

## **Bank Transparency, Loan Loss Provisioning Behavior, and Risk-Shifting**

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## **Extended Abstract**

In addition to public securities markets, banks are a significant source of financing in economies around the world, playing an important role in mobilizing savings, allocating resources, and monitoring firms. An important, unresolved issue in bank regulation involves the importance of informational transparency of banks in promoting market disciplining of banks by outside investors as a fundamental lever of bank regulation that can both supplement and enhance the effectiveness of more traditional bank regulatory practices. In this paper, we complement and extend existing literature by using a large sample of banks domiciled in 28 countries to investigate the extent to which financial accounting information, a central component of bank-specific information sets, plays a significant role in disciplining bank risk-shifting behavior, after controlling for key elements of bank regulatory practices in a country. In particular, we study how the impact of financial accounting information on bank risk-shifting behavior varies with a key characteristic of a country's accounting regime, the extent of earnings smoothing via loan loss provisioning.

To capture bank risk-shifting behavior, we exploit Merton's (1977) characterization of deposit insurance as a put option to empirically estimate the equilibrium resolution of the conflict between banks' incentives to increase asset volatility, and deposit insurers' and uninsured creditors' attempts to counter such behavior by disciplining banks to increase capital in response to increases in risk.

We posit that earnings smoothing via loan loss provisioning is likely to be a first order determinant of bank transparency, particularly with respect to transparency of bank risk-taking. Loan loss provisioning represents the key accrual accounting choice in banks' income statements and so is likely to have a first order effect on the information properties of bank's earnings. Loan loss provisioning behavior itself is the subject of substantial debate in the current banking and accounting literatures, in particular with respect to whether earnings smoothing increases the information content of earnings by revealing innate fundamentals or whether it obscures fundamentals and reduces information. Also, with the potential to be reflective of the fundamental risk of losses inherent in underlying loan portfolios, loan loss provisioning is a key aspect of bank financial reporting for regulators and outside investors interested in monitoring risk-taking behavior.

We provide robust evidence that banks exhibit more risk-shifting behavior in countries where accounting regimes are characterized by higher levels of earnings smoothing. This suggests that earnings smoothing by banks leads to less informative earnings in the sense that such accounting information appears to be less effective in facilitating the ability of outside investors and regulators to monitor and discipline bank risk-taking.

## 1. Introduction

A large academic literature focuses on the role of financial accounting information in facilitating the monitoring and disciplining of business firms, and in supporting the existence of vibrant securities markets (see e.g., Bushman and Smith (2001), Ball (2001) and Black (2001), among others). However, in addition to public securities markets, banks are a significant source of financing in economies around the world, playing an important role in mobilizing savings, allocating resources, and monitoring firms.<sup>1</sup> The scope of recent banking crises and strong evidence on the beneficial effects of well-functioning banking systems for economic growth have fueled a global debate and growing academic literature focused on understanding what works best in bank regulation and supervision.<sup>2</sup> An important, unresolved issue in bank regulation involves the importance of informational transparency of banks in promoting market disciplining of banks by outside investors as a fundamental lever of bank regulation that can both supplement and enhance the effectiveness of more traditional bank regulatory practices.

In this paper, we complement and extend existing literature by using a large sample of banks domiciled in 28 different countries to investigate the extent to which financial accounting information, as a key component of informational transparency, plays a significant role in disciplining bank risk-shifting behavior, after controlling for key elements of bank regulatory practices adopted by each country. In particular, we study how the impact of financial accounting

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<sup>1</sup> Through syndicated loans arranged by commercial banks, industrial firms borrowed 1.4 trillion dollars in 2003 and 13.2 trillion dollars between 1993 and 2003. To put this in perspective, between 1993 and 2003, industrial firms issued 10.2 trillion dollars of public debt and 2.3 trillion dollars of common stock (see Drucker and Puri (2006)).

<sup>2</sup> Recent availability of data on bank regulations around the world has sparked empirical investigation into relationships between specific regulatory practices and banking-sector development, performance, and stability. See for example Barth, Caprio and Levine (2004, 2005, 2007), Beck, Demirguc-Kunt and Levine (2006), Demirgüç-Kunt, Detragiache, and Tressel (2006), Laeven and Levine (2006), and Nier and Baumann (2006), among others.

information on bank risk-shifting behavior varies with key characteristics of a country's accounting regime.<sup>3</sup>

To capture bank risk-shifting behavior, we exploit Merton's (1977) characterization of deposit insurance as a put option to estimate the net result of the conflict between a bank's incentives to increase asset volatility, and deposit insurers and uninsured creditors' attempts to counter such behavior by disciplining the bank to increase capital. To proxy for accounting transparency, we distinguish accounting regimes by the extent to which banks in each country use loan loss provisioning behavior to smooth accounting earnings. We provide robust evidence that banks exhibit more risk-shifting behavior in countries with accounting regimes characterized by higher levels of earnings smoothing. This result is consistent with earnings smoothing via loan provisioning behavior making it more difficult for regulators and outside investors to assess risk-taking behavior, and thus limiting their ability to discipline bank risk-taking by demanding higher levels of capital in response to increased risk. This suggests that earnings smoothing by banks leads to lower quality earnings in the sense that such accounting information seems less effective in facilitating the ability of outside investors and regulators to monitor and discipline bank risk-taking.

The premise that financial accounting information can play a fundamental role in the prudential oversight of banks is consistent with the Basel II Capital Accord which posits a central role for informational transparency in bank regulation by facilitating market discipline.<sup>4</sup>

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<sup>3</sup> As discussed in more detail below, risk-shifting behavior refers to attempts by banks' equity holders to benefit themselves at the expense of deposit insurers by increasing the risk of the asset portfolio without adequately increasing bank capital simultaneously.

<sup>4</sup> Basel Committee on Banking Supervision (BCBS) (2001) notes "The New Basel Capital Accord is based around three complementary elements or "pillars". Pillar 3 recognizes that market discipline has the potential to reinforce minimum capital standards (Pillar 1) and the supervisory review process (Pillar 2), and so promote safety and

While Basel Pillar 3 envisions a range of disclosures that may or may not be part of the formal financial accounting rules of a given country (BCBS (2001)), financial accounting systems form the foundation of the firm-specific information set available to interested parties outside the firm and are a logical starting point for investigating properties of information important for addressing moral hazard problems at banks.<sup>5</sup> It is also plausible that the quality of banks' financial accounting information is correlated with the quality of bank disclosures that fall outside of a country's financial accounting rules. Increasing accounting transparency may enhance ex-ante discipline on bank risk-taking activities by allowing investors in uninsured liabilities to better observe risk-taking behavior and respond quickly to greater risks by demanding higher yields on their investments.<sup>6</sup> Accounting transparency may also promote better supervisory oversight by regulators (see e.g., Hovakimian and Kane (2000), Kane (2004), and Flannery and Thakor (2006)).<sup>7</sup>

We posit that earnings smoothing via loan loss provisioning is likely to be a first order determinant of bank transparency, particularly with respect to transparency of bank risk-taking.

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soundness in banks and financial systems. Market discipline imposes strong incentives on banks to conduct their business in a safe, sound and efficient manner, including an incentive to maintain a strong capital base as a cushion against potential future losses arising from risk exposures.”

<sup>5</sup> Similar to the definition of “corporate transparency” developed in Bushman, Piotroski and Smith (2005), think of bank transparency as the availability of credible, bank-specific information to those outside of banks. We use the term “accounting transparency” to represent that aspect of bank transparency specifically related to the financial accounting information regime of a country.

<sup>6</sup> While the premise that better disclosure beneficially impacts bank risk taking behavior seems intuitive, economic theory shows that there are circumstances under which this is not the case. For example, Blum (2006) demonstrates that benefits of market discipline via subordinated debt contracts depends on the ability of banks to credibly commit to a given risk level. Cordella and Yeyati (1997) show that public disclosure can indeed serve to reduce bank risk taking, but only to the extent that the bank has control over the risk of its portfolio. In a different vein, Plantin, Sapra and Shin (2007) and Allen and Carletti (2007) focus on potential negative effects of mark-to-market accounting on bank soundness.

<sup>7</sup> Accounting transparency, by promoting market discipline, may benefit regulators by, for example, allowing them to observe spreads on subordinated debt. Accounting transparency may also reduce regulatory capture by powerful, self-interested regulators. Finally, transparency may benefit supervisory by allowing them to better allocate scarce resources to the most severe problem banks.

First, the loan loss provision represents the key accrual accounting choice in a bank's income statement. Thus, loan loss provisioning behavior is likely to have a first order effect on the information properties of a bank's earnings.

Second, loan loss provisioning behavior itself is the subject of substantial debate in the current banking literature (e.g., Koch and Wall (2001) and Benston and Wall (2005)). Also, the question as to whether smoothing increases or decreases the informativeness of earnings has been the subject of much debate in the accounting literature. The debate in the banking literature focuses on the role of loan provisioning behavior in mitigating the pro-cyclical effects of business cycles on banks due to risk sensitive capital requirements.<sup>8</sup> The counter-cyclical view is that credit risk is build up in a boom and materializes in a downturn (e.g., Borio et al. (2001)). In this view, loan loss provisions should be positively correlated with the lending cycle, and banks should build up loan loss reserves in good times to be drawn on in bad times. To the extent that such forward looking provisioning behavior leads to smoother earnings, it raises the question of whether observed smoothing behavior increases the informativeness of earnings by better reflecting risks of the underlying loan portfolio, or whether it reflects earnings management by banks attempting to obscure their risk-taking behavior or achieve other reporting objectives (see e.g., Bickers and Metzmakers (2004), Leaven and Majnoni (2003)). Our focus on risk-shifting,

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<sup>8</sup> Risk-based bank minimum capital requirements tend to have a pro-cyclical effect on the economy. The deterioration of the quality of bank loan portfolios during economic downturns inevitably increases banks' risk exposure—and therefore the level of capital requirements—exactly when capital becomes more expensive or simply unavailable to weaker institutions (Basel Committee on Banking Supervision, 2000). A common view is that an economic upswing and rising incomes indicate improving conditions for firms and reduce the likelihood of loan defaults, whereas a recession will have the opposite effect. If banks reflect this scenario by lowering provisions during economic booms and increasing them during downturns, such provisioning behavior may reinforce the current trend of the business cycle.

which is presumed to be undesirable behavior, gives us an opportunity to examine whether earnings smoothing promotes or mitigates such behavior.

Finally, with the potential to be reflective of the fundamental risk of losses inherent in underlying loan portfolios, loan loss provisioning is a key aspect of bank financial reporting for regulators and outside investors interested in monitoring risk-taking behavior.

A central challenge of our research design is to empirically measure risk-shifting by banks around the world. Banking offers a unique setting by virtue of the existence of explicit and implicit deposit guarantees. Merton (1977) establishes that deposit insurance can be characterized as a put option written by the deposit insurer to the shareholders of the bank with the strike price equal to the face value of the deposits, and where the value of deposit insurance to bank stockholders is increasing in asset risk and bank leverage. The existence of this put option creates incentives for banks to shift risk onto the guarantee agency by increasing the risk of assets without simultaneously increasing capital adequately. Countering such bank incentives, deposit insurers and uninsured creditors have incentives to monitor and discipline bank risk-taking behavior that, if effective, would result in a negative relation between a bank's leverage and asset volatility. Thus, equilibrium risk-shifting reflects the net resolution of the conflict between banks' incentives to increase risk and the effectiveness of monitoring and disciplining activities undertaken by deposit insurers and uninsured investors in countering such behavior.

We follow the empirical approach of Duan, Moreau and Sealey (1992), Hovakimian and Kane (2000), and Hovakimian, Kane and Leaven (2003) by exploiting the economics underlying the deposit guarantee put option to estimate equilibrium risk-shifting by banks as a function of earnings smoothing. We document that estimated risk-shifting at banks within a country is positively related to a country's earnings smoothing via loan loss provisioning, after controlling

for a wide range of country-level variables. In particular, we control for fundamental levers of bank supervision, including the level of supervisory power granted to banking regulators, the stringency of capital requirements, and the rigor of regulations concerning the credibility of bank-generated disclosures. We also control for the existence of explicit deposit insurance schemes and the extent of state ownership of banks. Finally we control for properties of the general contracting environment including shareholder and creditor rights, and the efficiency of the judicial system.

We also decompose risk-shifting into two fundamental components: (1) the sensitivity of bank leverage to changes in asset volatility, and (2) the magnitudes of the partial derivatives of the put option with respect to changes in asset volatility and leverage. We document that the sensitivity of bank leverage to changes in asset volatility is decreasing in the extent of earnings smoothing, suggesting that in countries with high levels of smoothing, accounting information is less effective in allowing outside investors and regulators discipline banks by forcing increases in capital in response to increase in risk. We also document that the magnitudes of the partial derivatives of the put option with respect to changes in asset volatility and leverage are increasing in earnings smoothing, resulting in higher incentives for banks to risk-shift. This is consistent with the deposit insurance put option being further out of the money in countries with lower levels of smoothing relative to countries with higher smoothing.

The rest of the paper is organized as follows. In section 2 we discuss extant research pertinent to our paper and develop the empirical framework. Section 3 discusses the sample and variable construction and section 4 presents the main empirical results. Section 5 provides several alternative empirical specifications while section 6 analyzes the robustness of the results. Section 7 concludes.

## **2. Related Literature and Empirical Framework**

In section 2.1 we discuss important recent literature focused on understanding the effectiveness of market discipline as a tool of bank regulation. In section 2.2 we develop our empirical framework in depth, laying out the theory underlying our specification for estimating risk-shifting by banks, providing a roadmap of our empirical strategy, and describing our empirical model for estimating smoothing. Finally, section 2.3 summarizes the main empirical specifications and discusses the fundamental control variables used in the analyses.

### **2.1 Related Literature on Market Discipline as a Bank Regulatory Tool**

Fueled by recent availability of rich cross-country data on bank regulations and supervisory practices, a growing body of academic research provides evidence on which of the many different bank regulations and supervisory practices employed around the world work best, if at all, to promote banking-sector development, performance, and stability. Barth, Caprio and Levine (2001) design and implement a survey funded by the World Bank to collect information on extensive array bank regulations and supervisory practices for 107 countries.

In an influential paper, Barth, Caprio, and Levine (2004) examine regulations on capital adequacy, deposit insurance system design features, bank supervisory power, regulations fostering information disclosure and private sector monitoring of banks, and government ownership of banks, among other factors. Their main results suggest that policies that rely on regulatory features that foster accurate information disclosure, empower private-sector corporate control of banks, and foster incentives for private agents to exert corporate control work best to promote bank development, performance and stability. Further, Beck, Demirgüç-Kunt, and Levine (2006) find that a supervisory strategy that empowers private monitoring of banks by

forcing banks to disclose accurate information to the private sector, tends to lower the degree to which corruption of bank officials is an obstacle to firms raising external finance.

In an interesting take on transparency and bank soundness, Demirgüç-Kunt, Detragiache, and Tressel (2006) study whether compliance with the Basel Core Principles for Effective Banking Supervision improves bank soundness. They document that countries which require banks to regularly and accurately report their financial data to regulators and market participants have sounder banks (measured with Moody's financial strength ratings). They note that these findings highlight the importance of transparency in making supervisory processes effective and strengthening market discipline, and the authors conclude that countries should consider giving priority to information provision over other elements of the Basel Core Principles. Tadesse (2006), using a range of survey-based metrics find that banking crises are less likely in countries with greater regulated disclosure and transparency.

We also build on Hovakimian, Kane and Laeven (2003) who document that explicit deposit insurance increases risk-shifting, but that this effect is tempered when features such as risk-sensitive deposit insurance premiums, coverage limits, and coinsurance are incorporated into the deposit-insurance system.

Finally, Nier and Baumann (2006) also look at the role of bank transparency in providing incentives for banks to limit their risk. Where we focus on risk-shifting behavior, Nier and Baumann look at the extent to which higher levels of transparency enhance market discipline and provide more incentives for banks to limit their risk of default by holding larger capital buffer. Nier and Baumann's primary measure of transparency is a bank level index of disclosure constructed by counting the number of individual disclosures available in the bank's published accounts as represented in the Fitch IBCA BankScope data base.

We extend this research along several dimensions. First, much of this research investigates market discipline and transparency using measures based on disclosure-related banking regulations or transparency indexes based on counts of disclosures available in bank financial reports. While we also incorporate banking regulations into our design, we focus on financial accounting as a fundamental tool of market discipline. We also directly measure observed properties of accounting regimes. In particular, our focus on earnings smoothing via loan loss provisioning allows us to directly investigate textured properties of the bank-specific information set available to regulators and investors in evaluating the risk-taking behavior of banks and taking appropriate responses. We also extend the findings of Nier and Bauman (2006) by explicitly examining whether the effect of transparency on capital buffers is enough to mitigate undesirable behavior such as risk-shifting. It is theoretically possible that the while there is an increase in capital buffer, it is not enough to offset the incentives to risk-shift.

## **2.2 Empirical Framework:**

Our research objective is to investigate the relation between country-level measures of earnings smoothing via loan loss provisioning and the extent of risk-shifting at banks. We begin in sections 2.2.1 by developing the fundamental framework for estimating risk-shifting by banks based on the theory of deposit insurance. In section 2.2.2 we lay out our approach for investigating the channels through which smoothing may impact risk-shifting behavior. We develop our smoothing measure in section 2.2.3.

### **2.2.1 Estimating Risk-Shifting by Banks**

Deposit insurance, by providing an explicit or implicit guarantee to insured depositors to protect them in the event of default by the bank, reduces incentives for such depositors to

monitor risk-taking activities of banks, creating scope for banks to increase risk at the expense of the deposit insurance agency. Risk-shifting is accomplished when banks manage to increase the risk-adjusted cost of deposit insurance. To the extent that deposit insurance agencies are unable to pass such increased costs onto individual banks, a wealth transfer occurs. To determine the degree to which banks actually engage in risk-shifting behavior, we first need to estimate the price of risk-adjusted deposit insurance premiums.

Merton (1977) characterizes deposit insurance as a put option written by a deposit insurer to equity holders of the bank with the strike price equal to the face value of the debt. Merton derives a theoretical pricing model for this put option that is a non-linear function of the volatility of bank assets and bank leverage. Let  $IPP$  represent the value of the put option per dollar of deposits,  $\sigma_v$  the volatility of the market value of assets, and  $D/V$  the leverage of the bank (defined as the face value of deposits divided by the market value of bank assets). Viewing  $\sigma_v$  and  $D/V$  as parameters that can be set independently, Merton (1977) derives the key comparative static results that  $\frac{\partial IPP}{\partial \sigma_v} > 0$  and  $\frac{\partial IPP}{\partial D/V} > 0$ . The framework we use builds off of Merton's model.

Following Ronn and Verma (1986), Hovakimian and Kane (2000) and Hovakimian et al. (2003), we estimate  $\sigma_v$  and  $D/V$  and compute a value of  $IPP$  for each bank-year observation (see appendix B for full details of the estimation). Following this risk-shifting literature, first, consider the following linear approximation for the value of the deposit put option:

$$IPP \cong \gamma_0 + \gamma_1 \sigma_v + \gamma_2 D/V. \quad (1)$$

In (1), the coefficients  $\gamma_1$  and  $\gamma_2$  are the partial derivatives  $\frac{\partial IPP}{\partial \sigma_v}$  and  $\frac{\partial IPP}{\partial D/V}$ , respectively, and capture how much value a shareholder could potentially extract from the insurer by unconstrained adjustments of  $\sigma_v$  and  $D/V$ .<sup>9</sup> However, the key economic idea underlying our empirical specification is that  $\sigma_v$  and  $D/V$  cannot be chosen independently. Deposit insurers have regulatory powers to respond to increased risk, and uninsured creditors have the ability to respond to increased risk by, for example, increasing spreads on subordinated debt. Thus, banks are not unconstrained in their choice of risk, leverage pairs.

To model equilibrium relations between increases in risk and leverage, Duan et al. (1992) posit a two equation system to characterize the struggle between potential risk-shifting banks and outside disciplinary forces. The first equation models the implications of outside discipline by positing an equilibrium relation that specifies leverage as a linear function of asset risk:

$$D/V = \alpha_0 + \alpha_1 \sigma_v. \quad (2)$$

In (2), the coefficient  $\alpha_1 = \frac{dD/V}{d\sigma_v}$  captures the intensity with which outside disciplinary forces create incentives for banks to decrease leverage in response to increases in risk. We expect a negative relation between  $D/V$  and  $\sigma_v$  (i.e.,  $\alpha_1 < 0$ ), where  $|\alpha_1|$  should increase as the intensity of discipline imposed by regulators and uninsured investors increases. The discipline captured by  $\alpha_1$  serves to offset the incentives of banks to risk-shift as any increase in risk is met by pressure to reduce leverage (increase capital).

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<sup>9</sup> To clarify, the right hand side of (1) represents a linear approximation of the non-linear function derived in Merton (1977), and is used in the literature to facilitate empirical analysis. Given the comparative statics in Merton (1977), that  $\frac{\partial IPP}{\partial \sigma_v} > 0$  and  $\frac{\partial IPP}{\partial D/V} > 0$ , we expect both coefficients  $\gamma_1$  and  $\gamma_2$  to be positive. This is confirmed in Table 2, panel A. We take a number of significant steps below to verify that our results are not spurious due to the non-linearity of the theoretical option value function.

The second equation of Duan et al. (1992) simply recasts equation (1) to reflect the fact that  $\sigma_v$  and  $D/V$  are not independent parameters. To incorporate the fundamental tension between the two variables, substitute the assumed equilibrium relation in (2) into (1) for  $D/V$ , yielding:

$$IPP \cong \beta_0 + \beta_1 \sigma_v, \quad (3)$$

where  $\beta_1$  in equation (3) is given by

$$\beta_1 \equiv \gamma_1 + \gamma_2 * \alpha_1 \equiv \frac{\partial IPP}{\partial \sigma_v} + \frac{\partial IPP}{\partial D/V} * \frac{dD/V}{d\sigma_v}. \quad (4)$$

The coefficient  $\beta_1$  captures the net effect of the struggle between potential risk-shifting banks and outside disciplining forces. The first term in (4),  $\frac{\partial IPP}{\partial \sigma_v}$ , the partial derivative of  $IPP$  with respect to risk, captures the bank's unconstrained incentive to increase risk. The second term,  $\frac{\partial IPP}{\partial D/V} * \frac{dD/V}{d\sigma_v}$ , is generally negative and captures the *offsetting* impact of the disciplinary response to increased risk. This second term is generally negative as the sensitivity of leverage to increases in risk,  $\alpha_1 = \frac{dD/V}{d\sigma_v}$ , should generally be negative and the partial derivative of  $IPP$  with respect to leverage,  $\frac{\partial IPP}{\partial D/V}$ , is positive by Merton (1977). Overall,  $\beta_1 > 0$  is consistent with observed risk-shifting as the disciplining effect does not completely neutralize incentives to increase risk.<sup>10</sup>

Equation (3) is the foundation of our empirical design. Ignoring for a moment control variables and details of our proxy for *Smoothing*, our empirical strategy for investigating the

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<sup>10</sup> The economic intuition of behind the conclusion that  $\beta_1$  can be interpreted as observed risk-shifting is that if banks find risk-shifting behavior beneficial (i.e. profit maximizing) then they would manage their overall risk levels in such a way that would increase the actuarially value of their insurance. If banks do not find risk-shifting behavior to be advantageous, they would have no incentive to manage the their risk in such a way because any increases in the risk profile would be borne by the equity holders of the bank.

effect of smoothing on risk-shifting involves estimating variations of the following basic equation (using a change specification):

$$\Delta IPP_{itj} = \beta_0 + \beta_1 \Delta \sigma_{v,itj} + \beta_2 \text{Smoothing}_j + \beta_3 \Delta \sigma_v * \text{Smoothing}_j + \varepsilon_{itj}^\beta,$$

where  $i$  indexes individual banks,  $t$  indexes time, and  $j$  indexes country. Observing  $\beta_3 > 0$  is consistent with *Smoothing* increasing observed risk-shifting by banks.

### 2.2.2 Channels Through Which Smoothing Impacts Transparency

After establishing a relation between *Smoothing* and risk-shifting, we next analyze channels through which accounting transparency impacts risk-shifting. Recall from equation (4) above that risk-shifting is captured by the coefficient  $\beta_1 \equiv \gamma_1 + \gamma_2 * \alpha_1 \equiv \frac{\partial IPP}{\partial \sigma_v} + \frac{\partial IPP}{\partial D/V} * \frac{dD/V}{d\sigma_v}$ .  $\beta_1$  is determined by the magnitude (and sign) of  $\alpha_1$ , and the magnitudes of both  $\gamma_1$  and  $\gamma_2$ .

Focusing first on  $\alpha_1$ , the sensitivity with which leverage responds to increases in risk, we build on equation (2) above to investigate whether  $\alpha_1$  is a function of *Smoothing*. That is, ignoring control variables, we estimate (using changes):

$$\Delta D/V_{itj} = \alpha_0 + \alpha_1 \Delta \sigma_{v,itj} + \alpha_2 \text{Smoothing}_j + \alpha_3 \Delta \sigma_v * \text{Smoothing}_j + \varepsilon_{itj}^\alpha.$$

$\alpha_3 > 0$  is consistent with *Smoothing* decreasing the intensity of the disciplinary response of leverage to an increase in risk, implying that *Smoothing* is associated with less effective offsetting incentives against bank risk-shifting.

Finally, accounting can effect risk-shifting by impacting the magnitudes of the partial derivatives  $\gamma_1 = \frac{\partial IPP}{\partial \sigma_v}$  and  $\gamma_2 = \frac{\partial IPP}{\partial D/V}$ , which capture how much value a shareholder can extract from the insurer by unconstrained adjustments of  $\sigma_v$  and  $D/V$ . These coefficients depend on the levels of leverage and risk of a bank, or in other words, on how far the deposit insurance option is out of the money. If  $D/V$  is very low relative to  $\sigma_v$ , the risk of default of the bank will be low

and the option will be way out of the money. This implies that the partial derivatives with respect to  $\sigma_v$  and  $D/V$  will be small, as in the limit, the value of the option becomes insensitive to changes in these parameters as the option goes out of the money. Thus, banks will have lower incentives to risk shift as the option goes further out of the money. To explore the extent to which *Smoothing* affects the incentive to risk-shift by impacting  $\gamma_1$  and  $\gamma_2$ , we extend equation (1) as follows:

$$\Delta IPP_{itj} = \gamma_0 + \gamma_1 \Delta \sigma_{v,itj} + \gamma_2 \Delta D/V_{itj} + \gamma_3 \text{Smoothing}_j + \gamma_4 \Delta \sigma_{v,itj} * \text{Smoothing}_j + \gamma_5 \Delta D/V_{itj} * \text{Smoothing}_j + \varepsilon_{itj}^{IPP}.$$

Observing  $\gamma_4 > 0$  and  $\gamma_5 > 0$  implies that *Smoothing* increases banks' incentives to risk-shift by increasing the partial derivatives  $\frac{\partial IPP}{\partial \sigma_v}$  and  $\frac{\partial IPP}{\partial D/V}$ .

### 2.3 Estimating Smoothing via the Loan Loss Provisioning

A long standing debate in the accounting literature concerns whether earnings smoothing increases the information content of earnings by revealing innate fundamentals or whether it obscures fundamentals and reduces information in earnings. While some argue that income smoothing reveals information (e.g., Arya et al. (2003); Chaney and Lewis (1995); Trueman and Titman (1988); Sankar and Subramanyam (2001); Demski (1998)), others argue that income smoothing distorts information (e.g., Barth et al. (2007a, 2007b); Francis et al. (2004); Lang et al. (2003); Leuz et al. (2003)). While the existence of earnings smoothing has been documented, it has proven difficult to empirically distinguish whether smoothing enhances or obscures

information.<sup>11</sup> Our design offers a unique setting in which to address this issue by investigating whether earnings smoothing promotes or discourages risk-shifting at banks.

In a related vein, as noted in the introduction, there is also discussion in the banking literature concerning smoothing via loan provisioning behavior. Some argue that risk is built up during good economic times and so banks should build up loan loss reserves in good times to be drawn on in bad times to mitigate credit crunches (e.g., Borio et al. (2001)). To the extent that such forward looking provisioning behavior leads to smoother earnings, it raises the possibility that observed smoothing behavior may increase the informativeness of earnings by better reflecting risks of the underlying loan portfolio. Of course, observed smoothing may have nothing to do with forward looking risk assessment and may instead reflect earnings management by banks attempting to obscure their risk-taking behavior (see e.g., Bickers and Metzmakers (2004), Leaven and Majnoni (2003)). We do not take a stance on whether smoothing increases or decreases the information content of earnings. Our focus on risk-shifting, which is presumed to be undesirable behavior, gives us an opportunity to examine whether smoothing promotes or mitigates such behavior.

We follow existing literature (Ahmed et al. (1999); Beatty et al. (1995); Collins et al. (1995); Laeven and Majnoni (2003); Liu and Ryan (2006)) to estimate smoothing for each country. We estimate the following pooled, cross-sectional, time series regression for each country:

$$LLP_{itj} = \delta_0 + \delta_1 Ebllp_{itj} + \delta_2 \Delta NPL_{itj} + \delta_3 NCO_{itj} + \delta_4 Cap_{itj} + \delta_5 Size_{itj} + \delta_6 LLR_{itj} + \delta_7 Loansa_{itj} + \delta_8 \Delta GDP_{tj} + \delta_9 RealLoan\_Growth_{itj} + Fixed\ Effects + \varepsilon.$$

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<sup>11</sup> Tucker and Zaorwin (2006) provide some evidence that smoothing seems to lead to more informative prices. Jayaraman (2007) shows that income smoothing leads to more informed trading but he also finds that in certain situations discretionary smoothing is likely to be informative.

*LLP* is defined as loan loss provisions for the year scaled by loans outstanding at the beginning of the year. *Ebllp* is defined as earnings before tax and loan loss provisions scaled by lagged total loans outstanding. We use the coefficient on *Ebllp* as our measure of income smoothing, where  $\delta_1 > 0$  is indicative of observed income smoothing in a country. We term this coefficient *Smoothing*.

We include a set of fundamental controls in the model.  $\Delta NPL$  is the change in non-performing loans over the reporting period scaled by lagged total loans outstanding, while *NCO* is net charge-offs for the reporting period scaled by lagged total loans outstanding. Both  $\Delta NPL$  and *NCO* are included in the regression to control for changes in the underlying characteristics of the loan portfolio.<sup>12</sup>

Prior research (Beatty et al. (1995); Collins et al. (1995)) suggest that the loan loss provision could be used for capital management, thus we include *Cap*, defined as the book value of equity divided by total assets, as a proxy for the capital position of the bank.<sup>13</sup> We include *Size* which is the natural logarithm of total assets of the bank. *LLR* is the lagged loan loss reserve scaled by lagged total loans outstanding. To control for differences in bank asset portfolio composition, we include a proxy for bank asset diversification, *Loansa*, defined as total loans outstanding divided by total assets.

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<sup>12</sup> In supplementary analysis in section 5 of the paper, we modify the smoothing regression to include changes in the standard deviation of the market value of assets following Ahmed et al. (1999). Liu and Ryan (2006) also suggest that there is a potential relation between loan loss provisions and charge offs due to income statement and balance sheet management incentives.

<sup>13</sup> Prior research focuses on regulatory capital as an incentive to manage provision was primarily because of regulatory capital regulation prior to Basel I that allowed provisions to play a marginally more important role in capital management. Subsequent to Basel I the effect of provisions on regulatory capital has been reduced. We still control for the incentive because it is unclear in the cross country setting whether the incentives would not still be present in other banking environments.

Laeven and Majnoni (2003) suggest that loan loss provision should be correlated with economic cycles as well as loan cycles, because it is during times of economic expansion and increased lending that credit risk is built up through reduced credit standards and/or lower perceived risks. Following Laeven and Majnoni (2003) we include  $\Delta GDP$  which is the change in GDP per capita, and  $RealLoan\_Growth$  which is real loan growth for the bank over the reporting period deflated by the CPI. Prior research suggests that real loan growth is a proxy for relaxed credit standards and increased credit risk. We also include both time and type fixed effects.<sup>14</sup>

## 2.4 Full Empirical Specification

The following three equations summarize our main empirical specifications. Note that to control for fixed effects, we use changes in risk and leverage. All results hold in levels.

i. *The Effect of Smoothing on Bank Risk-Shifting.* The objective is to investigate whether earnings smoothing increases or decreases risk-shifting.  $\beta_3 > 0$  is consistent with smoothing increasing risk-shifting, as it reflects that a given increase in risk leads to a larger increase in  $IPP$  in the presence of smoothing.

$$\begin{aligned} \Delta IPP_{itj} = & \beta_0 + \beta_1 \Delta \sigma_{v,itj} + \beta_2 Smoothing_j + \beta_3 \Delta \sigma_{v,itj} * Smoothing_j + \sum_{n=4}^{11} \delta_n Main_n + \sum_{n=11}^{18} \delta_n \Delta \sigma_{v,itj} * Main_n \\ & + \sum_{t=1994}^{2005} Year\ Fixed\ Effect_t + \sum_{p=1}^8 Bank\ Type_p + \varepsilon \end{aligned}$$

ii. *The Effect of Smoothing on the Sensitivity of Leverage (D/V) to Risk ( $\sigma_v$ ).* The objective is see whether smoothing increases or decreases outside discipline as reflected in how sensitive changes in leverage are to changes in risk.  $\alpha_3 > 0$  is consistent with smoothing reducing outside discipline, as it lowers the intensity with which leverage decreases in response to a given change in risk.

$$\begin{aligned} \Delta D/V_{itj} = & \alpha_0 + \alpha_1 \Delta \sigma_{v,itj} + \alpha_2 Smoothing_j + \alpha_3 \Delta \sigma_{v,itj} * Smoothing_j + \sum_{n=4}^{11} b_n Main_n + \sum_{n=11}^{18} b_n \Delta \sigma_{v,itj} * Main_n \\ & + \sum_{t=1994}^{2005} Year\ Fixed\ Effect_t + \sum_{p=1}^8 Bank\ Type_p + \varepsilon \end{aligned}$$

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<sup>14</sup> The type fixed effects control for bank type (commercial, savings, credit institution, etc.) we allow all type of banks into the sample for the primary analysis except for Islamic banks. In examining the robustness of our results we also limit the sample to only commercial banks and attain quantitatively and qualitatively similar results.

iii. *The Effect of Smoothing on the Partial Derivatives*  $\frac{\partial IPP}{\partial \sigma_v}$  and  $\frac{\partial IPP}{\partial D/V}$ .  $\gamma_4, \gamma_5 > 0$  is consistent with smoothing increasing banks' incentives to increase risk in order to increase *IPP*. Note that  $\gamma_4, \gamma_5 = 0$  implies that option value is not sensitive to changes in risk or leverage. This would be the case when the deposit option is far out of the money, implying that risk is very low relative to leverage (the bank is very well capitalized given risk).

$$\Delta IPP_{itj} = \gamma_0 + \gamma_1 \Delta \sigma_{v,itj} + \gamma_2 \Delta \frac{D}{V_{itj}} + \gamma_3 \text{Smoothing}_j + \gamma_4 \Delta \sigma_{v,itj} * \text{Smoothing}_j + \gamma_5 \Delta \frac{D}{V_{itj}} * \text{Smoothing}_j + \varepsilon$$

The variables labeled *Main* represent control variables representing key elements of the bank regulatory practices adopted by each country. We discuss these next (all variables are described in detail in Appendix A of the paper).

**Supervisory power:** A strong supervisory review process is a fundamental pillar of the Basel II Accord (Pillar 2). We include *SupervisoryPower* as a measure of the power bank regulators have over the operations of the bank. This measure is taken from Barth, Caprio and Levine (2006) and represents an index constructed from answers to individual questions contained in an extensive survey of bank regulatory practices funded by the World Bank.

**Regulations on capital adequacy:** Pillar 1 of the Basel II Accord focuses on the importance of capital adequacy in promoting bank soundness. We include the measure *CapIndex* which is again an index constructed by Barth, Caprio and Levine (2006) to measure the stringency of the capital requirements in each country.

**Bank regulations on private-sector monitoring of banks:** We include a control variable, *Credibility*, which measures the degree to which external audits are independent, professional and rigorous as reflected in bank regulations governing audit practices.

**Explicit Deposit Insurance:** We include an indicator variable, *DI*, that takes the value of 1(0) if the country has explicit (implicit) deposit insurance. This variable has been shown by Hovakimian, Kane and Laeven (2003) to impact the level of risk-shifting by banks.

**State ownership of banks:** Previous research by LaPorta, Lopez-de-Silanes, and Shleifer (2002) and Barth, Caprio and Levine (2004) show that it is important to account for the extent of state ownership of banks. We include a variable, *State Bank*, to control for these differences.

**Properties of the general contracting environment:** We include three measures to control for the general contracting environment. *InvestorRights* measures the investor protection rights present in the country; *CreditorRights* is a proxy for the amount of rights creditors are given in the country; *JudicialEfficiency* is an assessment of the efficiency and integrity of the country's legal system.

We also include time and bank-type fixed effects.<sup>15</sup> We turn now to the data and sample.

### 3. Data and sample

The sample period of our study spans 1994-2005. All bank financial statement data is taken from Bankscope and all market data from Datastream. Country-level variables derive from five different sources; the World Development Indicators Database, Barth et al. (2006), Demirguc-Kunt et al. (2005), La Porta et al. (1998), and La Porta et al. (2002). For more detailed information concerning variable construction and sources refer to Appendix A. To be included in the sample a bank is required to have all necessary bank-level data for both the country-level smoothing estimation and the risk-shifting estimations. Second, for a country to be included, we require all country-level data. Third, we require that a bank have at least three years of data to be

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<sup>15</sup> In our estimation procedure we include all types of bank except Islamic banks. Our inferences are not sensitive to the inclusion of only commercial banks, or of excluding banks in the U.S. and Japan. See section 6 for more details on robustness.

included in the analysis. Finally to control for outliers and extreme observation we trim the data at the 1 and 99 percentiles.

The analysis requires estimates of three key variables:  $V$ , the market value of bank assets,  $\sigma_v$ , the standard deviation of the market value of assets, and  $IPP$ , the value of the deposit insurance put option per dollar of deposits. Here, we follow the methodology developed by Ronn and Verma (1986), and later modified by Hovakimian and Kane (2000) and Hovakimian et al. (2003), which builds off the Black and Scholes (1973) pricing formulation and Merton's (1977) extension to deposit insurance.

First, we exploit the concept that a firm's equity can be characterized as a call option on the firm's assets, where the strike price is the face value of debt. Using measures of face value of the reported total liabilities ( $D$ ), the observed market value of equity ( $E$ ), and the estimated standard deviation of stock returns ( $\sigma_E$ )<sup>16</sup>, we obtain values for  $V$  and  $\sigma_v$  by solving two simultaneous equations dictated by standard option pricing theory. Next, we plug the derived values for  $V$  and  $\sigma_v$  into a variant of Merton's (1977) deposit insurance put option to obtain an estimate of  $IPP$  for every bank-year observation in the sample.

Merton (1977) formulates the deposit insurance guarantee as a European put option, and assumes that bank's assets are seized and sold as soon as the value of the deposits is greater than the market value of the assets. Ronn and Verma (1986) posit that there would likely be some forbearance on the part of the regulators, in hopes that things would turn around. Therefore a

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<sup>16</sup> Following Hovakimian et al. (2003), we estimate the standard deviation of returns each bank-year observation using monthly returns.

forbearance term is included in the model.<sup>17</sup> For a detailed explanation of the computation of  $IPP$ ,  $V$  and  $\sigma_v$  see Appendix B.

Table 1 presents the descriptive statistics for the sample. To calibrate our  $IPP$ ,  $V$ , and  $\sigma_v$  measures we compare our estimates to prior research (Hovakimian et al., (2003)). While our sample period differ, estimates of  $IPP$ ,  $V$ , and  $\sigma_v$  found in both Panel A and Panel B are quantitatively and qualitatively similar to those of prior research. Table 1 reports our *Smoothing* measure, which is the coefficient on  $Eblp$  from a pooled regression run by country, where higher values indicate more observed smoothing via the loan loss provision is present in the country.

Table 1 Panel A indicates that *Smoothing* exhibits considerable variation.

Panel B of Table 1 provides bank-level descriptive statistics. One point to note is the  $Cap$  (book value of equity from the annual financial statements divided by total assets) and  $D/V$  statistics. The mean (median)  $Cap$ , which is a proxy for Tier 1 capital, is reported at 0.088 (0.155) for the sample. Given Basel guidelines and regulation one would infer that the mean bank in the sample is just above the Basel guidelines for capital requirements (8.5%). However, these estimates are generally downward biased as they ignore any risk weighting of assets.  $D/V$ , which uses our estimate of a bank's market value of assets in the denominator, implies mean (median) capital of 0.135 (0.233), which is consistent with evidence in prior research that banks in general hold capital above the required level.

As pointed out in Section 2 our goal is to empirically examine how equilibrium risk-shifting varies with *Smoothing*. Given this objective we need a measure of observed risk-shifting. We begin by presenting baseline regressions to clarify the interpretations of the risk-

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<sup>17</sup> In the reported results, we follow prior research and set the forbearance parameter to 0.97. In unreported results and consistent with prior findings, our results are not sensitive to the inclusion or exclusion of the parameter.

shifting framework captured by equations (1), (2), and (3) put forth in in section 2.2. In Table 2 we estimate the three equations without including *Smoothing* or the other institutional measures. All estimations use a pooled sample over the entire time period, clustering standard errors at the country-level. Panel A reports the estimation of the linear approximation of Merton's (1977) option pricing function described in equation (1) in Section 2.2. The coefficients on  $\gamma_1$  and  $\gamma_2$  are positive and significant, indicating that the estimated partial derivatives of *IPP* with respect to both risk and leverage are positive, as predicted by theory.

To reiterate our discussion in Section 2, the relation in Panel A assumes that one can hold leverage constant while changing risk. Such an assumption is not plausible as when bank risk changes there most likely will be a corresponding disciplinary response on leverage. We posit an equilibrium in which leverage is a linear function of risk. In Panel B, we document that consistent with Duan et al. (1992) and economic intuition, there is a negative and significant relation between leverage ( $D/V$ ) and risk ( $\sigma_v$ ). This is consistent with the presence of outside disciplinary forces driving the expected negative relation between the choice of risk and leverage.

Exploiting the assumption that leverage is a linear function of risk due to existence of disciplinary forces, we next estimate equilibrium risk-shifting, which reflects the outcome of the game between banks and outside disciplinary forces. We do so by examining the relation between changes in the value of the put option ( $\Delta IPP$ ) and changes in risk ( $\Delta \sigma_v$ ). In Table 2, Panel C, we document a positive and significant relation between the change in the value of the put ( $\Delta IPP$ ) and the change in risk ( $\Delta \sigma_v$ ), consistent with the existence of risk-shifting on average, i.e. banks' incentives to increase risk on average swamps the countervailing forces of outside discipline. Overall, the results in Table 2 show that there is indeed a negative response of

leverage to increases in risk, but in equilibrium, the disciplinary response is not strong enough to fully neutralize the incentive to risk-shift.

As discussed earlier, we use income smoothing via the loans loss provision as a proxy for informational transparency. Again, to create a baseline, Table 3 reports a pooled estimation across all countries of income smoothing via the loan loss provision. A positive coefficient on  $Eblp$  indicates observed smoothing on average. Consistent with Laeven and Majnoni (2003), we find evidence of income smoothing with a significant coefficient on  $Eblp$  of 0.0439. In addition to income smoothing, we also observe, consistent with prior findings, a negative relationship between  $LLP$  and  $\Delta GDP$  which is indicative of a pro-cyclical relationship between  $LLP$  and macro-economic measures of credit risk build up (Laeven and Majnoni (2003)). Using the basic specification in Table 3, we estimate *Smoothing* coefficients for each country, which are reported in Table 1 Panel A.

#### 4. Empirical Results

We now turn to the main analysis of the paper. Table 4 reports our main results on the relation between *Smoothing* and risk-shifting. Tables 5 and 6 report our analyses of the channels through which accounting impacts risk-shifting. In particular, Table 5 analyzes the effect of *Smoothing* on the sensitivity of changes in leverage ( $\Delta D/V$ ) to changes in risk ( $\Delta\sigma_v$ ), and Table 6 reports the effect of *Smoothing* on the partial derivatives  $\frac{\partial IPP}{\partial\sigma_v}$  and  $\frac{\partial IPP}{\partial D/V}$ . All estimations are pooled and run using OLS, with standard errors clustered at the country-level.

We first discuss Table 4 where we regress  $\Delta IPP$  on risk ( $\Delta\sigma_v$ ), and  $\Delta\sigma_v$  interacted with *Smoothing* and other bank regulatory variables. Recall that a positive coefficient on  $\Delta\sigma_v$  in this

regression is consistent with observed risk-shifting. In Table 4, column I, we begin by replicating Hovakimian et al. (2003) (hereafter HKL) who find that the presence of explicit deposit insurance in a country increases risk-shifting by banks in that country. The idea is that explicit deposit insurance generally weakens the incentives of depositors to monitor bank risk-taking. We find that the coefficient on the explicit deposit insurance dummy, *DI*, is positive and significant, consistent with an increase in risk-shifting.

Table 4, columns II documents that bank risk-shifting is significantly higher in countries with more *Smoothing*, after controlling for key elements of a country's bank regulatory practices and important features of the general contracting environment. The interaction of  $\sigma_v$  with *Smoothing* is positive and significant at the 1% level, consistent with more risk-shifting. In addition to *Smoothing*, we also document that *CapitalIndex* (measuring the stringency of capital requirements) and *JudicialEfficiency* result in lower levels of risk-shifting as the coefficients on both variables are negative and significant. Interestingly, the coefficient on *SupervisoryPower* (measuring the power bank regulators have over bank operations) has a positive and significant effect on risk-shifting behavior. This would suggest that empowered regulatory supervisors are not effective on average in neutralizing risk-shifting incentives, and in fact exacerbate the problem. Prior research (Beck, Demirgüç-Kunt, and Levine, 2006) suggests that empowering official supervisory agencies to directly monitor, discipline, and influence banks, does not improve the integrity of bank lending, while Barth, Caprio, and Levine (2004) do not find a strong relationship between official supervisory indicators and bank performance and stability.

Table 4, column III, reports the effect of including a squared term to control for concerns about non-linearity in the true relation between option value and risk. While the coefficient on the squared term is positive, our result on the *Smoothing* coefficient is still positive and

significant at the 1% level. In unreported results we included higher order  $\Delta\sigma_v$  terms, up to  $\Delta\sigma_v^{14}$ , and find that the results and inferences on *Smoothing* are not affected.

Having establishing a relation between *Smoothing* and risk-shifting, we turn next to an analysis of the channels through which accounting transparency impacts risk-shifting. Recall from equation (4) above that risk-shifting is captured by the coefficient  $\beta_1 \equiv \gamma_1 + \gamma_2 * \alpha_1 \equiv \frac{\partial IPP}{\partial \sigma_v} + \frac{\partial IPP}{\partial D/V} * \frac{dD/V}{d\sigma_v}$ , which is a function of incentives and disciplinary response.  $\beta_1$  is determined by the magnitude (and sign) of  $\alpha_1$  (i.e. the disciplinary response to changes in risk), and on the magnitudes of both  $\gamma_1$  and  $\gamma_2$  (i.e. the incentives).

In Table 5, we investigate whether  $\alpha_1$ , which captures the intensity with which outside discipline decreases leverage in response to increases in risk, is a function of *Smoothing*. Recall that the more negative is  $\alpha_1$ , the more sensitive is a bank's leverage to a change in risk. Table 5, documents that the coefficient on the interaction between  $\Delta\sigma_v$  and *Smoothing* is positive and significantly different from zero, while the coefficients on the interactions between  $\Delta\sigma_v$  and *CapIndex*, *DI* and *JudicialEfficiency* are negative and significant at the 0.10, 0.01 and 0.01 level respectively. The positive coefficient on *Smoothing* suggests that in environments characterized by more smoothing via the loan loss provision there is less disciplinary pressure on leverage in response to changes in risk.

Finally, accounting transparency can effect risk-shifting by impacting the magnitudes of the partial derivatives  $\gamma_1 = \frac{\partial IPP}{\partial \sigma_v}$  and  $\gamma_2 = \frac{\partial IPP}{\partial D/V}$ , which capture how much value a shareholder can extract from the insurer by unconstrained adjustments of  $\sigma_v$  and  $D/V$ . If  $D/V$  is low relative to  $\sigma_v$ , the risk of default of the bank will be low, the option will be way out of the

money, and the partial derivatives with respect to  $\Delta\sigma_v$  and  $\Delta D/V$  will be small as the value of an out of the money option is insensitive to changes in the these parameters.

In Table 6 we investigate the impact of *Smoothing* and other bank regulatory features on the magnitudes of the partial derivatives  $\gamma_1 = \frac{\partial IPP}{\partial \sigma_v}$  and  $\gamma_2 = \frac{\partial IPP}{\partial D/V}$ . Column I in Table 6 indicates that the coefficients on *Smoothing* interacted with both  $\Delta\sigma_v$  and  $\Delta D/V$  are positive and significant at the 1% and 10% level respectively. That is, increasing *Smoothing* increases the sensitivity of the fair deposit insurance premium to changes in both  $\sigma_v$  and  $D/V$ , increasing the incentives for banks to risk-shift.

Column II in Table 6 include both a squared risk term and leverage term to try and control for shape concerns. The *Smoothing* interaction on  $\Delta\sigma_v$  is still positive and significant at the 1% level after including the higher order terms while the coefficient on leverage is positive but insignificant at conventional levels.

## 5. Alternative Specifications

To alleviate concerns about our linear specification for the value of the put option, we turn to an alternative specification to examine the relation between risk-shifting and smoothing behavior. That is, we want to rule out the possibility that the relation between risk-shifting and smoothing in Table 4 is spurious and due simply to *Smoothing* picking up non-linearity in the true relation between option value and risk (despite the fact that we included higher order polynomial terms for risk). To do this, we first estimate a country-level risk-shifting coefficient for each country. That is, we estimate the following pooled regression for each country and use  $\beta_1$  as an estimate of average risk-shifting in that country:

$$\Delta IPP_{itj} = \beta_0 + \beta_1 \Delta \sigma_{v,itj} + \sum_{t=1994}^{2005} Year\ Fixed\ Effect_t + \sum_{p=1}^8 Bank\ Type_p + \varepsilon.$$

We also estimate a country-level measure of the sensitivity of bank leverage to changes in risk. That is, we estimate the following pooled regression for each country and use  $|\alpha_1|$  as an estimate of the average sensitivity of leverage to changes in risk:

$$\Delta D/V_{itj} = \alpha_0 + \alpha_1 \Delta \sigma_{v,itj} + \sum_{t=1994}^{2005} \text{Year Fixed Effect}_t + \sum_{p=1}^8 \text{Bank Type}_p + \varepsilon.$$

Then, we estimate a smoothing regression pooling together all banks in all countries, interacting bank earnings,  $Ebllp$ , with the country estimates of  $\beta_1$  and  $|\alpha_1|$ .<sup>18</sup>

Table 7 columns II and III report the results for the  $\beta_1$  and  $|\alpha_1|$  interactions, respectively. For ease of interpretation we use  $|\alpha_1|$  so that larger values means higher disciplinary response. Column II indicates that stronger disciplinary response is associated with less smoothing via the loan loss provision as indicated by the negative and significant coefficient (-0.0877) on the interaction term. Column III shows that in countries where there is more observed risk-shifting there is smoothing. That is, banks that risk-shift more also make accounting decisions associated with lower quality accounting earnings! These two results make it hard to attribute the results in Tables 4 and 5 to shape concerns.

To further validate the argument that information transparency has an effect on observed risk-shifting we employ an alternative measure of information transparency. As an alternative measure, *Timeliness*, where we use the  $R^2$  from the following regression:  $Ret = \delta_0 + \delta_1 Earn + \delta_2 \Delta Earn + \varepsilon$  scaled by average total assets (Ball et al., 2007). This measure captures how well

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<sup>18</sup> One notable difference from our prior smoothing specification, is that in now we include the change in asset volatility. Ahmed et al. (1999) suggest that changes in asset volatility should be included when examining smoothing characteristics. In the estimation of country by country smoothing coefficients, we did not include this variable because of data availability. In table 7, requiring  $\Delta \sigma_v$  and all other controls variables reduces the sample size to 2,557. We also truncate the data at the 1 and 99 percentiles to control for outliers which further reduces the sample.

the accounting information captures information in price. Therefore higher values of *Timeliness* mean more informative accounting.

Table 8 report the estimation of using *Timeliness* instead of *Smoothing*. The results show that higher values of *Timeliness* are associated with less observed risk-shifting. This result again supports the argument that better financial accounting has a positive impact in reducing observed risk-shifting behavior.

## 6. Robustness Checks

Prior research has suggested that banks in the United States and Japan make up a lot of the data in BankScope. It is possible that this imbalance of observations drives the reported results. We therefore re-run the analysis once with both countries excluded, and then including the countries one at a time. In untabulated results, inferences from all the analysis are both quantitatively and qualitatively similar to those presented in this paper.

Another concern is a simultaneity bias in the in the Table 5 regression. That is, it is possible that instead of  $\sigma_v$  driving  $D/V$ , the two variables could be simultaneously determined. We test for the simultaneity bias using a Hausman Test and find no evidence of simultaneity present in the analysis, which is also consistent with findings in prior research.

Because we use all bank type in the analysis it is possible that results could be driven by different bank types (Investment banking, savings banks, etc.). To eliminate concern that this may be driving the results, we run the analysis using only commercial banks and inferences are robust.

While the majority of the country-level variables display considerable variation, *DI* has 6 of the 28 countries that have only implicit deposit insurance. These countries make up 21.4% of

the sample. In results not reported, elimination of these countries without explicit deposit insurance does not affect our inference and results are robust.

Results in the paper are reported after trimming the data at the 1 and 99 percentiles to control for possible outliers. To ensure that the results reported were not an artifact of our method of truncation we also trimmed at the 2 and 98 percentiles; 5 and 95 percentiles. Results not reported indicate that our results are not dependent on trimming cut-offs. We also winsorize instead of truncate the data and results are robust.

## **6. Summary and Conclusions**

In addition to public securities markets, banks are a significant source of financing in economies around the world, playing an important role in mobilizing savings, allocating resources, and monitoring firms. An important, unresolved issue in bank regulation involves the importance of informational transparency of banks in promoting market disciplining of banks by outside investors as a fundamental lever of bank regulation that can both supplement and enhance the effectiveness of more traditional bank regulatory practices.

In this paper, we complement and extend existing literature by using a large sample of banks domiciled in 28 countries to investigate the extent to which financial accounting information, a central component of bank-specific information sets, plays a significant role in disciplining bank risk-shifting behavior, after controlling for key elements of bank regulatory practices in a country. In particular, we study how the impact of financial accounting information on bank risk-shifting behavior varies with a key characteristic of a country's accounting regime, the extent of earnings smoothing via loan loss provisioning.

To capture bank risk-shifting behavior, we exploit Merton's (1977) characterization of deposit insurance as a put option to empirically estimate the equilibrium resolution of the conflict

between banks' incentives to increase asset volatility, and deposit insurers' and uninsured creditors' attempts to counter such behavior by disciplining banks to increase capital in response to increases in risk.

We posit that earnings smoothing via loan loss provisioning is likely to be a first order determinant of bank transparency, particularly with respect to transparency of bank risk-taking. Loan loss provisioning represents the key accrual accounting choice in banks' income statements and so is likely to have a first order effect on the information properties of bank's earnings. Loan loss provisioning behavior itself is the subject of substantial debate in the current banking and accounting literatures, in particular with respect to whether earnings smoothing increases the information content of earnings by revealing innate fundamentals or whether it obscures fundamentals and reduces information. Also, with the potential to be reflective of the fundamental risk of losses inherent in underlying loan portfolios, loan loss provisioning is a key aspect of bank financial reporting for regulators and outside investors interested in monitoring risk-taking behavior.

We provide robust evidence that banks exhibit more risk-shifting behavior in countries where accounting regimes are characterized by higher levels of earnings smoothing. This suggests that earnings smoothing by banks leads to less informative earnings in the sense that such accounting information appears to be less effective in facilitating the ability of outside investors and regulators to monitor and discipline bank risk-taking.

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## Appendix A

Variable	Description	Reference/Source
<b><u>Country-Level Characteristics</u></b>		
Alpha	Alpha is the $\alpha_1$ coefficient from the following by country pooled regression: $D/V_{itj} = \alpha_0 + \alpha_1 \sigma_{v,itj} + \varepsilon_{itj}$ . It is used as a measure of regulatory oversight observed over the estimation period.	Duan, Moreau, and Sealey (1992)/Datastream
Beta	Beta is the $\beta_1$ coefficient from the following by country pooled regression: $IPP_{itj} = \beta_0 + \beta_1 \sigma_{v,itj} + \varepsilon_{itj}$ . It is used as a measure for the amount of risk-shifting observed over the estimation period.	Duan, Moreau, and Sealey (1992)/Datastream
Smoothing	A proxy for the information transparency for the banking environment within a country. The measure is the coefficient on $Eblp$ from the following regression run by country: $LLP_{itj} = \delta_0 + \delta_1 Eblp_{itj} + \delta_2 \Delta NPL_{itj} + \delta_3 NCO_{itj} + \delta_4 Cap_{itj} + \delta_5 Size_{itj} + \delta_6 LLR_{itj} + \delta_7 Loansa_{itj} + \delta_8 \Delta GDP_{tj} + \delta_9 RealLoan\_Growth_{itj} + Fixed\ Effects + \varepsilon$ .	Beatty et al. (1995), Collins et al. (1995), Liu and Ryan (2006, and Laeven and Majononi (2003)
Timeliness	An equity market based earnings transparency measure computed as the $R^2$ from a pooled regression of $Ret_{it} = \varphi_0 + \varphi_1 Earnings_{it} + \varphi_2 \Delta Earnings_{it} + \varepsilon$ scaled by average total assets. $Earnings$ be defined as the report earnings number on the bank's financial statement at the end of the reporting period. $\Delta Earnings$ is the annual change in reported earnings over the reporting period. $Ret$ is the annual buy and hold return over the reporting period.	Ball, Bushman and Vasvari (2007)/Datastream and Banscope.
SupervisoryPower	An index computed from answers to the following questions: (a) Does the supervisory agency have the rights to met with external auditors to discuss their reports without the approval of the bank?; (b) Are auditors required by law to communicate directly to the supervisory agency and presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse?; (c) Are off-balance sheet items disclosed to the supervisors?; Can supervisors: (d) take legal action against external auditors for negligence?; (e) force a bank to change its internal organizational structure?; (f) order a bank's directors or management to constitute provisions to cover actual or potential losses?; (g) suspend the directors' decision to distribute bonuses?; (h) suspend the director's decision to distribute management fees?; (i) Who can legally declare – such that this declaration supersedes some of the rights of shareholders – that a bank is insolvent?; (j) According to the Banking Law, who has authority to intervene – that is, suspend some or all ownership rights – a problem bank?; Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency: (k) supersede shareholder rights?; (l) remove or replace management?; and (m) remove and replace directors?	Barth, Caprio, and Levine (2006)
CapIndex	A composite measure that captures both the amount of capital and verifiable sources of capital that a bank is required to posses. The index is computed from answers from the following questions: (a) Is the minimum capital-to-asset ratio requirement risk weighted in line with the Basel I guidelines?; (b) Does the minimum ratio vary as a function of an individual bank's credit risk?; (c) Does the minimum	Barth, Caprio, and Levine (2006)

ratio vary as a function of market risk?; (e) Before minimum capital adequacy is determined, is the market value of loan losses not realized on accounting books deducted from the book value of capital?; (f) Before minimum capital adequacy is determined, are unrealized losses in securities deducted from the book value of capital?; (g) Before minimum capital adequacy is determined, are unrealized foreign exchange losses deducted from the book value of capital?; (h) Can initial disbursement or subsequent injections of capital be done with assets other than cash or government securities?; (i) Can the initial disbursement of capital be done with borrowed funds?; and (j) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities?

Credibility	A measure of the degree to which external audits are independent, professional and rigorous as reflected in bank regulations governing audit practices. The index is the sum of the following five indicator variables: (a) compulsory audit—a variable that takes 1 if external audit is compulsory in the country; (b) required extend of audit—a variable that assumes the value 1 if bank regulation sanctions the extent of the external audit; (c) license requirements—a variable that takes 1 if auditors are required to be licensed or certified; (e) auditor report to supervisor—a variable that takes 1 if auditors’ report should be given to the bank supervisory agency; and (f) auditor meet supervisor without consent of bank—a variable that takes 1 if the bank supervisory agency can meet the external auditors to discuss audit reports without the consent of the bank auditee.	Barth, Caprio and Levine (2006); Tadesse (2006)
InvestorRights	A summary measure of shareholder rights in a country, measured as the number of important shareholder rights that exist in the country’s legal code.	LaPorta, Lopez-de-Silanes, Shleifer and Vishny (1998).
CreditorRights	A summary measure of creditor rights in a country, measured as the number of important creditor rights that exist in a country’s legal code.	LaPorta, Lopez-de-Silanes, Shleifer and Vishny (1998).
DI	Indicator variable that takes the value of 1(0) if the country has explicit (implicit) deposit insurance.	Demirguc-Kunt, Karacaovali, and Laeven (2005)
StateBank	Share of the assets of the top 10 banks in a given country owned by the government of that country in 1995. The percentage of assets owned by the government in a given bank is calculated by multiplying the share of each shareholder in that bank by the share the government owns in that shareholder, then summing the resulting shares.	LaPorta, Lopez-de-Silanes, and Shleifer(2002).
JudicialEfficiency	Assessment of the “efficiency and integrity of the legal environment as it affects business, particularly foreign firms” produced by the country-risk rating agency Business International Corporation. It “may be taken to represent investors’ assessments of conditions in the country in question.” Average between 1980 and 1993. Scale between 0 to 10, with lower scores equal to lower efficiency levels.	LaPorta, Lopez-de-Silanes, Shleifer and Vishny (1998).

**Bank-Level Variables:**

IPP	The actuarially fair value of the deposit insurance put-option that is issued at the end of the fiscal year. For detailed formulation of <i>IPP</i> see Appendix B.	Ronn and Verma (1986).
V	The market value of assets. For detailed formulation of <i>V</i> see Appendix B.	Ronn and Verma (1986).
$\sigma_v$	The instantaneous standard deviation of the return on the market value of assets. For detailed formulation of $\sigma_v$ see Appendix B.	Ronn and Verma (1986).
$\frac{D}{V}$	Leverage which is defined as total face value of liabilities divided by the market value of assets.	Ronn and Verma (1986).
Debt	Total face value of liabilities reported on the financial statements.	Bankscope
Cap	A proxy for Tier 1 capital that is computed as the book value of equity reported on the annual financial statements divided by total assets reported on the financial statements.	Bankscope
Assets	Total assets reported on the financial statements	Bankscope
Book Value	The book value of equity reported in the financial statements	Bankscope
E	The end of the period market value of equity calculated as ending stock price multiplied by the number of shares outstanding.	Datastream
$\sigma_E$	The annualized instantaneous standard deviation of the return on equity, which is computed using the prior twelve months' returns.	Datastream
LLP	The reported loan loss provisions on the income statement at the end of the period scaled by lagged total loans outstanding.	Bankscope
Ebl1p	Earnings before tax and loan loss provisions scaled by lagged total loans outstanding.	Bankscope
$\Delta$ NPL	The change in non-performing loans over the reporting period scaled by lagged total loans outstanding.	Bankscope
Size	Defined as the natural logarithm of total assets.	Bankscope
LLR	The lagged level of the loan loss reserve scaled by lagged total loans outstanding.	Bankscope

Loansa	Lagged total loans outstanding divided by lagged total assets. <i>Loansa</i> is a proxy for bank diversification.	Bankscope
RealLoan_Growth	The change in loans outstanding over the reporting period deflated by the CPI and scaled by lagged loans outstanding.	Bankscope/World Development Indicators Database
NCO	Net charge-offs as of the end of the reporting period scaled by lagged loans outstanding.	Bankscope

## Appendix B

Three key variables that are necessarily for the examination or risk-shifting are;  $V$ -the market value of assets,  $\sigma_v$ - the instantaneous standard deviation of the rate of return on the value of the bank's assets, and  $IPP$ -the value of the deposit insurance put-option per dollar of deposit. As mentioned in the text  $V$ ,  $\sigma_v$ , and  $IPP$  are all unobservable. We follow Ronn and Verma (1986) in calculating these variables synthetically from option-based models of deposit insurance (Merton, 1977).

We first obtain values of  $V$  and  $\sigma_v$  by solving two simultaneous equations. The solutions from these two equations are then used to calculate  $IPP$ . Before we get to the calculations following prior research we make the following assumptions; first, deposits equal the total liabilities of the bank. Second, asset values follow a geometric Brownian motion. Third, because deposits are of the demand type we assume the time to maturity is the time to the next audit this way the guarantor can treat the deposits as if they were term and interest bearing.

The first equation states  $\sigma_v$  as a function of  $E$ ,  $V$  and  $\sigma_E$ :

$$\sigma_v = \frac{\sigma_E E}{VN(x)} \quad (1)$$

where

$$x \equiv \frac{\ln(V/\rho D) + \sigma_v^2 T/2}{\sigma_v \sqrt{T}}$$

$E$  is the market value of equity of the bank at the end of the period.  $\sigma_E$  is the instantaneous standard deviation of return on equity ( $E$ ) calculated over the prior twelve months.  $N(\cdot)$  is the cumulative density of a standard normal random variable.  $\rho$  is the forbearance and is set to 0.97, this parameter allows the asset value to deteriorate to 97 percent of the debt value before the

option to called. The idea behind the forbearance parameter is that guarantors of the deposit may find it optimal to stay the exercise of the option in hopes that things may come around.  $T$  is the unit of time until the next audit which is set to 1. The second equation is the option formulation for  $E$ . Ronn and Verma (1986) model the market value of the bank's equity as:

$$E = VN(x) - \rho DN(x - \sigma_v \sqrt{T}) \quad (2)$$

where all variables are as defined above.

After simultaneously solving (1) and (2) for values of  $V$  and  $\sigma_v$ , we can then plug in the values and obtain a value of  $IPP$ . The  $IPP$  formulation is as follows:

$$IPP = N(y + \sigma_v \sqrt{T}) - (1 - \delta)^n \left(\frac{V}{D}\right) N(y) \quad (3)$$

where

$$y \equiv \frac{\ln[D/V (1 - \delta)^n] - \sigma_v^2 T/2}{\sigma_v \sqrt{T}}$$

and  $\delta$  is the dividend per dollar of value of the assets, paid  $n$  times per period. The resulting  $IPP$  is the deposit insurance put-option (or actuarial fair insurance premium) per dollar of deposits.

**Table 1-Panel A****Country-Level Descriptive Statistics on Institutional Variables**

Smoothing is the coefficient from a country-level smoothing regression where higher values indicate more smoothing. SupervisoryPower, CapIndex, and DI are all obtain from Barth et al. (2006) and are measures of the country's banking regulatory environment. InvestorRights, CreditorRights and JudicialEfficiency are taken from La Porta et al. (1998). ST\_Bank is taken from La Porta et al. (2002). Credibility is calculated following Tadesse(2006). See Appendix A for detailed variable definitions.

<i>Country-level Descriptive Statistics</i>									
<b>Country</b>	<b>Smoothing</b>	<b>SupervisoryPower</b>	<b>CapIndex</b>	<b>Credibility</b>	<b>DI</b>	<b>StateBank(%)</b>	<b>InvestorRights</b>	<b>CreditorRights</b>	<b>JudicialEfficiency</b>
ARGENTINA	0.205	9.5	7	5	1	60.50	4	1	6
AUSTRALIA	0.084	11	7	5	0	12.33	4	1	10
CANADA	0.138	10.5	4	5	1	0	5	1	9.25
CHILE	0.383	11	6	5	1	19.72	5	2	7.25
COLOMBIA	0.892	13	6	5	1	53.92	3	0	7.25
ECUADOR	0.321	14	10	5	1	40.61	2	4	6.25
GERMANY	0.152	9	6	5	1	36.36	1	3	9
HONG KONG	0.044	11	7	5	0	0	5	4	10
INDIA	0.426	10	8	5	1	84.94	5	4	8
IRELAND	-0.057	13	4	4	1	04.48	4	1	8.75
ISRAEL	-0.125	8	7	5	0	64.64	3	4	10
JAPAN	0.243	12	6	4	1	0	4	2	10
KENYA	-0.398	13.5	8	5	1	29.94	3	4	5.75
MEXICO	-0.125	11.5	8	5	1	35.62	1	0	6
NETHERLANDS	0.403	8	6	5	1	09.20	2	2	10
NORWAY	0.187	9	7	5	1	43.68	4	2	10
PAKISTAN	0.076	13	7	5	0	85.96	5	4	5
PERU	0.737	12	6	5	1	26.46	3	0	6.75
PHILIPPINES	0.302	11	5	3	1	27.23	3	0	4.75
PORTUGAL	0.037	14	7	5	1	25.66	3	1	5.5
SINGAPORE	0.169	12.5	8	5	0	13.53	4	4	10
SOUTH AFRICA	0.116	9	7	5	0	0	5	3	6
SPAIN	0.146	8.5	10	4	1	01.98	4	2	6.25
THAILAND	0.142	9	5	5	1	17.09	2	3	3.25
TURKEY	0.000	14	6	5	1	56.46	2	2	4
UNITED KINGDOM	0.040	11.5	6	4	1	0	5	1	10
USA	0.014	13	6	5	1	0	5	4	10
ZIMBABWE	0.051	14	5	4	1	30.04	3	4	7.5

**Table 1-Panel B****Descriptive Statistics**

The descriptive statistics presented below are taken from a pooled sample of 28 countries from 1994-2005. See Appendix A for detailed variable definitions.

Descriptive Statistics			
Variable	Mean	Median	StdDev
<i>IPP (%)</i>	0.1782	0.0000	0.0206
$\sigma_v$	0.0708	0.0322	0.1261
<i>D/V</i>	0.7766	0.8646	0.2550
$\Delta IPP$	-0.0005	-0.0000	0.0272
$\Delta \sigma_v$	-0.0055	-0.0017	0.1450
$\Delta D/V$	-0.0038	-0.0019	0.2632
<i>V</i>	22,248.2	2,735.1	82,698.0
<i>D</i>	17,522.1	1,992.7	59,507.5
<i>Cap</i>	0.1530	0.0886	0.2033
<i>Assets</i>	18,842.0	2,367.5	62,250.3
<i>Book Value</i>	1,319.91	261.27	3,291.77
<i>E</i>	2,971.91	356.04	20,338.9
$\sigma_E$	0.0910	0.0704	0.0919
<i>LLP</i>	0.0092	0.0049	0.0285
<i>Ebllp</i>	0.0411	0.0278	0.2434
$\Delta NPL$	-0.0017	-0.0006	0.1248
<i>NCO</i>	0.0071	0.0026	0.0462
<i>Size</i>	8.5927	8.4654	1.9991
<i>LLR</i>	0.0295	0.0163	0.0617
<i>Loansa</i>	0.6256	0.6434	0.1426
<i>RealLoan Growth</i>	-0.0943	-0.0611	0.3304
$\Delta GDP(\%)$	2.4844	2.5905	3.6529

*IPP* is the value of the implicit deposit insurance put option (Ronn and Verma, 1986).  $\sigma_v$  is the observed annual standard deviation of the market value of assets. *D/V* is total debt divided by the market value of assets. *V* is the market value of assets (\$ millions). *Debt* is face value of total debt (\$ millions). *Cap* is a proxy for a bank's reported capital position computed as total book value of equity divided by total assets. *Assets* is the reported total assets of the bank (\$ millions). *Book Value* is the reported book value of equity (\$ millions). *E* is the market value of equity (\$ millions).  $\sigma_E$  is the instantaneous standard deviation of the market value of equity.  $\Delta GDP$  is the annual percent change in GDP per capita. *LLP* is reported loan loss provisions divided by lag loans. *Ebllp* is earnings before tax and loan loss provisions divided by lag loans.  $\Delta NPL$  is the change in non-performing loans divided by lag loans. *Size* is the natural log of total assets. *Loansa* is defined as lag loans divided by total assets. *RealLoan Growth* is the growth in loans over the year deflated by the CPI. *NCO* is net charge-offs divided by lag loans. For further details see Appendix A.

**Table 2**

**Baseline Regression Framework; Incentives, Sensitivity and Risk-Shifting  
(Merton, 1977; Duan et al., 1992)**

The following is a replication of the three equation approach taken in the remainder of the paper. The first equation is the linear form of Merton (1977) where the put-option is an increasing function of both risk and leverage.  $\Delta IPP$  is defined as the change in the implicit deposit insurance put-option for the bank as of the fiscal year end.  $\Delta D/V$  is the change in the ratio of book value of total debt outstanding divided by the market value of equity.  $\Delta\sigma_v$  is the change in the annual standard deviation of the market value of assets. The second and third equations are derived from Duan et al. (1992). The second equation is used to measure the sensitivity of leverage to risk. The third equation is used to measure the observed bank risk-shifting over the estimation period. Reported standard errors are clustered at country-level.  $IPP$ ,  $V$  and  $\sigma_v$  are calculated using Ronn and Verma (1986), see Appendix A for variable definitions and Appendix B for calculation of  $IPP$ ,  $V$  and  $\sigma_v$ .

Panel A: $\Delta IPP = \gamma_0 + \gamma_1 \Delta\sigma_v + \gamma_2 \Delta D/V + \varepsilon_1$		
Variable	Estimate	Standard Error
<i>Intercept</i>	0.0342 ***	0.0033
$\sigma_v$	0.1763 ***	0.0357
$D/V$	0.0594 ***	0.0164
$R^2$	0.5797	
<i>NOBS</i>	3,431	
Panel B: $\Delta D/V = \alpha_0 + \alpha_1 \Delta\sigma_v + \varepsilon_2$		
Variable	Estimate	Standard Error
<i>Intercept</i>	0.2277 ***	0.0173
$\sigma_v$	-1.1135 ***	0.2659
$R^2$	0.4043	
<i>NOBS</i>	3,431	
Panel C: $\Delta IPP = \beta_0 + \beta_1 \Delta\sigma_v + \varepsilon_3$		
Variable	Estimate	Standard Error
<i>Intercept</i>	0.0478 ***	0.0031
$\sigma_v$	0.1101 ***	0.0341
$R^2$	0.3830	
<i>NOBS</i>	3,431	

\*\*\*, \*\*, \* indicates significance at the 0.01, 0.05, and 0.10 level respectively (two-sided).

**Table 3****Baseline Regression of Income Smoothing by Banks: All Countries Pooled Together**

To empirically examine the observed income smoothing at the bank-level we estimate the following Income Smoothing regression:

$$LLP_{itj} = \delta_0 + \delta_1 Ebllp_{itj} + \delta_2 \Delta NPL_{itj} + \delta_3 NCO_{itj} + \delta_4 Cap_{itj} + \delta_5 Size_{itj} + \delta_6 LLR_{itj} + \delta_7 Loansa_{itj} + \delta_8 \Delta GDP_{tj} + \delta_9 RealLoan\_Growth_{itj} + Fixed\ Effects + \varepsilon$$

where *LLP* is defined as loan loss provision scaled by lagged loans outstanding; *Ebllp* is earnings before loan loss provisions and tax scaled by lagged loans outstanding;  $\Delta NPL$  is the change in non-performing loans scaled by lagged loans outstanding; *NCO* is net charge-offs scaled by lagged loans outstanding; *CAP* is equity divided by total assets; *Size* is the log of total assets; *LLR* is the lagged level of loan loss reserves scaled by lagged loans outstanding; *Loansa* is total loans outstanding divided by total assets;  $\Delta GDP$  is the growth in GDP per capita; *RealLoan\_Growth* is the change in loans outstanding deflated by CPI.

<i>Dependant Variable: LLP</i>	
Variable	I
<i>Intercept</i>	0.0179 (0.026)
<i>Ebllp</i>	0.0439 *** (0.013)
$\Delta NPL$	0.0904 *** (0.018)
<i>NCO</i>	-0.0333 (0.056)
<i>CAP</i>	0.0123 (0.012)
<i>Size</i>	0.0007 *** (0.000)
<i>LLR</i>	0.0189 (0.055)
<i>Loansa</i>	0.0076 ** (0.003)
$\Delta GDP$	-0.0015 *** (0.001)
<i>RealLoan_Growth</i>	-0.0037 (0.003)
<hr/>	
$R^2$	0.7708
<i>NOBS</i>	5,736
<i>Fixed Effects</i>	Country, Year, Type

\*\*\*, \*\*, \* indicate significance at the 0.01, 0.05, and 0.10 level respectively (two-sided).

Standard errors are reported in the parentheses and are clustered at the country-level.

**Table 4**

**Estimated Relation Between Bank Risk-Shifting and Smoothing**

The following analysis follows Duan et al. (1992) estimation of observed risk-shifting where the measure of observed risk-shifting is the  $\beta_1$  from the following model:  $\Delta IPP_{itj} = \beta_0 + \beta_1 \Delta \sigma_{v,itj} + \varepsilon$ . Where  $\Delta IPP$  is the change in the fair value of the deposit insurance put-option and  $\Delta \sigma_v$  is the change in the instantaneous standard deviation in market value of assets (computed following Ronn and Verma, 1986). The reported analysis is estimated in a pooled regression clustering standard errors (in parentheses) at the country-level:

$$\Delta IPP_{itj} = \beta_0 + \beta_1 \Delta \sigma_{v,itj} + \beta_2 SMOOTHING_j + \beta_3 \Delta \sigma_{v,itj} * SMOOTHING_j + \sum_{n=4}^{11} \delta_n Main_n + \sum_{n=11}^{18} \delta_n \Delta \sigma_{v,itj} * Main_n + \sum_{t=1994}^{2005} Year\ Fixed\ Effect_t + \sum_{p=1}^8 Bank\ Type_p + \varepsilon$$

<i>Dependent Variable: <math>\Delta IPP</math></i>			
Variable	I	II	III
<b>Interactions w/ <math>\Delta \sigma_v</math></b>			
<i>Smoothing</i>		0.2174 *** (0.061)	0.1526 *** (0.057)
<i>SupervisoryPower</i>		0.0229 *** (0.007)	0.0208 *** (0.006)
<i>CapIndex</i>		-0.0305 * (0.018)	-0.0293 * (0.017)
<i>Credibility</i>		0.0096 (0.038)	-0.0058 (0.037)
<i>DI</i>	0.1003 ** (0.041)	-0.0285 (0.051)	-0.0181 (0.048)
<i>StateBank</i>		0.0887 (0.092)	0.1084 (0.092)
<i>InvestorRights</i>		-0.0011 (0.013)	-0.0001 (0.012)
<i>CreditorRights</i>		0.0075 (0.015)	0.0121 (0.014)
<i>JudicialEfficiency</i>		-0.0155 *** (0.004)	-0.0160 *** (0.003)
<b>Main Effects</b>			
$\Delta \sigma_v$	0.0293	0.0403	0.1090
<i>Smoothing</i>		0.0000	0.0011
<i>SupervisoryPower</i>		-0.0002	-0.0002
<i>CapIndex</i>		-0.0004	-0.0005
<i>Credibility</i>		-0.0034	-0.0028
<i>DI</i>	0.0007	0.0003	-0.0001
<i>StateBank</i>		0.0009	0.0005
<i>InvestorRights</i>		-0.0004	-0.0007
<i>CreditorRights</i>		0.0013	0.0013
<i>JudicialEfficiency</i>		0.0004 *	0.0003
<b>Higher Order Terms</b>			
$\Delta \sigma_v^2$			-0.0186 **
$R^2$	0.4037	0.5890	0.5979
<i>NOBS</i>	3,431	3,431	3,431

\*\*\*, \*\*, \* indicate significance at the 0.01, 0.05, and 0.10 level respectively (two-sided).

**Table 5****The Effect of Smoothing on the Sensitivity of Leverage ( $\Delta D/V$ ) to Risk ( $\Delta\sigma_v$ )**

The following analysis follows Duan et al. (1992) estimation of leverage sensitivity to risk, where the sensitivity measure is the  $\alpha_1$  from:  $\Delta D/V_{itj} = \alpha_0 + \alpha_1 \Delta\sigma_{v,itj} + \varepsilon$ . Where  $\Delta D/V$  is the change in the ratio of total debt divided by market value of assets.  $\Delta\sigma_v$  is the change in the instantaneous standard deviation in market value of assets (computed following Ronn and Verma, 1986). The reported analysis is estimated in a pooled regression clustering standard errors (in parentheses) at the country-level:

$$\Delta D/V_{itj} = \alpha_0 + \alpha_1 \Delta\sigma_{v,itj} + \alpha_2 \text{SMOOTHING}_j + \alpha_3 \Delta\sigma_{v,itj} * \text{SMOOTHING}_j + \sum_{n=4}^{11} b_n \text{Main}_n + \sum_{n=11}^{18} b_n \Delta\sigma_{v,itj} * \text{Main}_n + \sum_{t=1994}^{2005} \text{Year Fixed Effect}_t + \sum_{p=1}^8 \text{Bank Type}_p + \varepsilon$$

<i>Dependent Variable: <math>\Delta D/V</math></i>	
Variable	I
<b>Interactions w/ <math>\Delta\sigma_v</math></b>	
<i>Smoothing</i>	2.0658 *** (0.489)
<i>SupervisoryPower</i>	0.0804 (0.060)
<i>CapIndex</i>	-0.2259 * (0.124)
<i>Credibility</i>	-0.1196 (0.329)
<i>DI</i>	-1.2902 ** (0.578)
<i>StateBank</i>	0.6809 (0.769)
<i>InvestorRights</i>	-0.3031 (0.114)
<i>CreditorRights</i>	0.1199 (0.119)
<i>JudicialEfficiency</i>	-0.1510 *** (0.035)
<b>Main Effects</b>	
$\Delta\sigma_v$	2.1458
<i>Smoothing</i>	0.0408
<i>SupervisoryPower</i>	-0.0024
<i>CapIndex</i>	-0.0050 *
<i>Credibility</i>	-0.0339 ***
<i>DI</i>	0.0045
<i>StateBank</i>	0.0078
<i>InvestorRights</i>	-0.0015
<i>CreditorRights</i>	0.0149 ***
<i>JudicialEfficiency</i>	0.0022
$R^2$	0.5815
<i>NOBS</i>	3,431

\*\*\*, \*\*, \* indicate significance at the 0.01, 0.05, and 0.10 level respectively (two-sided).

**Table 6****The Effect of Income Smoothing on the Partial Derivatives  $\frac{\partial IPP}{\partial \sigma_v}$  and  $\frac{\partial IPP}{\partial D/V}$** 

The estimation of the effect of accounting transparency (Smoothing) on the incentive to risk-shift is measure by the marginal effect of Smoothing on  $\gamma_1$  and  $\gamma_2$  from the following regression:

$$\Delta IPP_{itj} = \gamma_0 + \gamma_1 \Delta \sigma_{v,itj} + \gamma_2 \Delta \frac{D}{V}_{itj} + \gamma_3 SMOOTHING_j + \gamma_4 \Delta \sigma_{v,itj} * SMOOTHING_j + \gamma_5 \Delta \frac{D}{V}_{itj} * SMOOTHING_j + \varepsilon$$

Where  $\Delta IPP$  is the change in the fair value of the deposit insurance put-option,  $\Delta \sigma_v$  is the change in the instantaneous standard deviation in market value of asset,  $\Delta \frac{D}{V}$  is defined as the change in the ratio of the total face value of liabilities divided by market value of assets ( $V$  and  $\sigma_v$  are computed following Ronn and Verma, 1986). The level of significance is determined using standard errors that have been clustered at the country-level.

<i>Dependent Variable: <math>\Delta IPP</math></i>		
Variable	I	II
$\Delta \sigma_v$	0.344	0.380
$\Delta D/V$	0.344 *	0.348 *
<hr/>		
<i>Interaction w/ <math>\Delta \sigma_v</math></i>		
<i>Smoothing</i>	0.325 ***	0.249 ***
<i>SupervisoryPower</i>	0.032 ***	0.028 ***
<i>CapIndex</i>	-0.041 **	-0.040 **
<i>Credibility</i>	-0.055	-0.060
<i>DI</i>	-0.065	-0.051
<i>StateBank</i>	0.184 **	0.209 **
<i>InvestorRights</i>	-0.014	-0.011
<i>CreditorRights</i>	0.044 ***	0.044 ***
<i>JudicialEfficiency</i>	-0.020 ***	-0.021 ***
<hr/>		
<i>Interaction w/ <math>\Delta D/V</math></i>		
<i>Smoothing</i>	0.066 *	0.040
<i>SupervisoryPower</i>	0.013 **	0.012 **
<i>CapIndex</i>	-0.022 **	-0.021 **
<i>Credibility</i>	-0.039	-0.038
<i>DI</i>	-0.035	-0.030
<i>StateBank</i>	0.090 *	0.098 **
<i>InvestorRights</i>	-0.017 *	-0.015
<i>CreditorRights</i>	0.021 **	0.021 **
<i>JudicialEfficiency</i>	-0.013 ***	-0.014 ***
<hr/>		
<i>Higher Order Terms</i>		
$\Delta \sigma_v^2$		-0.016 **
$\Delta D/V^2$		0.010 **
<hr/>		
$R^2$	0.8211	0.8280
<i>NOBS</i>	3,431	3,431

\*\*\*, \*\*, \* indicate significance at the 0.01, 0.05, and 0.10 level respectively (two-sided).

**Table 7: The Effect of  $\beta_1$  and  $|\alpha_1|$  on Observed Income Smoothing: An Alternative Specification**  
 To empirically examine the observed income smoothing at the bank-level and Alpha (Beta) we estimate the following Income Smoothing regression:

$$LLP_{itj} = \delta_0 + \delta_1 Ebllp_{itj} + \delta_2 \beta_1^j (|\alpha_1^j|) + \delta_3 Ebllp_{itj} * \beta_1^j (|\alpha_1^j|) + \delta_4 \Delta\sigma_{v,itj} + \delta_5 \Delta NPL_{itj} + \delta_6 NCO_{itj} \\ + \delta_7 Cap_{itj} + \delta_8 Size_{itj} + \delta_9 LLR_{itj} + \delta_{10} Loansa_{itj} + \delta_{11} \Delta GDP_{tj} + \delta_{12} RealLoan\_Growth_{itj} \\ + Fixed\ Effects + \varepsilon$$

where LLP is defined as loan loss provision scaled by lagged loans outstanding; Ebllp is earnings before loan loss provisions and tax scaled by lagged loans outstanding;  $|\alpha_1|$  is the absolute value of the by country estimated disciplinary response coefficient; Beta is the by country estimate of observed risk-shifting;  $\Delta\sigma_v$  is the annual change in the standard deviation of asset volatility;  $\Delta NPL$  is the change in non-performing loans scaled by lagged loans outstanding; NCO is net charge-offs scaled by lagged loans outstanding; CAP is equity divided by total assets; Size is the log of total assets; LLR is the lagged level of loan loss reserves scaled by lagged loans outstanding; Loansa is total loans outstanding divided by total assets;  $\Delta GDP$  is the growth in GDP per capita; RealLoan\_Growth is the change in loans outstanding deflated by CPI; Fixed Effects include Type and Year; Errors are clustered at the Country-level to control for the possible lack of independence.

<i>Dependant Variable: LLP</i>			
Variable	I	II	III
<i>Intercept</i>	-0.0157 (0.016)	-0.0526 (0.191)	-0.0320 (0.161)
<i>Ebllp</i>	0.1272 *** (0.016)	0.2932 *** (0.068)	0.0701 (0.047)
<b>Interactions</b>			
<i> \alpha_1 *Ebllp</i>		-0.0877 *** (0.020)	
<i>Beta*Ebllp</i>			1.3755 ** (0.546)
<b>Main Effects</b>			
<i> \alpha_1  ( or Beta)</i>		-0.0007 (0.001)	0.0283 (0.034)
$\Delta\sigma_v$	0.0000 *** (0.000)	-0.0023 (0.004)	-0.0046 (0.004)
$\Delta NPL$	0.1013 *** (0.030)	0.0971 *** (0.035)	0.0981 *** (0.035)
<i>NCF</i>	0.3025 *** (0.089)	0.4646 *** (0.085)	0.5130 *** (0.092)
<i>CAP</i>	0.0090 (0.009)	0.0040 (0.011)	0.0043 (0.012)
<i>Size</i>	-0.0003 (0.000)	0.0000 (0.000)	-0.0001 (0.000)
<i>LLR</i>	-0.0533 * (0.031)	-0.0736 *** (0.021)	-0.0679 *** (0.025)
<i>Loansa</i>	0.0081 ** (0.004)	0.0031 ** (0.001)	0.0072 *** (0.001)
$\Delta GDP$	-0.0016 *** (0.001)	-0.0005 (0.000)	-0.0008 (0.001)
<i>RealLoanGrowth</i>	0.0019 (0.002)	-0.0001 (0.002)	0.0006 (0.002)
<i>R-squared</i>	0.8600	0.6719	0.6565
<i>N</i>	2,557	2,384	2,384

\*\*\*, \*\*, \* indicate significance at the 0.01, 0.05, and 0.10 level respectively (two-sided).

**Table 8****The Relation between Timeliness on Observed Bank Risk-Shifting**

The following analysis follows Duan et al. (1992) estimation of observed risk-shifting where the measure of observed risk-shifting is the  $\beta_1$  from the following model:  $\Delta IPP_{itj} = \beta_0 + \beta_1 \Delta \sigma_{v,itj} + \varepsilon$ . Where  $\Delta IPP$  is the change in the fair value of the deposit insurance put-option and  $\Delta \sigma_v$  is the change in the instantaneous standard deviation in market value of assets (computed following Ronn and Verma, 1986). The reported analysis is estimated in a pooled regression clustering standard errors (in parentheses) at the country-level:

$$\Delta IPP_{itj} = \beta_0 + \beta_1 \Delta \sigma_{v,itj} + \beta_2 \text{Timeliness}_j + \beta_3 \Delta \sigma_{v,itj} * \text{Timeliness}_j + \sum_{n=4}^{11} \delta_n \text{Main}_n + \sum_{n=11}^{18} \delta_n \Delta \sigma_{v,itj} * \text{Main}_n + \sum_{t=1994}^{2005} \text{Year Fixed Effect}_t + \sum_{p=1}^8 \text{Bank Type}_p + \varepsilon$$

<i>Dependent Variable: <math>\Delta IPP</math></i>	
Variable	I
<b>Interactions w/ <math>\Delta \sigma_v</math></b>	
<i>Timeliness</i>	-0.1559 *** (0.037)
<i>SupervisoryPower</i>	0.0195 *** (0.005)
<i>CapIndex</i>	-0.0082 (0.018)
<i>Credibility</i>	0.0606 (0.038)
<i>DI</i>	-0.0175 (0.035)
<i>StateBank</i>	0.1428 * (0.079)
<i>InvestorRights</i>	-0.0103 (0.010)
<i>CreditorRights</i>	-0.0091 (0.009)
<i>JudicialEfficiency</i>	-0.0076 ** (0.003)
<b>Main Effects</b>	
$\Delta \sigma_v$	-0.2062
<i>Timeliness</i>	0.0096 *
<i>SupervisoryPower</i>	-0.0009 *
<i>CapIndex</i>	-0.0004
<i>Credibility</i>	-0.0050 *
<i>DI</i>	0.0013
<i>StateBank</i>	-0.0013
<i>InvestorRights</i>	0.0000
<i>CreditorRights</i>	0.0010
<i>JudicialEfficiency</i>	0.0005 *
$R^2$	0.5886
<i>NOBS</i>	3,397

\*\*\*, \*\*, \* indicate significance at the 0.01, 0.05, and 0.10 level respectively (two-sided).