. In emerging markets it seems that increased foreign ownership reduces risk-taking at high levels of explicit coverage.

[Insert Figure 4 here]

Risk-taking can be analyzed further in Table 7 where the results refer to regressions wherein the dependent variables capture either asset side risk (NPL and STDROA) or liability side risk (CAP/TA). The latter variable represents the capital banks hold as buffers against asset side risk. These regressions can tell us whether the results discussed above are explained by adjustment of assets side risk or the capital ration in response to differences in depositor protection. For example, the coefficients for foreign ownership standing alone and interacting in Table 7, Panel b, for Emerging Market indicate that the above results for the impact of foreign ownership on the Z-score are explained primarily by the impact of foreign ownership on the capital ratio, CAP/TA. This ratio is lower in banking systems with a high share of foreign ownership but the interactive term shows that the foreign ownership is associated with a relatively higher capital ratio in countries with high explicit deposit insurance coverage (Column 4).

The lower CAP/TA in countries with high foreign ownership is consistent with results in Leye Yeyati and Micco (2007). One interpretation of this result is that foreign banks are implicitly supported by capital in the home country banks. If so, the interactive term indicates that this support is lesser in countries with high depositor protection. Are foreign banks unwilling to commit capital in countries with little explicit deposit insurance coverage? A positive answer to this question is consistent with the results but further studies of the interaction between home country and host country capital is required to provide a confident answer.

Another observation that follows from the results in Table 7, Panel a, for All Countries is that the above mentioned U-shaped relationship between NPL/CAP and deposit insurance coverage is explained by an inverse U-shaped relationship between CAP/TA and deposit insurance coverage. The coefficients in CAP/TA regressions in Table 7 for lncovdep and lncovdep squared are significant or, in one case, near significant. Thus, high explicit coverage as well as low explicit coverage induces risk-taking through relatively low capital ratios.

[Insert Table 7 here]

6. Risk minimizing deposit insurance coverage in Emerging Markets

In order to see how the risk minimizing explicit deposit insurance coverage depends on country specific factors we turn to Table 8. Here we use regression results to calculate 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 some relations are not statistically significant in the previous tables.

In Table 8 the first column after the country names shows the actual ratio for deposit insurance coverage relative to the average deposit size (covdep) in each country in 2003. The

next four columns show the ratio that would minimize risk-taking according to the results in the different regressions for emerging markets in Table 6. The results in the two NPL/CAP columns are fairly consistent in terms of ranking of the different countries (columns 2-3). The covdep that would minimize the standard deviation of NPL/CAP looks very different, however (column 4). Each proxy for risk-taking is imperfect for reasons discussed above. If we consider the panel analysis of NPL/CAP as the one providing the most reliable estimates of coefficients, we can compare the covdep value that minimize risk-taking according to this regression with the actual covdep value 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 column 5, Table 8, the Z-score regression, where foreign ownership has a significant effect, leads to the conclusion that emerging market countries with a large share of foreign ownership should offer comprehensive coverage. For emerging market countries in Europe, the share of foreign ownership ranges from 65% in Latvia to 98.9% in Estonia, and the Z-score regression suggests that the risk-minimizing coverage for these countries could be full. In accordance with the discussion above these results can be interpreted to mean that foreign banks commit relatively more capital in countries with high explicit deposit insurance coverage.

The overall results also show that South Korea, the Czech Republic, Estonia, Hungary, Latvia and Slovakia seem to offer deposit insurance coverage close to the risk-minimizing one.

[Insert Table 8 here]

7. Concluding Remarks

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. Each proxy has its weaknesses relative to a theoretically appropriate measure of risk-taking. Data constraints implies that in cross-section analysis of emerging markets, the number of countries is limited to 32. Although the proxies for risk-taking are appropriate for analysis on the level of individual banks, we focus on the country level for two reasons. First, the governance and deposit insurance characteristics are country specific and, second, data for non-performing loans on the bank level are generally unreliable and inconsistent across countries, while our country level data is based on estimates by the IMF.

The results suggest that the relationship between banks' risk taking and explicit deposit insurance coverage can be described as U-shaped as hypothesized. This result is fairly robust although it does not hold for the Z-score. It holds for the capital ratio component of the Z-score score, as well as for the ratio of nonperforming loans relative to capital and the standard deviation of non-performing loams relative to capital.

The analysis of the impact of state and foreign ownership on the U-shaped relationship indicates that these ownership variables affect risk-taking but not primarily through effects on the quality of governance in the sense that bank managers maximize shareholder wealth. A large share of state ownership in the banking system is associated with greater risk-taking as measured by non-performing loans relative to capital. This effect seems to be associated with high explicit depositor protection, in particular. Foreign ownership is not associated with risk-taking as measured by non-performing loans relative to capital but with higher risk-taking as measured by Z-scores and the capital ratio alone. However, in countries with high explicit deposit insurance coverage this effect of foreign ownership is nullified or even reversed. One interpretation of this

result is that foreign banks prefer to commit capital in countries with high explicit deposit insurance coverage.

The results with respect shareholder rights indicate that countries with stronger rights have a lower level of non-performing loans relative to capital. This effect is particularly strong in countries with low explicit depositor protection and presumably relatively high risk shifting incentives caused by high implicit protection.

The hypothesis of a more pronounced U-shaped relationship between explicit deposit insurance coverage and risk-taking in countries with higher quality of governance was partially supported by the results for shareholder rights and state ownership.

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. The general policy implication of our analysis is that banks' risk-taking is minimized at an intermediate level of deposit insurance coverage. Increasing shareholder rights allow countries to reduce the deposit insurance coverage, while the coverage should be relatively high in countries with substantial foreign ownership of banks.

Further research is required to draw firm conclusions about the impact of governance structures on risk-taking and market discipline in different deposit insurance systems. Specifically, bank-specific governance characteristics should be introduced since the variation across banks is likely to be substantial. Other avenues that should be explored are alternative measures for market discipline in corporate behavior as well as in market prices.

Variable	Description	Source
NPL	Bank nonperforming loans to total loans	Financial Stability reports, IMF
CAP/TA	Bank capital to total assets	Financial Stability reports, IMF
NPL/CAP	Bank nonperforming loans to total loans divided by bank capital to assets	Authors' calculation based on the data from Financial Stability reports, IMF
STDNPL/CAP	The standard deviation of bank nonperforming loans to total loans divided by the average value of bank capital to assets	Authors' calculation based on the data from Financial Stability reports, IMF
Z-Score	The average return on assets (ROA) plus equity-asset ratio, divided by the standard deviation of ROA	Authors' calculation based on the data from Financial Stability reports, IMF
STDROA	The standard deviation of the return on assets	Authors' calculation based on the data from Financial Stability reports, IMF
Real GDP/Cap	The natural log value real GDP per capita (constant 2000 US$)	World Development Indicator (WDI)
Real GDP Growth	Real GDP growth rate (annual %)	WDI
M2 to Reserves	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
lncovdep	The natural log value of (1+ covdep), where covdep is the ratio of the maximum deposit insurance coverage limit per deposit per capita.	Authors' calculation based on the data from Demirgüç-Kunt et al. (2005)
State 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 (Barth et al., 2004 & 2006)
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 (Barth et al., 2004 & 2006)
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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Figure 1 Hypothesized relationships between explicit deposit insurance coverage (EC) and risk-taking (RT) and the impact of institutional and banks' ownership variables.
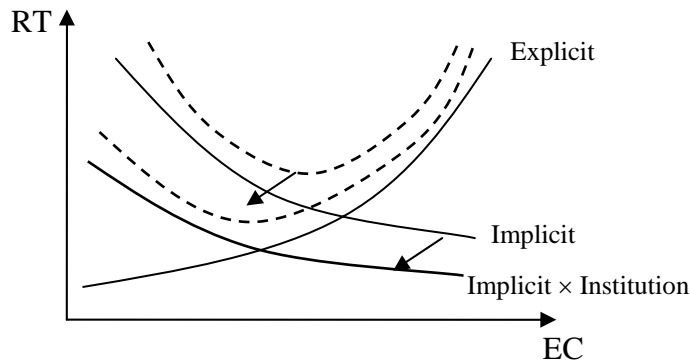
This figure shows the relationship between bank's excessive risk-taking (RT) and explicit deposit insurance coverage (EC). The line "Explicit" is drawn at a constant degree of credibility of non-insurance; an upward slope reflects the moral hazard incentives become stronger at high levels of EC. The line "Implicit" is drawn at a constant level of risk taking caused by explicit deposit insurance coverage; a negative slope shows how RT caused by implicit insurance decline with increasing EC as a result of credibility of non-insurance (CNI). The two lines are added vertically. The total effect of EC on risk taking is shown as a U-shaped curve.

The line Implicit × Institution shows how the curve Implicit shifts as a result of better quality 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 × Institution.

Figure 2 The U-shape relationship and the impact of bank governance
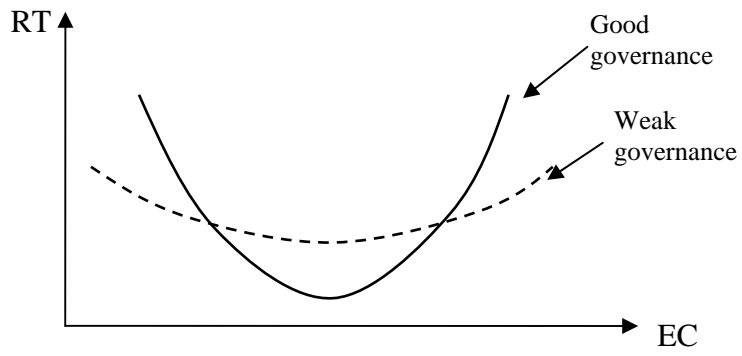
"Good" governance implies that shareholders' objectives have a large weight in managers' incentives.

Figure 3 Risk-taking (proxied by NPL/CAP) at different levels of deposit insurance coverage and corporate governance in Emerging Markets

3a. State Ownership
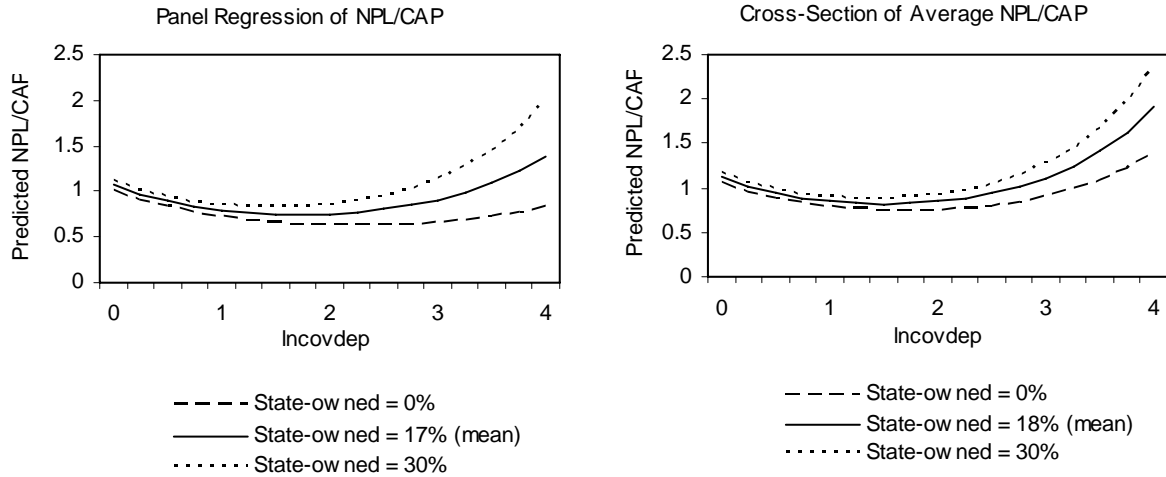
3b. Shareholder Rights
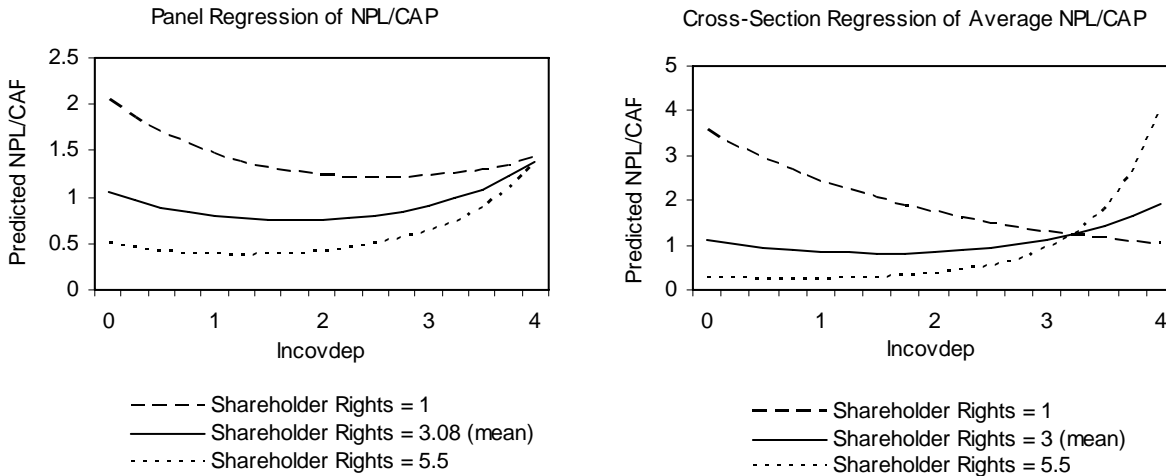
Figures above plot the predicted values of NPL/CAP at different levels of coverage limit of deposit per capita. The predicted values are calculated by varying the levels of government ownership and shareholder rights and using the mean values of other independent variables. The figures are based on results in Table 6.

Figure 4 Risk-taking (proxied by Z-score) at different levels of deposit insurance coverage and foreign ownership

Figures above plot the predicted values of Z-score at different levels of coverage limit of deposit per capita. The predicted values are calculated by varying the levels of foreign ownership and using the mean values of other independent variables. The figure on the left is based on the regression result in column 5, Table 4, and figure on the right is from column 5, Table 6.

Table 1 Deposit Insurance Coverage and Governance of Banks

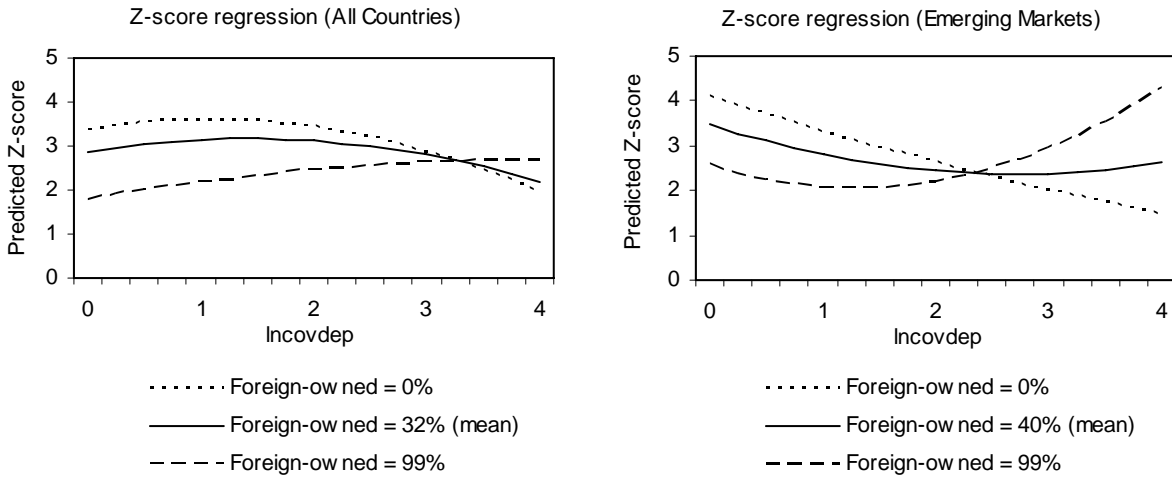|	NPL/Total Loans (average, %)	Cap/TA (average, %)	Coverage Limit as of 2003 (Local Currency)	Coverage Limit as of 2003 (dollars)	Coverage Limit /Deposit per Capita (covdep) as of 2003	Government Ownership in 2001	Foreign Ownership in 2001	Shareholder rights	Creditor rights
East and Southeast Asia									
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
Central and Eastern Europe									
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
Other Emerging Market Economies									
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
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
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	CAP/TA	Covdep	(Lncovdep × Lncovdep)	State Ownership	Foreign Ownership	Shareholder 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							
CAP/TA	0.406	-0.047	0.375	-0.411	0.272						
lncovdep	0.421	0.037	0.166	-0.125	0.192	0.567					
(lncovdep × lncovdep)	-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: All Countries

Dependent Variable	NPL/CAP	NPL/CAP	NPL/CAP	STDNPL/ 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)	0.080 (0.465)
Real GDP Growth	-2.965* (0.051)	-2.794** (0.043)	-6.969# (0.201)	-3.321# (0.308)	5.669 (0.464)
M2 to Reserve	-0.135 (0.362)	-0.118 (0.390)	-0.012 (0.929)	-0.047 (0.417)	0.233# (0.192)
Inflation	0.996** (0.029)	0.829* (0.074)	-2.802** (0.008)	-0.425 (0.494)	-1.204 (0.427)
Real Interest Rate	1.731** (0.001)	1.711** (0.000)	-0.242 (0.773)	-0.387# (0.228)	-2.175# (0.162)
CAP/TA	-0.070** (0.000)	-0.073** (0.000)	-0.073** (0.003)	-0.020* (0.057)	0.014 (0.629)
lncovdep	-0.329# (0.198)	-0.333# (0.151)	-0.306# (0.168)	-0.199# (0.140)	0.483# (0.117)
(lncovdep × lncovdep)	0.096* (0.064)	0.096** (0.043)	0.106* (0.086)	0.075** (0.036)	-0.175** (0.035)
State Ownership	0.917* (0.082)	0.832# (0.110)	1.228** (0.014)	0.192 (0.470)	-0.128 (0.856)
Foreign Ownership	0.009 (0.985)	0.090 (0.854)	0.397 (0.431)	0.183 (0.484)	-0.880** (0.045)
Shareholder Rights	-0.169** (0.034)	-0.190** (0.010)	-0.203** (0.027)	-0.007 (0.887)	-0.023 (0.846)
Creditor Rights	0.041 (0.696)				
Constant	0.566 (0.420)	0.899# (0.142)	1.850** (0.001)	0.714* (0.064)	3.821** (0.000)
R2	0.455	0.458	0.634	0.474	0.427
N	242	251	52	52	52
Chi-Square/F-Statistics	124.05	116.90	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 bank governance, proxied by state- and foreign ownerships of banks, and shareholder and creditor rights, on banks' risk-taking. The panel regressions of NPL/CAP are estimated using the random country effects model and independent variables are lagged by one year; the chi-square is reported for overall model fit. The cross-section regressions are estimated using OLS with the robust standard errors; the F-statistics is reported for overall model fit. The values of NPL/CAP and Z-score are in natural logarithm. *, ** 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 and Bank Ownership: Emerging Market Economies

Dependent Variable	NPL/CAP	NPL/CAP	NPL/CAP	STDNPL/CAP	Z-score
Model	Panel	Panel	Cross-Section	Cross-Section	Cross-Section
	(1)	(2)	(3)	(4)	(5)
Real GDP/Cap	-0.419**	-0.465**	-0.393**	-0.234*	-0.134
	(0.002)	0.000	(0.015)	(0.063)	(0.685)
Real GDP Growth	-3.150*	-2.963*	-2.354	-8.530#	1.436
	(0.061)	(0.052)	(0.759)	(0.123)	(0.914)
M2 to Reserve	-0.308#	-0.258#	-0.014	-0.113	-0.093
	(0.152)	(0.195)	(0.959)	(0.543)	(0.828)
Inflation	1.443**	1.154**	-2.038#	-1.283#	-2.148
	(0.000)	(0.007)	(0.188)	(0.214)	(0.393)
Real Interest Rate	1.423**	1.494**	-0.459	-0.223	-0.280
	(0.010)	(0.003)	(0.699)	(0.729)	(0.873)
CAP/TA	-0.069**	-0.072**	-0.069#	-0.013	-0.013
	(0.013)	(0.005)	(0.198)	(0.487)	(0.789)
lncovdep	-0.519*	-0.494*	-0.154	-0.345#	-0.173
	(0.092)	(0.075)	(0.706)	(0.291)	(0.809)
(lncovdep × lncovdep)	0.129**	0.123**	0.043	0.105#	-0.039
	(0.047)	(0.036)	(0.621)	(0.134)	(0.803)
State Ownership	1.402**	1.252**	0.893#	0.304	-0.523
	(0.020)	(0.034)	(0.141)	(0.498)	(0.641)
Foreign Ownership	0.171	0.240	-0.166	0.296	-0.540
	(0.763)	(0.661)	(0.786)	(0.438)	(0.532)
Shareholder Rights	-0.207*	-0.221**	-0.292**	-0.002	0.018
	(0.083)	(0.030)	(0.017)	(0.982)	(0.917)
Creditor Rights	-0.033				
	(0.773)				
Constant	0.445	0.656	2.158**	0.793#	3.545**
	(0.582)	(0.406)	(0.012)	(0.200)	(0.020)
R2	0.336	0.338	0.612	0.422	0.4112
N	156	165	32	32	32
Chi-Square/F-Statistics	87.01	83.25	8.25	33.33	1.10
Prob>Chi-Square	0.000	0.000	0.000	0.009	0.412

This table reports the estimation results of the impact of bank governance on banks' risk-taking for a sample of emerging market economies. The panel regressions of NPL/CAP are estimated using the random country effects model and independent variables are lagged by one year; the chi-square is reported for overall model fit. The cross-section regressions are estimated using OLS with the robust standard errors; the F-statistics is reported for overall model fit. The values of NPL/CAP and Z-score are in natural logarithm. *, ** 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 Deposit Insurance Coverage, Ownership, and Interactions: All Countries

Dependent Variable	NPL/CAP	NPL/CAP	STDNPL/CAP	Z-score
Model	Panel	Cross-Section	Cross-Section	Cross-Section
	(1)	(2)	(3)	(4)
Real GDP/Cap	-0.371**	-0.531**	-0.124**	0.054
	(0.000)	(0.000)	(0.020)	(0.650)
Real GDP Growth	-2.886**	-3.036	-2.425	4.965
	(0.037)	(0.592)	(0.459)	(0.534)
M2 to Reserve	-0.127	-0.002	-0.032	0.200#
	(0.357)	(0.985)	(0.562)	(0.296)
Inflation	0.830*	-2.202*	-0.191	-1.351
	(0.092)	(0.054)	(0.743)	(0.356)
Real Interest Rate	1.597**	-0.230	-0.355#	-2.153#
	(0.001)	(0.772)	(0.240)	(0.164)
CAP/TA	-0.074**	-0.083**	-0.021*	0.017
	(0.000)	(0.002)	(0.064)	(0.563)
lncovdep	-0.305#	-0.382*	-0.219*	0.433#
	(0.185)	(0.076)	(0.067)	(0.184)
(lncovdep × lncovdep)	0.026	0.102#	0.067#	-0.211**
	(0.671)	(0.203)	(0.102)	(0.044)
State Ownership	0.302	1.641*	-0.148	0.147
	(0.630)	(0.054)	(0.529)	(0.871)
Foreign Ownership	0.064	0.830#	0.465#	-1.595**
	(0.914)	(0.245)	(0.139)	(0.003)
Shareholder Rights	-0.258**	-0.347**	-0.046	-0.022
	(0.003)	(0.009)	(0.390)	(0.896)
State Ownership × (lncovdep × lncovdep)	0.117**	-0.153#	0.071#	-0.066
	(0.015)	(0.178)	(0.245)	(0.763)
Foreign Ownership × (lncovdep × lncovdep)	0.017	-0.087#	-0.050#	0.148#
	(0.663)	(0.277)	(0.194)	(0.112)
Shareholder Rights × (lncovdep × lncovdep)	0.015*	0.028#	0.005	0.008
	(0.096)	(0.151)	(0.554)	(0.774)
Constant	1.149*	2.101**	0.806**	3.940**
	(0.070)	(0.002)	(0.019)	(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	4.39
Prob>Chi-Square	0.000	0.000	0.000	0.000

This table reports the estimation results of the impacts of bank governance on banks' risk-taking and how it depends on explicit deposit insurance coverage (lncovdep). The panel regressions of NPL/CAP are estimated using the random country effects model and independent variables are lagged by one year; the chi-square is reported for overall model fit. The cross-section regressions are estimated using OLS with the robust standard errors; the F-statistics is reported for overall model fit. The values of NPL/CAP and Z-score are in natural logarithm. *, ** 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 6 Deposit Insurance Coverage, Ownership, and Interactions: Emerging Markets

Dependent Variable	NPL/CAP	NPL/CAP	STDNPL/ CAP	Z-score
Model	Panel	Cross-Section	Cross-Section	Cross-Section
	(1)	(2)	(3)	(4)
Real GDP/Cap	-0.400**	-0.342**	-0.159#	-0.324#
	(0.002)	(0.042)	(0.157)	(0.298)
Real GDP Growth	-3.122**	1.365	-5.272#	-4.986
	(0.042)	(0.861)	(0.309)	(0.702)
M2 to Reserve	-0.277#	-0.012	-0.022	-0.423
	(0.168)	(0.964)	(0.907)	(0.362)
Inflation	1.220**	-1.052	-0.710	-2.812#
	(0.009)	(0.542)	(0.465)	(0.201)
Real Interest Rate	1.259**	-0.412	-0.353	0.293
	(0.012)	(0.743)	(0.572)	(0.855)
CAP/TA	-0.076**	-0.070#	-0.020	0.010
	(0.003)	(0.163)	(0.379)	(0.855)
lncovdep	-0.413#	-0.414	-0.263	-0.810
	(0.171)	(0.330)	(0.438)	(0.334)
(lncovdep × lncovdep)	0.016	-0.064	0.077#	-0.095
	(0.848)	(0.523)	(0.229)	(0.519)
State Ownership	0.370	0.361	-0.046	-0.504
	(0.590)	(0.681)	(0.920)	(0.681)
Foreign Ownership	-0.078	-0.317	0.511#	-1.543*
	(0.914)	(0.693)	(0.244)	(0.093)
Shareholder Rights	-0.320**	-0.569**	-0.059	-0.130
	(0.007)	(0.001)	(0.548)	(0.599)
State Ownership × (lncovdep × lncovdep)	0.159**	0.087	0.045	0.063
	(0.012)	(0.510)	(0.644)	(0.799)
Foreign Ownership × (lncovdep × lncovdep)	0.041	0.049	-0.057	0.274**
	(0.409)	(0.639)	(0.348)	(0.032)
Shareholder Rights × (lncovdep × lncovdep)	0.019*	0.054**	0.008	0.040#
	(0.053)	(0.020)	(0.625)	(0.264)
Constant	1.070#	3.003**	1.058#	3.734**
	(0.222)	(0.005)	(0.106)	(0.020)
R2	0.392	0.708	0.516	0.454
N	165	32	32	32
Chi-Square/F-Statistics	117.706	10.06	1.95	2.88
Prob>Chi-Square	0.000	0.000	0.095	0.020

This table reports the estimation results of the impact of bank governance on banks' risk-taking and how it depends on deposit insurance coverage for a sample of emerging market economies. The panel regressions of NPL/CAP are estimated using the random country effects model and independent variables are lagged by one year; the chi-square is reported for overall model fit. The cross-section regressions are estimated using OLS with the robust standard errors; the F-statistics is reported for overall model fit. The values of NPL/CAP and Z-score are in natural logarithm. *, ** 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 7 Components of NPL/CAP and Z-score

Dependent Variable	(1) NPL	(2) CAP/TA	(3) NPL	(4) CAP/TA	(5) ROA	(6) STDROA
Model	Panel	Panel	Cross-Section	Cross-Section	Cross-Section	Cross-Section
Panel a: All Countries						
CAP/TA	-0.018#	0.066**	-0.027#	0.057**	0.032	0.035#
	(0.200)	(0.000)	(0.298)	(0.000)	(0.689)	(0.210)
lncovdep	-0.209#	0.094**	-0.245#	0.137*	0.208	-0.280#
	(0.229)	(0.044)	(0.256)	(0.053)	(0.688)	(0.318)
(lncovdep × lncovdep)	-0.007	-0.021*	0.064	-0.037#	-0.191#	0.151#
	(0.897)	(0.081)	(0.429)	(0.152)	(0.204)	(0.139)
State Ownership	0.107	-0.086	1.482*	-0.159	-1.683#	-0.512
	(0.856)	(0.545)	(0.091)	(0.377)	(0.113)	(0.554)
Foreign Ownership	-0.127	-0.138*	0.533	-0.297**	-0.762	1.245**
	(0.820)	(0.060)	(0.459)	(0.020)	(0.397)	(0.020)
Shareholder Rights	-0.247**	0.019	-0.310**	0.036#	0.006	0.049
	(0.005)	(0.373)	(0.022)	(0.259)	(0.975)	(0.767)
State Ownership × (lncovdep × lncovdep)	0.135**	-0.003	-0.153#	0.000	0.054	0.074
	(0.010)	(0.870)	(0.196)	(0.996)	(0.826)	(0.693)
Foreign Ownership × (lncovdep × lncovdep)	0.055#	0.023**	-0.047	0.041*	0.135	-0.094#
	(0.165)	(0.004)	(0.562)	(0.092)	(0.356)	(0.276)
Shareholder Rights × (lncovdep × lncovdep)	0.015#	-0.002	0.026#	-0.002	0.012	-0.008
	(0.155)	(0.411)	(0.172)	(0.789)	(0.721)	(0.760)
Panel b: Emerging Markets						
CAP/TA	-0.015	0.081**	-0.010	0.060**	-0.046	0.042
	(0.498)	(0.000)	(0.837)	(0.000)	(0.504)	(0.412)
lncovdep	-0.261#	0.053#	-0.497#	-0.083	-0.630	0.643
	(0.230)	(0.228)	(0.272)	(0.454)	(0.401)	(0.395)
(lncovdep × lncovdep)	-0.019	-0.007	-0.074	-0.009	-0.196	0.076
	(0.793)	(0.632)	(0.503)	(0.791)	(0.328)	(0.593)
State Ownership	-0.105	-0.171#	0.087	-0.274#	-1.923#	0.054
	(0.880)	(0.153)	(0.928)	(0.247)	(0.138)	(0.963)
Foreign Ownership	-0.440	-0.191**	-0.683	-0.366*	-1.007	1.159#
	(0.51)	(0.010)	(0.397)	(0.081)	(0.387)	(0.166)
Shareholder Rights	-0.279**	0.026#	-0.517**	0.052#	-0.188	0.169
	(0.023)	(0.184)	(0.009)	(0.285)	(0.391)	(0.519)
State Ownership × (lncovdep × lncovdep)	0.174**	-0.012	0.106	0.018	0.248	-0.030
	(0.014)	(0.619)	(0.428)	(0.663)	(0.438)	(0.899)
Foreign Ownership × (lncovdep × lncovdep)	0.076#	0.013#	0.112#	0.063*	0.314#	-0.189#
	(0.128)	(0.180)	(0.262)	(0.086)	(0.127)	(0.148)
Shareholder Rights × (lncovdep × lncovdep)	0.016#	-0.001	0.057**	0.003	0.041	-0.034
	(0.172)	(0.618)	(0.022)	(0.686)	(0.410)	(0.356)

This table reports the estimation results of the impacts of bank governance on the components of NPL/CAP and Z-score. Economic control variables are included but not reported. The panel regressions are estimated using the random country effects model and independent variables are lagged by one year. The cross-section regressions are estimated using OLS with the robust standard errors. The values of NPL, CAP/TA, and STDROA are in natural logarithm. *, ** 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 8 Comparing Actual and Risk-minimizing Explicit Deposit Insurance Coverage (2003)

Country	(1) Coverage Limit /Deposit per Capita (covdep) as of 2003	(2) NPL/CAP minimizing covdep (based on the Panel regression, column 1, Table 6)	(3) NPL/CAP minimizing covdep (based on the Cross-Section regression, column 2, Table 6)	(4) Std(NPL)/Avg(CAP) minimizing covdep (based on the Cross-Section regression, column 3, Table 6)	(5) Z-score maximizing covdep (based on the Cross-Section regression, column 4, Table 6)
Indonesia	Full	4.1	10.0	2.4	0
South Korea	4.49	3.9	8.0	3.1	0
Malaysia	Full	6.7	2.6	2.9	0
Philippines	3.76	7.3	4.9	2.9	0
Singapore	0	5.2	2.2	4.2	Full
Thailand	Full	6.0	15.0	2.6	0
Bulgaria	10.87	2.9	1.7	5.0	Full
Czech Republic	5.10	4.9	3.1	12.3	Full
Estonia	3.13	4.0	2.0	13.0	Full
Hungary	4.02	4.3	3.0	10.5	Full
Latvia	4.07	5.0	2.6	5.8	Full
Lithuania	12.05	3.4	2.0	6.1	Full
Poland	13.58	3.4	2.9	5.3	Full
Romania	12.30	2.6	2.7	3.2	0
Slovakia	7.39	6.0	4.8	13.1	Full
Slovenia	3.38	8.5	8.4	3.3	0

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 using different proxies. The calculations are based on results presented in Table 6 for Emerging Markets.