Banking Fragility and Disclosure: International Evidence

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Abstract

Motivated by recent public policy debates on the role of market discipline in banking stability, the study examines the impact of greater bank disclosure in mitigating the likelihood of systemic banking crisis. In a cross sectional study of banking systems across forty-nine countries in the nineties, it finds evidence that banking crises are less likely in countries with regulatory regimes that require extensive bank disclosure and stringent auditing.

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Key Words: Banking Crisis, Disclosure, Audit Stringency

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I. Introduction

Although banking crises[1] have been a common feature of banking systems for a long time – the U.S. alone experienced eleven banking panics between 1800 and the beginning of World War I (Baim and Calomiris (2001)) – the crises of recent times have been rather severe. The cost of bailing out troubled banks in a banking crisis ranges between 20 and 50 percent of a country's GDP, with a resolution time that can extend up to nine years (Honohan and Klingebial (2000))[2]. Hoggarth and Saport (2001) report the average fiscal costs of banking crisis resolution to be about 16% of GDP, and the cumulative real output losses from a banking crisis to be more than 17% of GDP. As an example, the cost to Indonesia of resolving the crisis of 1997 is estimated at 50% of its GDP. Banking problems are also believed to be at the center of the recent financial upheaval that engulfed emerging and transition economies (Caprio and Klingebial (1996)).

These financial crises of the late 1990s coupled with recent corporate scandals around the world have brought to the fore the public debate on the need to strengthen market discipline through greater disclosure and transparency. Enhanced transparency via greater disclosure of accurate and timely information about banks is believed to improve market discipline, which could reduce the likelihood of banking crisis. This paper investigates empirically the impact of greater disclosure on banking system stability.

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[1]Banking crisis, in this study, refers to ***systemic*** banking crisis. Banking instability is the existence of adverse impact from dysfunctions in the banking system or the risk thereof (Canoy et al. (2001), and encompasses both individual bank instability (bank failure), and banking crisis. The former refers to a failure of a financial institution, and the latter describes the situation where an individual financial institution failure leads to many *simultaneous* failures of other financial institutions. This is different from 'contagion' where an individual failure leads to 'one or more *sequential* failures'. Banking crisis could be 'systemic' or borderline. 'Systemic' banking crises are episodes of crises where most or all bank capital in the system is exhausted (Caprio and Klingebial (1996). The detailed criteria used for classifying are provided in section II below.

[2] By contrast, the U.S. banking crisis of the Great Depression of the 1930s, when almost a quarter of the banks were bankrupted, the negative net worth of the failed banks was only 3 percent of GDP (Beim and Calomiris (2001)). Other countries had similar histories of both infrequent banking crises and low cost of banking collapse. In the pre World-War I era, the countries that experienced major banking crisis include Argentina (in 1890), Australia (1893), Brazil (1892), Italy (1893) and Norway (1901), but the negative net worth of their failed banks never exceeded 1 percent of GDP, nor the costs of cleaning up exceeded 10 percent of GDP. In fact, countries such as Canada, Germany, Japan, Mexico, Russia, and Sweden avoided banking crisis completely during that era (Beim and Calomiris (2001)).

The role of disclosure to banking system stability is not well understood. Economic theory provides conflicting predictions about the benefits of greater disclosure. The 'Disclosure-Stability' view holds that greater disclosure and the consequent transparency facilitates efficient allocation of resources by improving market discipline. Increased transparency permits greater market discipline whereby strong banks are rewarded for their risk management and performance and weak banks are penalized with higher costs of raising capital, thereby enabling early detection of weak banks before they drag the entire banking system into crisis. That is, market discipline provides incentives for banks to manage their risks prudently and operate efficiently, thus reducing the severity and frequency of bank failures.

On the other hand, the 'Disclosure-Fragility' view holds that disclosure may lead to interpretation of specific information about banks' financial conditions unjustifiably as indicator of widespread problems in the banking system, thereby leading to bank runs or stock market collapse (Calomiris and Mason (1997), Gilbert and Vaughan (1998) and Kaufman (1994)). Disclosure of financial problems at a bank may lead to the bank's failure through a bank run. It may also lead to an overreaction in the financial markets, jeopardizing the ability of the bank to raise capital. This lack of investor confidence could spread to the entire banking system, causing systemic banking failure. In that case, rather than providing market discipline to improve resource allocation, more disclosure may lead to the collapse of the banking system, causing failure of both strong and weak banks alike. On the other hand, others argue that disclosure of bank problems, in fact, leads to quick recovery from crisis, thus reducing realized loss (see, e.g., Rosengren (1998)). It would force banking consolidation, transfer of problem assets and closure of insolvent banks, speeding the recovery of the banking sector.

The theoretical ambiguities surrounding the impacts of greater disclosure to bank stability are reflected in the public policy debate and the reluctance of countries in adopting pro-disclosure policies. International organizations such as the Basle Committee, the World Bank, and the International Monetary Fund recommend countries to enhance the transparency of their banking sectors by improving disclosure. Yet, despite these calls, disclosure and transparency is not always the hallmark of banking sector reform policies in all countries. Japan, for example, adopted a policy of less disclosure recently while undergoing a protracted period of banking crisis. Since 1998, banks in Japan are required to report securities at book rather than at market value (understating liabilities), to provide own estimates of market value of real estate holdings, and to net loans against deposits to same customers (underreporting risk) (Jordan et al. (1999)).

The study of bank disclosure and bank performance is especially important in light of the ongoing public policy initiatives that rely on disclosure as a centerpiece of regulatory reforms in the banking sector. The Basel committee has finalized a new framework for bank capital adequacy. The New Basel Capital Accord relies on minimum capital requirement (pillar 1) and supervisory review of bank assessment of capital relative to risk (pillar 2), complemented by market discipline via greater disclosure requirements (pillar 3) (see BCBS (2003)). By providing flexibility for banks in measuring their risk and capital adequacy, the New Accord brought market discipline into focus as a supplemental tool in bank capital regulation.

Despite its importance in banking sector policy and the surrounding theoretical ambiguity, there is little cross-country empirical evidence on the *role* of *disclosure* in bank system *stability*. For the U.S., Jordan et al. (1999) examine the impact of disclosing supervisory information on troubled U.S. banks during financial crisis, and report that doing so does not lead to destabilization of the banking system. Baumann and Nier (2003) examine the relation between

disclosure and bank capital and risk, and report an inverse relation between disclosure and bank risk-taking. They do not study banking crises at a national level however. There is a growing empirical literature on banking crises; yet the literature does not address the role of disclosure regulations. Demirguc-Kunt and Detragiache (1998) and Beck et al. (2003) investigate respectively the role of macroeconomic stability and banking regulation in banking crisis. Cull, Senbet and Sorge (2005) and Demirguc-Kunt and Detragiache (2002) examine the relations between deposit insurance design features and banking crises. Barth, Caprio and Levine (2004) explore the relation between bank regulation and banking crisis, but they do not address the issue of disclosure directly. In the context of the effectiveness of banking regulation, they examine the degree of private monitoring on bank performance and fragility. They find that while private monitoring increases bank performance, it has no association with bank fragility, and pose the issue as a puzzle. This study focuses exclusively on financial disclosure and audit stringency as part of private monitoring, and finds that this has indeed a robust positive role in fostering banking system stability. Delving into specific regulatory features, the paper also provides an assessment of the importance of individual disclosure and auditing regulatory provisions in promoting stability. In a companion paper, Tadesse (2005) explores the role of overall transparency that includes both the quality of disclosure and the degree of information gathering activity by investors as well as the extent of information dissemination in the country.

The paper studies the impact of increased bank disclosure requirements and stronger auditing regulatory regime on the likelihood of occurrence of a systemic banking crisis based on data on forty nine countries over the period 1990 through 1997. It examines the impacts of both overall improvements in disclosure and the disclosure of specific items of information relevant to the ability of outside investors to assess bank risk and capital adequacy. Similarly, the study

examines the impacts of improvements in overall external auditing stringency, and of the specific regulatory requirements that improve audit effectiveness. To draw accurate inferences about the impact of disclosure and audit stringency on bank crisis, it controls for a number of factors that may influence banking fragility. Following the literature, it controls for differences in the macro economic environments of banking system, the overall institutional quality of countries, and for differences in bank market structure, such as the degree of competition, concentration, ownership structure, capital regulations, entry regulations, and restrictions on bank activity.

The study finds that the likelihood of systemic banking crisis is, in general, lower in countries with regulations that require higher standards of disclosure. It finds that the likelihood of banking crisis is lower in countries whose banks provide more comprehensive information both in the core standard financial statements and in the supplemental notes. In reference to specific disclosure regulations, banking crisis is less likely in countries that require disclosure of off-balance sheet transactions. The likelihood of banking crisis is also lower in countries that require a more accurate presentation of financial information in general and an accurate presentation of non-performing loans (NPLs) in particular. Consolidated financial reporting is considered to be more accurate (or informative) presentation, and the study finds that regulations that require consolidated financial reporting for related bank activities are associated with greater likelihood of banking system stability.

The impact of greater banking disclosure to banking stability appears to be economically significant. An increase in bank disclosure by one standard deviation reduces the likelihood of banking crisis by about 3.5% per annum. In cost terms, applying this probability to the cumulative output loss of a typical banking crisis episode, the benefit translates to a saving of

about ½ a percent of GDP. These results appear not to be driven by reverse causality and are robust to a battery of sensitivity checks.

The study finds that the likelihood of systemic banking crisis is also lower in countries that require more stringent external auditing of bank financial reporting. In particular, banking crisis is lower in countries where external auditing is made a strong tool of bank supervision by requiring auditors to report to the supervisory agency, and where permitting auditors to meet supervisory agency without the consent of the auditee enhances auditor independence. The study also finds that audit stringency is complementary to bank disclosure in that the contribution of audit stringency to banking system stability is *in addition to* the benefit of bank disclosure.

Overall, the findings are consistent with the 'disclosure-stability' view. While improvements in disclosure in many dimensions are found to be either associated with greater bank stability or to have no significant relation to stability, there is no evidence that greater disclosure is related to banking system fragility. In terms of current public policy, the results provide an empirical support for the New Accord's initiative in requiring greater disclosure as a source of banking system stability. Going forward, however, to enhance the benefits of greater disclosure, the results emphasize the importance of improving the credibility of financial reporting as well. While expanding the scope of bank disclosure, the New Accord fails to provide verification requirements beyond those required for financial reporting, and security registration. The results underscore the value of external auditing stringency in improving transparency and promoting bank stability.

The balance of the paper is organized as follows. Section II provides a detailed description of the data and the methodology. Section III presents the main results and Section IV provides additional robustness tests. Section V provides discussion and concluding remarks.

II. Data and Methodology

A. Data

The study attempts to explain the likelihood of incidence of banking crisis as a function of banking regulations that govern bank disclosure and auditing. To this end, I rely on data from two major sources. Information on incidences of banking crises is obtained from the database of Caprio and Klingebial (2003), which provides comprehensive information on episodes of banking crisis since the 1970s for a large sample of countries. The data on regulation of disclosure and auditing is from a new World Bank database, explained in Barth et al. (2004), and is based on surveys of bank supervisory bodies in the late 1990s. Though, Barth et al. (2004) reports that the regulatory and supervisory environment, in general, does not change significantly over time, it is reasonable to assume that the survey responses reflect the period closest to when the survey was taken (i.e., the 1990s) more accurately than the distant past. For this reason, although the data on banking crises extends to the 1970's, I focus rather on explaining incidence of banking crisis only in the 90s (1990 through 1997). For this period, I cover all countries with data on bank regulation and supervision and data on crises as my sample. This results in a sample size of 49 countries with 21 episodes of crises involving 20 countries. (Appendix I presents the list of countries in the sample and the episodes of crisis in the 1990s.) Below, I explain these data sources and the specific variables in greater detail.

Banking Crises: Caprio and Klingebial (2003) provide data on the occurrences and severity of banking crises for a large sample of countries. Crises are classified as either major (or systemic) or mild (non-systemic). Systemic crises are defined to be episodes in which most or all bank capital in the banking system is exhausted. Consistent with criteria also used in other works (Caprio and Klingebial (2003), Barth et al. (2004), and Demirguc-Kunt (1998)), episodes

are considered systemic if (i) non-performing assets account for more than 10% of total assets or (ii) rescue costs amount to more than 2% of GDP or (iii) the crisis involved large scale nationalizations or (iv) the crisis involved bank runs where emergency measures are taken. I construct a variable, **Crisis**, as an indicator variable that takes 1 if a country has undergone systemic banking crisis in the period 1990 through 1997. As discussed above, the focus on the 1990s is because of the availability of data on disclosure and audit stringency only for this period (to be discussed below under sample selection).

I use two sets of explanatory variables, in addition to the set of control variables, to explain incidence of systemic banking crises (**Crisis**). These are variables on (1) the regulation of disclosure practices, and (2) the regulation of bank auditing.

Regulation of Disclosure Practices: Bank disclosure is mandated in all countries, and the respective supervisory body sanctions the minimum set of disclosure requirements. Data on disclosure requirements is obtained from a recent database on bank supervision and regulation maintained by the World Bank (see, Barth, et al. (2001). The database is constructed based on surveys of national bank regulatory and supervisory authorities in 1998 and 1999. I utilize the survey responses on issues of disclosure and auditing to construct indices of bank disclosure, disclosure informativeness and external audit stringency. The World Bank survey questions on disclosure and auditing regulations are provided in Appendix III.

Bank Disclosure: The focal variable of interest, **Bank Disclosure**, measures the extent and comprehensiveness of financial reporting as required by the banking regulation in the country. From the World bank survey questions about disclosure regulations, I construct this measure based on the responses to the following questions in the World Bank survey: (i) whether bank financial reports in the country should include information on bank risk management

practices, (ii) whether bank disclosure regulations require accurate representation of non-performing loans (NPLs), by requiring accrued income on non-performing loans (NPL) to *not* be reported in the bank's income statement, (iii) whether bank reporting rules promote presentation of comprehensive information by requiring consolidation of financial information between bank and non-bank subsidiaries, and (iv) if bank-reporting regulations encourage full disclosure by requiring that off-balance sheet transactions be disclosed to the public. The responses are coded as values of 1 and 0, and the variable **Bank Disclosure** is constructed as a principal component of the four indicator values. Higher values indicate more comprehensive disclosure as required by bank regulation. This definition of sound disclosure is also consistent with the literature. Rosengren (1998), for example, considers adequate public disclosure of risk management practices and accurate representation of NPLs as attributes of sound disclosure.

Supplemental Reporting: measures the extent of supplementary information (vis-a-vis what is reported in the core financial statements) as required by countries' regulation. Out of the variables that constitute ***Bank Disclosure***, I construct a new variable that summarizes the extent of supplemental information by aggregating the requirement that banks provide information on risk management practices and the requirements for reporting of off-balance sheet transactions to the public. ***Supplemental Reporting*** is a principal component of Risk and Off-Balance Sheet.

In addition to these specific disclosure related variables, I also consider a variable to measure the degree of legal sanctions against bank officials for nonconformance to these regulations. The new variable, ***Director Liability***, aggregates (i) an indicator variable that takes the value 1 if directors in that country are legally liable for misleading information, and (ii) a variable that takes 1 if those legal sanctions have actually been enforced against directors in recent years.

Table 1 and 2 provide a summary of these variables. The disclosure variables exhibit wide variation across countries. **Bank disclosure** is negatively correlated with incidence of banking crisis (though the relation is not statistically significant). The same is true of the relation between crisis and **supplemental information**.

Regulation of Audit Practices: The role of external auditors is critically important in bank disclosure. The benefit of disclosure is that it enables investors (market participants) to make accurate assessment of the firm's financial condition. In their loan decisions, banks collect private information from their customers. However, banks are reluctant to disclose proprietary information about their customers, making it difficult for outsiders, without access to individual loan information, to assess the health of the bank. This is more so in banks that lend to small firms which do not publicly disclose their information. Bank examiners and auditors have access to bank's individual loans and the banks' risk management practices. Hence they play an important role in validating the financial information disclosed by the banks.

Bank supervisory authorities regulate audit practices. Data on audit practices is obtained from the World Bank database on bank supervision and regulation (Barth et al. (2004)). I use survey responses on seven different audit practice measures to construct an aggregate index of external auditing stringency.

External Audit Stringency, the focal variable of interest, measures the degree to which external audits are independent, professional and rigorous as reflected by the regulations that govern bank-auditing practices. From the World bank survey questions about audit-practice regulations, I construct the variable based on the responses to the following questions: (i) whether external audit of banks is a compulsory requirement, (ii) whether the scope of external audit is mandated by the regulation, (iii) whether there is a license requirement for auditors, (iv)

whether it is a requirement that auditors' reports should be reported to supervisory authorities, and (v) whether supervisors can meet external auditors to discuss audit report *without* the banks' approval. The response to each of these questions was coded as 1 or 0. Affirmative response to any of the questions is indicative of greater stringency of a audit regulatory regime, and therefore, coded as 1. The **External-Audit Stringency** variable is constructed as a principal component of the five indicator variables. Independent, professional and rigorous third-party audit provides validation that bank-produced statements represent the financial condition of the bank as is, thereby increasing the credibility of the bank disclosure. To the extent that this enhances the ability of market participants to accurately assess the risk profile and capital adequacy of the bank, and strengthens market discipline, increases in **External-Audit Stringency** as well as each of the component variables would be associated with lower rates of fragility.

In addition to these specific audit quality-related variables, I also consider the legal sanctions against auditors in the case of nonconformance. ***Auditor Liability*** measures the degree of legal sanctions against auditors in the case of nonconformance. I construct a variable by aggregating three variables that reflect legal burdens against auditors: (i) an indicator variable that takes 1 if auditors are legally required to report misconduct by managers/directors to supervisory agency, (ii) a variable that assumes the value 1 if legal action against external auditors be taken by supervisor for negligence, and (iii) a variable on legal enforcement which takes 1 if legal action has been taken against auditor in recent years.

Table 1 and 2 provide summary of the variables. The stringency of external audit varies extensively across countries. Table 1 shows that the External Audit Stringency variable exhibits wide variation ranging in value from –6.725 to 0.554. Countries high on audit stringency tend to

have lower incidence of banking crisis (Table 2). Audit stringency and crisis exhibit significant negative correlation. Other indicators of audit professionalism, independence and audit rigor are all inversely correlated with incidence of crisis (not reported).

Control Variables: To examine the relations between disclosure, audit stringency and banking crises, I control for a number of factors. Following the literature on crises (e.g., Barth et al. (2004), Cull et al. (2005)), I use the average rate of **inflation** and the **external terms of trade** to control for sources of macroeconomic (in) stability that are likely to affect the quality of bank assets. Inflation serves as a proxy for macroeconomic mismanagement that adversely affects the economy and the banking system. A chronically inflationary environment deteriorates the quality of bank assets, with the likely effect of increasing banking crisis probability. External terms of trade captures the macro economic shocks that could adversely affect banks by increasing their non-performing loans. Improvements in terms of trade are expected to be associated with decreases in the likelihood of bank crises. In addition, I include **Per capita GDP** to control for the level of development of the country, and as a proxy for the *quality of overall institutional* environment. Banking sector problems could result from weaknesses in the legal system, which permeates widespread fraud, and/or weaknesses in the administrative capacity that is reflected in loose prudential supervision and regulation of the banking system. Per capita GDP is expected to measure differences across countries on these dimensions.

To check for robustness, we also consider other macro-economic variables as controls. These include real interest rate, foreign exchange reserve and GDP growth, and will be discussed under robustness section below.

In addition, I include measures of banking industry structure since recent research identifies industry structure as having measurable effects on the likelihood of banking crises.

Beck et al. (2003), for example, report that banking crisis is lower in countries with concentrated banking system, and both Beck et al. (2003) and Barth et al. (2004) find that countries with banking industry structure that allows more competition and less regulatory restrictions have lower incidence of bank crises. I use ***bank concentration***, the share of assets of the three largest banks, to control for banking system concentration, and expect to find that concentrated banking would be associated with less likelihood of crisis – a negative coefficient.

As an alternative measure of the banking industry structure, I use a variable, ***bank competition***, which is a measure of banking competitive conduct obtained from Claessens and Laeven (2004). Using a methodology from Panzar and Rosse (1987), they develop an index of competitiveness based on bank-level data in a large cross-section of banking systems, as a sum of the elasticity of bank revenue to changes in input prices. The variable, ***bank competition***, takes values between 1 (perfect competition) and 0 (with less than 1 representing monopolistic competition). Claessens and Laeven (2004) find that banking systems with less entry restrictions, less restriction to foreign bank entry and activity restrictions are more competitive, but find no inverse relation between competitiveness (measured in this way) and bank concentration. Barth et al. (2004) and Beck et al. (2003) report inverse relation between restrictive regulations against entry and activity, and banking crisis. I expect greater ***bank competition*** in the banking system to be associated with lower likelihood of banking crisis.

Additional controls about the institutional environment of banking are also considered as robustness. These include banking regulation on entry requirements to the industry, measures of regulatory restrictions on banking activity, index of banking freedom, and state ownership of banks. These variables will be discussed under robustness section below.

Table 1 summarizes the variables. The data displays enormous variations in the macroeconomic conditions and banking industry structure. Average inflation (log) ranges from 0.01 to 0.46 and, consistent with priors, is positively correlated with incidence of crisis. Bank concentration varies from a low of 19 percent to a high of 100 percent and, consistent with expectations, is associated with bank system stability, as is bank competition which has a significant negative correlation with incidence of crisis (Table 2). As would be expected, Per capita GDP is negatively correlated with incidence of banking crisis.

B. Methodology

I adopt a multivariate logit model of the following form to examine the relation between disclosure and banking fragility, estimating the likelihood of banking-crisis occurrence in a country as a function of a set of explanatory variables of interest, X that represents disclosure and auditing regulatory requirements, and a set of control variables, Z.

$$\ln L = \sum_{i=1}^{N}\sum_{t=1}^{T}\left(crisis_{it} Ln(F(X_{it}\beta; Z_{it}\lambda)\right) + (1 - crisis_{it}) Ln(1 - F(X_{it}\beta; Z_{it}\lambda))$$

β and λ are vectors of parameters of interest to be estimated, and $Crisis_{it}$ is a dummy variable that takes 1 if country i is in a systemic banking crisis in year t, and 0 otherwise. Such a specification conforms earlier studies of banking crises (see, e.g., Demirguc-Kunt et al. (1998, 2002)).

In the main regressions, I define each year for a country as either a crisis year or a non-crisis year, and examine the relation between crisis probability in an average year and country disclosure and auditing variables. Each country is included eight times (1990 through 1997) in a pooled time-series cross section. A concern in this type of specification is that it may introduce a problem of correlated errors (or lack of independence) because crisis episodes may be correlated across years for a country and/or across countries resulting in contagion. I address these methodological issues in the robustness section in a number of ways, including redefining the

crisis event as a single event for a country, specifying the model as a panel with random effects, and estimating it as a cross-country regression.

Another concern is the fact that the disclosure and auditing variables are measured in the late 1990s while the crisis episodes are observed over the 1990 through 1997. This is dictated by problem of data limitation. The first survey of bank regulation on which the disclosure indices are based was conducted in 1997 and the data is not simply available before then. The problem, however, may raise a concern that the disclosure and auditing data would reflect the banks' responses to crises episodes rather than the other way round, hence introducing reverse causality. That is to mean that a country may improve its disclosure environment in response to crises.

One can, however, effectively address, such a reverse causality issue through instrumental variables approach. In the robustness section below, I examine the relation between the exogenous component of bank disclosure and auditing – i.e., that part explainable by exogenous instruments (such as differences in legal origin of countries) – and crisis probability, the dependent variable. In addition, if it were true that a country improves its disclosure after a crisis episode, one would expect, on average, an occurrence of banking crisis to be followed by improvements in disclosure practices – i.e., a positive relation between crisis probability and disclosure. The effect of this data problem would, therefore, be to bias the results in favor of the 'Disclosure-Fragility' hypothesis, and against the 'Disclosure-Stability' thesis. Hence, in the case of a finding of positive relation between crisis probability and disclosure, caution should be exercised in interpreting the results. However, once causality is accounted for, a finding of negative relation would be a strong evidence for the 'Disclosure-Stability' view, given the presumed 'bias' in the data.

With these qualifications, I use the cross-country variation in the disclosure variables as observed in 1997 as a proxy for variations in the disclosure climate during the sample period. That is, it is assumed that, while there is cross-country variation, the relative rankings of the countries in their level of disclosure remains stable over this short period of time. Barth et al. (2004), for example, reports that the regulatory and supervisory environment of which bank disclosure is a consequence does not change *significantly* over time. The sample provides evidence consistent with this assumption. Despite the fact that the crises countries presumably may have improved their disclosure practices, as a group, these countries score significantly lower than the non-crises countries in all measures of bank disclosure and audit stringency. The average value of bank disclosure and audit stringency for crises countries are -0.245and –0.243 respectively while that for non-crisis countries are 0.296 and 0.244 respectively, and the differences are statistically significant at one-percent level.

III. Results

A. Disclosure Requirements and Banking Crises

Table 3 presents the results on the empirical relation between disclosure requirements and banking system stability. The table indicates that greater disclosure requirements reduce the likelihood of suffering a systemic banking crisis. The disclosure variable enters the empirical models with a large statistically significant negative sign. The inverse relation between greater disclosure and banking fragility holds controlling for macroeconomic sources of instability as well as banking industry structure. In column (1) disclosure is associated with lower likelihood of systemic banking crisis controlling for macro-economic sources of bank instability. Column (2) indicates that disclosure lowers the likelihood of banking crisis, controlling for banking industry structure. The results hold in column (3) where I account for both sets of controls.

Crisis probability is lower as well after controlling for the level of countries development as a proxy for overall institutional quality (column (4)).

The results are consistent with the thesis that greater disclosure enhances bank system stability via strengthening market discipline. The impact of greater disclosure to bank stability is economically large. For example, based on the complete model estimates in column (4), increasing disclosure by one standard deviation would lower the likelihood of banking crisis by about 3.5 percent[3]. This is a significant reduction, given that crisis probabilities are very low at any point in time (the mean value is about 6%). Hoggarth and Saport (2001) report the cumulative output loss of the average banking crisis to be about 16 percent of GDP. Applying the crisis-ameliorating probabilities, the impact of greater disclosure would be a saving of roughly about ½ percent of GDP.

With respect to the control variables, confirming economic theory and previous empirical results, improvements in external terms of trade reduces crisis probability while unbridled inflation increases crisis probability. More developed economies are less likely to suffer systemic banking crisis, indicating the positive role of the overall quality of the institutional environment. As predicted, bank concentration lowers banking crisis probability, confirming the results in Beck et al. (2003). Also, as expected, banking crisis is less likely in more competitive banking systems. While this is broadly consistent with earlier findings (Barth et al. (2004)) and Beck et al. (2003)) that regulatory restrictions as to entry and bank activity foster bank fragility, the direct evidence that increased competitive conduct (or competitiveness) lowers the likelihood of banking crisis is a new finding in this paper. The seemingly contradictory findings that both

[3] Noting that the predicted value from the model provides an estimate for $Ln(p_{it}/(1+p_{it})$, increasing Disclosure by one standard deviation (i.e. 0.945), holding the other variables at their mean levels, increases $Ln(p_{it}/(1+p_{it})$ by -3.325 (i.e. -3.519X 0.945). Solving for p_{it}, probability that banking crisis would occur in country i during period t, $p_{it} = e^{-3.325}/(1+e^{-3.325})$, which is equal to 0.0347.

concentrated and competitive markets foster stability could be interpreted as that it is the contestability of markets that matter. Alternatively, large banks through their diversification ability strengthen banking system stability while increased competition curbs the banks' potential extractive tendencies. Overall, the model fits the data well, correctly providing an *in-sample* prediction of crises episodes more than ninety percent of the time. But note that this high level of fit is to the *in-sample* observations based on which the models are estimated, and in no way speaks of predictability of crisis out-of-the-sample.

Panel B of Table 3 explores the disclosure-stability link by focusing on the role of specific disclosure properties. Supplementary information, in addition to the standard financial statements, appears to significantly impact the effectiveness of bank disclosure to stability. Such information, in the form of a detailed discussion of bank risk management practices and off-balance sheet transactions allow informed assessment of bank risk profile by market participants, fostering market disciple to work. Column (5) indicates the impact of this type of information in enhancing banking stability.

In general, specific requirements meant to increase greater accuracy and comprehensiveness of disclosure are associated with higher probability of bank stability. In particular, regulatory requirements that call for consolidated financial statements for banks (Column 7), and requirements for disclosure of off-balance sheet transactions (Column 8) to the public lower the likelihood of bank crises. Requirements for accurate reporting of non-performing loans (Column 6) enters with a negative sign (implying that it reduces bank fragility), but are significant only at 20% level. Similarly, disclosure of risk management methods (Column 9), while enters with the right sign, is not significant at the conventional levels.

Regulations that sanction legal liability on directors for misinformation have no statistically significant impact on fragility (column 10). This may reflect the fact that those sanctions could be covered in the countries' security laws, and hence could be redundant when packaged as bank regulation. To see if the impacts of disclosure requirements on banking stability are simply reflections of the legal sanctions against managers for misinformation, in column (11), I include both the disclosure and the directors' liability variables. Greater disclosure fosters banking system stability after accounting for legal liability.

Overall, the results are consistent with the disclosure-stability view that greater disclosure fosters bank stability via market discipline. The results are also supportive of the goal of the third pillar of the New Basal Capital Accord that aims to encourage market discipline by developing a set of disclosure requirements that allow market participants to assess bank risk positions and capital adequacy. The benefits of the specific recommendations in areas of supplemental reporting, consolidation, and reporting risk methodologies for fostering bank stability are validated by the findings.

B. Regulation of Audit Practices and Banking Crises

Table 4 indicates that regulations that call for stringent external audit of bank-generated information lowers the likelihood of banking crises. External Audit Stringency enters the regressions with a large statistically significant negative coefficient in all specifications. In column (1), greater audit stringency is associated with lower likelihood of systemic banking crisis, controlling for macro-economic sources of bank instability. Column (2) indicates that banking systems with stringent external audit requirements are less vulnerable to crisis, controlling for banking industry structure. The inverse relation between audit stringency and

bank fragility holds in column (3) where I account for both sets of controls. The same holds, when, in addition, I control for countries' level of development.

Evaluating the marginal effects of audit stringency, we see that a one standard deviation increase in the audit variable based on the full model in column (4) results in a decrease in crisis probability by about 25 percent, a much larger effect than the impact of disclosure. However, one should note that a comparison of the two could be misleading as the audit stringency variable has a much wider distribution than the disclosure variable. Nonetheless, the computation provides a sense of how large the economic impact of strengthening audit requirements is.

To evaluate if this effect of audit stringency on bank crisis is simply a proxy for the impact of greater disclosure, column (5) explicitly controls for bank disclosure. More stringent external audit requirements foster bank stability, controlling for greater disclosure. The result indicates that stringent auditing is not a substitute for accurate and comprehensive disclosure. Rather regulations that call for more vigilant external audit complement greater disclosure in fostering banking system stability.

The results also indicate that the control variables act as predicted. The overall effects of bank concentration and bank competition on crisis likelihood are still negative and significant. Terms of trade improvements reduce and higher inflation increases crisis probability. In addition, the models fit the data well, correctly providing an *in-sample* correct identification of episodes of crises up to ninety percent of the time.

Panel B of Table 4 examines the link between auditing stringency and bank system stability further by focusing on specific external auditing-related regulatory requirements. In general, specific requirements meant to increase external audit stringency are associated with lower likelihood of banking crises. Measures meant to represent strengthening of auditor

independence appear to be most important (columns (7) and (8). These are the requirements for external audit reports to be submitted to supervisory authorities, and the requirement that bank supervisory authorities can meet external auditors to discuss audit reports *without* bank approval. Regulations that set standards about the amount and extent of audit (column (6)) is not statistically related to bank stability (though the variable carries the right sign). I do not report on the impacts of having compulsory auditing and the requirements for auditors to be licensed because, in the sample, almost all countries (except Italy) require audited financial statements and licensed or certified auditors. The variables do not exhibit cross-country variation.

Regulations that sanction additional legal liability against auditors and enforcement of those sanctions do not appear to materially affect bank stability. Again, it might be that those sanctions are covered in the countries' security laws and could be redundant in banking regulations. To see if the impact of external audit stringency to banking stability is merely a reflection of the legal sanctions against auditors, column (10) includes both auditor liability and audit stringency. External audit stringency robustly reduces crisis probability controlling for auditor liability.

The findings support the disclosure-stability view in that stringent external audit complements greater disclosure in fostering bank stability. The results are consistent with the notion that external audit add value to market discipline by providing third-party verification of information that banks are reluctant to release to the public voluntarily. In their loan decisions, banks collect private information from their customers. Banks are reluctant to disclose proprietary information about their customers, making it difficult for outsiders, without access to individual loan information, to assess the health of the bank. External auditors have access to bank's individual loans and the banks' risk management practices. By validating through their

audit report, external auditors enrich the information environment, allowing investors to assess bank health, and market discipline to work in fostering bank stability.

In this respect, the New Basal Capital Accord, while requiring extensive disclosure, does not recommend external audit beyond required for financial reporting purposes. The evidence suggests that there may be value in extending audit requirements to cover the newly required disclosure.

IV. Robustness Checks

To ensure accurate inference and avoid mechanical explanations for the main results so far, I provide a series of sensitivity checks in this section. First, in Table 5, I examine the sensitivity of the results to inclusion of variables omitted in the main regressions. I consider both macro-economic (Panel A) and institutional variables (Panel B). The regression results in all models include all explanatory and control variables in the basic regression (i.e., Bank Concentration, Bank Competition, Inflation, Terms of Trade, and per capita GDP). To conserve space, I report the coefficients of the new variables and the focal variables of interest – that is, of the disclosure and audit variables only.

Economic theory predicts that macro economic shocks that adversely affect the economic performance of bank borrowers, whose impacts cannot be diversified away by the banks, would be positively related to bank fragility and incidences of crises. Among these economic shocks, I include in the main regressions shocks to external terms of trade and inflation. Another variable that may capture adverse macro economic shocks that hurt banks via increasing non-performing loans may be the general output downturns related to the business cycle. In column (1) of Table 5, I include a measure of the business cycle, the growth rate in real GDP, in the main regression.

The main results that disclosure and audit stringency reduce crisis probability are robust. Growth in the GDP does not enter significantly.

Bank profitability is partly a function of the costs of funds the bank pays on its deposits. High interest rate could increase the cost of funds for the bank. In addition, high interest rates could increase the default rate of bank borrowers, thus reducing the value of bank assets. To control for the banks cost of funds, I include the short-term real interest rate in the country in columns (2), in addition to the control variables of the main regressions. The main results of the paper that bank disclosure and auditing reduces crisis probability remain robust. Real interest rate, while carrying the correct sign in the regressions, does not enter with statistical significance.

The probability of systemic banking crisis can also be affected by the vulnerability of the banking system to sudden capital outflows from the country. In countries particularly with fixed exchange rate regimes, a general lack of confidence by foreign investors, or a mismatch of foreign and local rates of return on investments, may lead to sudden outflows of foreign capital, which could lead to illiquidity at the central bank and banking crisis, when investors convert their local deposits into foreign currency. To control for the potential effects of sudden capital outflows, I include as a variable the ratio of M2 to foreign exchange reserves in column (3). The variable captures the extent to which the liabilities of the banking system are backed by international reserves. During currency crisis, investors may rush to convert their domestic deposits into foreign currency so that the ratio measures the ability of the central bank to meet these demands. Calvo (1996) considers this ratio as a good predictor of a country's vulnerability to balance of payments crises. The main results of the paper are robust to accounting for this variable. Consistent with the theory, external vulnerability as measured by M2 to reserve ratio significantly increases crisis probability. In column (4), the main results hold when all the three

new variables (GDP growth, real interest rate and M2/reserve ratio) are included together in the regression.

In addition to macro-economic factors, the main regressions control for the institutional and regulatory environments of the banking sector. As additional robustness, Panel B checks for the sensitivity of the main results to other institutional features not controlled for in the regressions. I explore the impacts of the overall institutional environment of banks and bank ownership on bank fragility. First, I check if using direct measures of banking competition would matter. In addition to the bank concentration and competition measures used earlier, column (5) includes a measure of restriction to enter the banking industry from Barth et al. (2001). Consistent with previous findings (e.g., Beck et al. (2003)), countries with fewer hurdles to entry to the banking sector are less likely to experience banking crisis. The main result that disclosure reduces crisis probability is robust. Column (6) uses a measure of regulatory restrictions on bank activity. The index measures the relative ease with which banks can engage in various economic activities including securities, real estate and insurance markets. Column (7) uses instead an index of bank freedom. The main result remains robust. Columns (8) through (10) consider a measure of state ownership in banking, in combination with measures of entry and activity restrictions. Again, the main results are robust to controlling for the ownership structure in the banking system. Consistent with expectations and previous research (e.g., Beck et al. (2003), extensive government ownership in the banking sector is associated with bank fragility. Demirguc-Kunt et al. (2002) report that explicit deposit insurance increases (weakly) banking instability via exasperating the risk-shifting incentives of banks. Eichengreen and Arteta (2000), on the other hand, report a positive effect of explicit insurance to banking stability. To account for the incentive effects of deposit insurance features, I include an indicator variable for explicit

deposit insurance countries, similar to the way Demirguc-Kunt et al. (2002) did. The results, under column (11) are robust; regulated disclosure and audit stringency reduce crisis probability, controlling for the design feature of the banking safety[4].

In addition to the selection of control variables, the research design and the specification of the empirical methodology may influence the reported results. In Table 6, I explore the sensitivity of the results to changes in the research design and methodology. To begin, the main results of the paper, the inverse relation between disclosure and banking system fragility and between external audit stringency and fragility is robust to measuring the focal variables – **Bank Disclosure** and **External Audit Stringency** - differently. In columns (1) through (3) of Table 6, I measure **Bank Disclosure** and **External Audit Stringency** as sums of the component indicator variables rather than as principal components. The effect of greater disclosure and audit stringency on crisis likelihood is negative and very significant.

In the main regression, a crisis event in a country is defined as any year in the sample period, 1990 through 1997, in which the country was in crisis. This means that each country is included seven times in a pooled time-series cross section, and the year in which the country was in crisis was coded as a crisis year. Such a design may raise some concerns. The first is that it is very difficult to ascertain the beginning and the end of a crisis episode, and thus the designation of a particular year as a crisis year may not be precise. Second, to the extent that crisis events in contagious years may be correlated, the design may introduce a lack of independence in the error terms. Columns (3) through (6), explore the robustness of the results for alternative specifications that address these issues.

[4] The maximum likelihood iterations fail to converge under reasonable boundary conditions for the specification under column (11). The result is reported for completeness.

In columns (4), I define the crisis event more broadly so that if a country experiences a banking crisis in any year between 1990 and 1997, it is considered a crisis country for the entire sample period. Hence the twenty countries that went through crises were considered as if they experienced crisis in every year of the sample period. The results show that changing the definition of the crisis event in this manner does not affect the main results. The effects of greater bank disclosure and audit stringency remain negative and highly significant.

Columns (5) consider a rather narrow definition of the crisis event in that when the crisis period lasts more than a year, I define as the crisis year (event) only the first year of the crisis period and *exclude* the subsequent crisis years from the analysis. Doing so reduces the sample size considerably, but alleviates the lack-of-independence problem. It has also an advantage of reducing some reverse causality concerns that may arise when a country undergoes multiple years of crisis – the macroeconomic environment in the subsequent years during the crisis period may be influenced by the onset of the crisis. Dropping the subsequent years entirely reduces this type of reverse causality. The impact of bank disclosure is unaffected by such a change in the design[5]. Hence, the main results of the paper, the inverse relation between bank disclosure and fragility and between audit stringency and fragility are robust to defining the crisis episodes differently.

Column (6) checks whether the main findings are sensitive to whether a banking system has experienced recent crisis. I include an indicator variable that takes 1 if the country has gone through a banking crisis in the 80s. The results hold controlling for recent crisis history.

In addition to the concerns related to the way the crisis event was defined, it might be argued that, because there could be a number of factors that induce banking crisis, the observed

[5] I also run a cross-sectional specification where each county enters only once as a crisis or no-crisis country. The results do not change, though for reasonable parameters the likelihood function fails to converge in some cases.

result might still be a reflection of omitted explanatory variables that are correlated with the disclosure variables. The potential variables are too many to feasibly include, and even if it were feasible, the variables would be highly correlated with each other making identification of the effects of any one variable difficult. The main regression attempts to control for the key macro-economic and institutional variables suggested in economic theory. Table 5 above controls for additional variables. However, to effectively address both the potential omitted variables and the problem of lack-of-independence in the error terms, Columns (7) estimates the original model using a panel data methodology, specifying the *latent* country-related and time-related sources of variations on the dependent variable, crisis, as *random* effects. The random-effects panel specification has two advantages: (i) it accounts for intra-country and intra-year correlations in the error terms, and (ii) it properly controls for *all other* non-observable country-related and time-related sources of crisis probability. The model accounts for any omitted country and time factor. The results show that banking disclosure and audit stringency has robust negative impacts on banking fragility.

Finally, the results from the multivariate logistic regression do not explicitly control for the potential for endogeneity. As explained above, I use banking- disclosure variables drawn from the period after when we observe the countries' crises experiences. This may raise a concern that the disclosure data would reflect the banks' responses to crises episodes, hence introducing reverse causality. If it is true that a country improves its disclosure after a crisis episode, we would expect an occurrence of banking crisis to be followed by improvements in disclosure and transparency – i.e., a positive relation between crisis probability and disclosure. Yet, our results so far indicate a robust negative relation between crisis vulnerability and disclosure; hence this type of reverse causality appears to be less of a concern. Another form of

reverse causality might be the argument that banking fragility could lead to lower disclosure and transparency due to fears of greater instability from disclosing bank problems. One can examine the possibility of *both* forms of reverse causality using instrumental variables to identify the exogenous component of bank disclosure.

Based on theory and recent empirical works, I use the legal origin of countries as instruments. La Porta et al. (1998) show that civil law countries tend to support government intervention relative to private property rights. To the extent that disclosure regulations are government sanctions, their prevalence and characteristics could be partially dictated by the legal tradition of the country whereas the latter has little effect on the probability of crisis. Legal origin has also been extensively used as an instrument in the finance-growth literature (see Levine (2003)) as well as in the banking crises literature (see, e.g., Barth et al. (2004)).

I estimate an instrumental variables model with legal origin as instruments. In the first stage regressions, the data does not reject the validity of the instruments. Columns (8) and (9) present the instrumental variables results. They confirm the major findings in Table 3 through Table 5 that (i) greater bank disclosure lowers the likelihood of systemic banking crisis; and (ii) greater auditing stringency increases the likelihood of banking system stability. Hence controlling for simultaneity via the instruments does not alter the major findings, suggesting that the results are less likely to be explained by reverse causality.

V. Conclusion

While the history of banking crises stretches as far back as there has been banking systems, recent banking crises have been more frequent and costly. The recurring financial crises of the late 1990s coupled with recent corporate scandals around the world have brought to

the fore the public debate on the need for strengthening market discipline through greater disclosure and transparency.

The role of disclosure to banking system stability is not well understood, however. While the 'disclosure-stability' view holds that greater disclosure fosters stability through reducing informational asymmetries, the 'disclosure-fragility' view emphasizes the negative externalities that may be associated with greater disclosure and its potential to stymie stability. Reflecting the theoretical debate, disclosure policies have not made significant inroads in bank regulations around the world despite calls for more transparency by concerned international policy makers.

The paper examines the role of greater disclosure in fostering banking system stability. Based on data on a cross-section of forty-nine countries in the 1990s, the paper studies the impact of increased bank disclosure requirements and stronger auditing regulatory regimes on the likelihood of suffering systemic banking crisis.

The study documents that greater disclosure and stringent external audit requirements are strongly associated with banking system stability. Specifically, the likelihood of systemic banking crisis is lower in countries with regulations that require more comprehensive and accurate disclosure, and more stringent external auditing of bank reporting. The impact of greater banking disclosure to banking stability appears also to be economically large. The results indicate that greater disclosure results in significant savings in countries' real output loss that is often associated with banking system instability.

In policy terms, the findings provide empirical regularities consistent with the goals of the third pillar of the New Basal Capital Accord that aims to encourage market discipline by developing a set of disclosure requirements that allow market participants to assess bank risk positions and capital adequacy. The New Accord's initiatives in requiring greater disclosure are

consistent with the broader regulatory objectives of promoting banking system stability. The benefits of the specific recommendations of the initiative in the areas of supplemental reporting, consolidation, reporting risk methodologies, and frequency of reporting in fostering banking system stability are validated in the findings. To further enhance the benefits of greater disclosure, the results emphasize the importance also of improving the credibility of reporting. While expanding the scope of bank disclosure, the New Accord does not provide verification requirements beyond those required for accounting reporting, and security registration. The results underscore the value of external audit stringency in improving transparency and promoting bank stability.

Appendix I: Systemic Banking Crises in the 1990s

Country	Banking Crisis in 1990s	Country	Banking Crisis in 1990s
Australia		Japan	1992-97
Austria		Jordan	1990
Bahrain		Kenya	1993
Belgium		Korea, South	1997
Botswana		Lesotho	
Burundi		Malaysia	1997
Canada		Mauritania	1990-93
Chile		Mexico	1994-97
Denmark		Nepal	
El Salvador		Nigeria	1991-95
Egypt		Pakistan	
Finland	1991-94	Peru	1990
France		Philippines	
Germany		Portugal	
Ghana		Singapore	
Greece		Sri Lanka	1990-93
Guatemala		Sweden	1990-93
Guyana	1993-95	Switzerland	
Honduras		Thailand	1997
India	1991-97	Turkey	1991, 1994
Indonesia	1992-97	United Kingdom	
Ireland		U.S.A.	
Israel		Venezuela	1993-97
Italy	1990-95	Zambia	
Jamaica	1996-97		

Appendix II: Definition of Main Variables

Variables	Definition
Dependent Variables:	
Crisis	Indicator variable that takes 1 if a country has undergone systemic banking crisis in the period 1990 through 1997.
Explanatory Variables:	
Bank Disclosure	A measure of the extent and comprehensiveness of financial reporting required of banks. Its values are the principal component of four indicator variables: (i) Presentation of Non-Performing Loans - a variable that takes 1 if bank regulation requires that accrued income on non-performing loans should not be reported; (ii) Reporting Consolidated Financial Statements - a variable that takes 1 if consolidated financial statements of bank and non-bank subsidiaries are required; (iii) Reporting Off-Balance-Sheet to the Public - a variable that takes 1 if off balance sheet items are required to be disclosed to the public; and (iv) Reporting Risk Management Practice - a variable that takes 1 if banks are required to disclose risk management practices to the public.
Supplemental Reporting	A measure of the extent of supplementary information as required by countries' banking regulation. Its values are the principal component of variables in (iii) and (iv) above.
Director Liability	A measure of the degree of legal sanctions against bank officials for nonperformance vis a vis the bank regulations.
External Audit Stringency	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 principal component of five indicator variables: (i) Compulsory Audit - a variable that takes 1 if external audit is compulsory in the country; (ii) Required Extent of Audit - a variable that assumes the value 1 if bank regulation sanctions the extent of the external audit; (iii) License Requirements - a variable that takes 1 if auditors are required to be licensed or certified; (iv) Auditor Report to Supervisor - a variable that takes 1 if auditors' report should be given to the bank supervisory agency; and (v)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 report without the consent of the bank auditee.
Auditor Liability	A measure of the degree of legal sanctions against auditors in the case of nonperformance vis a vis the bank regulations.
Control Variables:	
Bank Concentration	The degree of concentration in the banking industry, measured as share of assets of the three largest banks in the country, averaged over the period 1990 through 1997.
Bank Competition	The degree of competitive conduct in the banking industry, measured as the sum of elasticities bank revenue to changes in input prices from Cleassens and Laeven (2004)
External Terms of Trade	The logarithm of the ratio of export price index to import price index for a country
Inflation	The logarithm of the average inflation rates
Per capita GDP	The logarithm of real per capita GDP

Appendix III: Survey Questions on Auditing and Disclosure

The table provides a shortened and condensed version of the original World Bank survey questions.

1. Entry into Banking
2. Ownership
3. Capital
4. Activities
5. External Auditing Requirements

5.1 Is an external audit a compulsory obligation for banks?
5.2 Are specific requirements for the extent or nature of the audit spelled out?
5.3 Are auditors licensed or certified?
5.4 Do supervisors get a copy of the auditor's report?
5.5 Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank?
5.6 Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse?
5.7 Can supervisors take legal action against external auditors for negligence?
5.8 Has action been taken against an auditor in the last 5 years?

6. Internal Management/Organizational requirements
7. Liquidity & Diversification Requirements
8. Depositor (Savings) Protection Schemes
9. Provisioning Requirements
10. Accounting/Information Disclosure Requirements

10.1 Does accrued, though unpaid, interest/principal enter the income statement while the loan is still performing?
10.1.1 Does accrued, though unpaid, interest/principal enter the income statement while the loan is still non-performing?
10.2 After how many days in arrears must interest income accrual cease?
10.3 Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries?
10.4 Are off-balance sheet items disclosed to supervisors?
10.4.1 Are off-balance sheet items disclosed to the public?
10.5 Must banks disclose their risk management procedures to the public?
10.6 Are bank directors legally liable if information disclosed is erroneous or misleading?
10.6.1 What are the penalties, if applicable?
10.6.2 Have penalties been enforced?
10.7 Do regulations require credit ratings for commercial banks?
10.7.1 What percentage of the top ten banks are rated by international credit rating agencies (e.g. Moody's, Standard and Poor)?
10.7.2 How many of the top ten banks are rated by domestic credit rating agencies?
10.7.3 Which bank activities are rated?
10.7.3.1 Bonds?
10.7.3.2 Commercial paper?
10.7.3.3 Other activity (e.g., bank certificates of deposit, pension and mutual funds, insurance companies, financial guarantees, etc.)?

11. Discipline/Problem Institutions/Exit
12. Supervision

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Table 1: Summary Statistics

Variable	N	Mean	Std Dev	Minimum	Maximum
Crisis	392	0.060	0.397	0	1.000
Bank Disclosure	376	0.274	0.869	-1.800	1.935
Supplemental Reporting	392	0.272	0.841	-1.295	1.392
Presentation of Non-Performing Loans	376	0.858	0.350	0	1.000
Reporting Consolidated Statements	368	0.879	0.326	0	1.000
Reporting Off-Balance Sheet To Public	376	0.860	0.348	0	1.000
Reporting Risk Management Practice	376	0.329	0.471	0	1.000
Director Liability	377	0.011	1.105	-2.941	1.044
External Audit Stringency	313	0.024	1.124	-6.725	0.554
Compulsory Audit	313	0.981	0.137	0	1.000
Required Extent of Audit	313	0.709	0.455	0	1.000
License Requirement	313	0.981	0.137	0	1.000
Auditor Report to Supervisor	313	0.962	0.192	0	1.000
Auditor Meet Supervisor without consent of Bank	313	0.709	0.455	0	1.000
Auditor Liability	392	0.013	0.924	-1.408	1.100
Bank Competition	282	0.649	0.104	0.410	0.860
Bank Concentration	392	0.715	0.219	0.190	1.000
External Terms of Trade	383	0.024	0.092	-0.189	0.232
Log of average Inflation	392	0.115	0.102	0.010	0.460
Per capita GDP	392	8.428	1.661	5.000	10.701

Table 2: Correlations

	Crisis	Bank Disclosure	Supplemental Reporting	External Audit Stringency	Bank Concentration	Bank Competition	External Terms of Trade	Inflation
Bank Disclosure	-0.00731							
	(0.8885)							
Supplemental Reporting	-0.0289	0.9225						
	(0.564)	(0.0001)						
External Audit Stringency	-0.26675	-0.19825	-0.1507					
	(<0.0001)	(0.0001)	(0.0022)					
Bank Concentration	0.05374	0.05404	0.0649	0.29267				
	(0.2041)	(0.2999)	(0.1901)	(<.0001)				
Bank Competition	-0.26343	0.00250	0.1972	0.15144	0.41617			
	(<.0001)	(0.9709)	(0.0025)	(0.0234)	(<.0001)			
External Terms of Trade	0.02583	-0.30211	-0.2675	0.03622	-0.06772	-0.01916		
	(0.6144)	(<.0001)	(0.0001)	(0.5293)	(0.1860)	(0.7755)		
Inflation	0.01597	-0.37016	-0.4202	0.20828	0.09893	0.29594	-0.0122	
	(0.7432)	(<.0001)	(0.0001)	(0.0002)	(0.0420)	(<.0001)	(0.8153)	
Per Capita GDP	-0.13094	0.42028	0.3366	-0.12436	-0.25521	-0.05737	-0.3056	-0.5267
	(0.0069)	(<.0001)	(0.0001)	(0.0110)	(<.0001)	(0.3844)	(<.0001)	(<.0001)

Numbers in parenthesis represent p-values.

Table 3: Bank Disclosure and Banking Crises

The estimated coefficients are parameter estimates of multivariate logistic models. The dependent variables is an indicator variable, crisis, that takes on the value one if there is a systemic banking crisis and the value zero otherwise. Bank Concentration is a measure of concentration in the banking industry, calculated as the fraction of assets held by the three largest banks in each country averaged over the sample period. Bank Competition is a measure of degree of competitive conduct in the banking industry, calculated as the sum of elasticities bank revenue to changes in input prices from Cleassens and Laeven (2004). External Terms of Trade is the logarithm of the ratio of export price index to import price index for a country. Inflation is the logarithm of average inflation rate. Bank Disclosure is a measure of the extent and comprehensiveness of financial reporting required of banks. Supplemental Reporting is a measure of the extent of supplementary information as required by countries' banking regulation. Director Liability is a measure of the degree of legal sanctions against bank officials for nonperformance vis-à-vis the bank regulations. Presentation of Non-Performing Loans, Reporting Consolidated Financial Statements, Reporting Off-balance Sheet to Public, and Reporting Risk Management Practices are dummy variables that take the value one if the countries' bank regulation requires the specific provision and the value zero otherwise. Per capita GDP is the logarithm of real per capita GDP. Numbers in parenthesis are standard errors. The sample period is 1990 through 1997. Detailed variable definitions are given in Appendix II.

	Panel A				**Panel B**						
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Bank Concentration		-3.463[b] (1.394)	-6.864[b] (2.762)	-7.483[b] (3.1748)	-7.934[b] (3.684)	-16.769[b] (6.6486)	-9.430[b] (3.9420)	-7.354 (3.7751)	-10.326[b] (4.0849)	-13.258[a] (4.930)	-8.002[b] (3.497)
Bank Competition		-3.377 (1.912)	-16.850[b] (6.668)	-16.075[a] (5.7350)	-16.025[b] (6.748)	-8.979[a] (3.1899)	-9.436[a] (3.2311)	-20.350[b] (7.9479)	-7.418[b] (3.0532)	-8.486[a] (3.146)	-17.458[a] (6.112)
External Terms of Trade	-8.8716[a] (2.175)		-22.109[a] (5.738)	-18.501[a] (5.2192)	-15.757[a] (4.996)	-11.427[a] (3.6296)	-13.312[a] (4.0093)	-17.152[a] (5.6095)	-9.755[a] (3.3507)	-11.490[a] (3.911)	-22.029[a] (6.143)
Inflation	-0.9026 (1.794)		11.565[a] (3.997)	10.028[a] (3.8654)	7.720 (3.877)	15.070[a] (5.6825)	11.488[a] (3.4984)	9.6487[b] (4.0308)	8.895[b] (3.6492)	13.14729[a] (4.4667)	12.711[a] (4.719)
Bank Disclosure	**-0.4776[b] (0.225)**	**-0.591[b] (0.261)**	**-3.889[a] (1.056)**	**-3.5191[a] (0.9987)**							**-3.981[a] (1.128)**
Supplemental Reporting					**-3.113[a] (0.967)**						
Presentation of Non-Performing Loans						-2.4420 (1.7923)					
Reporting Consolidated Statements							-1.934[c] (1.1137)				
Reporting Off-Balance Sheet To Public								-4.7716[a] (1.4379)			
Reporting Risk Management Practice									-1.1666 (1.1066)		
Director Liability										-0.4617 (0.4667)	-0.7073 (0.584)
Per Capita GDP				-0.3790 (0.2424)	-0.834[a] (0.245)	-0.9381[a] (0.3409)	-0.2727 (0.3366)	-0.8290[a] (0.2454)	-0.7011[a] (0.2404)	-0.7376[a] (0.2584)	-0.2949 (0.270)
Model χ^2	19.985[a] 0.0002	24.737[a] <.0001	81.897[a] (<.0001)	84.577[a] (<.0001)	85.366[a] <.0001	66.618[a] (<.0001)	70.8748[a] (<.0001)	83.664[a] (<.0001)	71.493[a] (<.0001)	67.789[a] (<.0001)	88.923[a] (<.0001)
% success	68.2	71.2	92.0	93.3	94.0	90.5	91.7	93.5	91.5	91.1	93.1
Pseudo R^2	0.086	0.119	0.5199	0.5369	0.532	0.4229	0.4420	0.4782	0.4459	0.418	0.462

[a] significant at 1 percent; [b] significant at 5 percent; [c] significant at 10 percent

Table 4: External Audit Stringency and Banking Crises

The estimated coefficients are parameter estimates of multivariate logistic models. The dependent variable is an indicator variable, crisis, that takes on the value one if there is a systemic banking crisis and the value zero otherwise. Bank Concentration is a measure of concentration in the banking industry, calculated as the fraction of assets held by the three largest banks in each country averaged over the sample period. Bank Competition is a measure of degree of competitive conduct in the banking industry, calculated as the sum of elasticities bank revenue to changes in input prices from Cleassens and Laeven (2004). External Terms of Trade is the logarithm of the ratio of export price index to import price index for a country. Inflation is the logarithm of average inflation rate. External Audit Stringency is a measure of the degree to which external audits are independent, professional and rigorous as reflected in bank regulations governing audit practices. Bank Disclosure is a measure of the extent and comprehensiveness of financial reporting required of banks. Auditor Liability is a measure of the degree of legal sanctions against auditors in the case of nonperformance vis-à-vis the bank regulations. Required Extent of Audit, Auditor Report to Supervisor, and Auditor Meet Supervisor without Consent of Bank are dummy variables that take the value one if the countries' bank regulation requires the specific provision and the value zero otherwise. Per capita GDP is the logarithm of real per capita GDP. Numbers in parenthesis are standard errors. The sample period is 1990 through 1997. Detailed variable definitions are given in Appendix II.

	Panel A					**Panel B**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Bank Concentration		-1.006 (1.491)	-5.357[b] (2.637)	-19.342[b] (7.8088)	-6.7264 (4.4331)	-23.8571 (17.0279)	-16.774[b] (7.0253)	-16.524[b] (6.6529)	-12.027[b] (4.667)	-19.012[b] (7.385)
Bank Competition		-4.512[b] (2.141)	-8.380[b] (3.524)	-10.806[a] (3.9334)	-18.417[a] (6.6996)	-14.573[c] (8.3552)	-10.589[a] (3.8956)	-8.152[b] (3.4979)	-8.343[b] (3.345)	-10.280[a] (4.214)
External Terms of Trade	-7.422[a] (2.155)		-10.252[a] (3.378)	-6.652[c] (3.5002)	-14.9872[a] (5.0292)	-0.00876 (9.7175)	-7.766[b] (3.2688)	-10.038[a] (3.6057)	-9.775[a] (3.450)	-6.433[c] (3.517)
Log of Average Inflation	2.713 (1.645)		9.603[a] (2.405)	20.377[a] (7.6006)	12.0865[a] (4.6049)	26.8497 (20.1855)	17.212[b] (6.8609)	16.427[a] (5.8772)	11.0189[a] (4.1294)	19.213[b] (8.078)
External Audit Stringency	**-0.704[a] (0.215)**	**-0.4623[a] (0.1327)**	**-0.3732 (0.282)**	**-0.985[a] (0.3715)**	**-0.7785[b] (0.3373)**					**-0.9783[a] (0.366)**
Bank Disclosure					**-3.6350[a] (1.1072)**					
Required Extent of Audit						-2.9237 (2.8774)				
Auditor Report to Supervisor							-3.5564[a] (1.3024)			
Auditor Meet Supervisor without consent of Bank								-1.361[b] (0.7042)		
Auditor Liability									0.0422 (0.5895)	0.1990 (0.707)
Per Capita GDP				-1.449[a] (0.538)	-0.7507[a] (0.3761)	-1.6103 (1.1767)	-1.4607[a] (0.5273)	-0.8725[a] (0.3364)	-0.7458[a] (0.2741)	-1.435[a] (0.513)
Model χ^2	25.768[a] <.0001	38.017[a] <.0001	58.149[a] <.0001	76.378[a] (<.0001)	90.8366[a] (<.0001)	69.918[a] (<.0001)	76.989[a] (<.0001)	71.783[a] (<.0001)	67.578[a] (<.0001)	81.699[a] (<.0001)
% success	69.6	75.5	89.4	91.2	94.8	91.9	92.1	92.2	91.0	92.2
Pseudo R^2	0.106	0.181	0.363	0.476	0.5277	0.4361	0.4802	0.4477	0.421	0.400

[a] significant at 1 percent; [b] significant at 5 percent; [c] significant at 10 percent

Table 5: Robustness Tests: Additional Controls

The dependent variable is an indicator variable, crisis, that takes on the value one if there is a systemic banking crisis and the value zero otherwise. Growth in GDP is rato of growth in real GDP. Real interest rate is nominal interest rate less contemporaneous rate of inflation. M2/reserve is ratio of the M2 to international reserves. Restriction of Entry is number of entry applications denied as a fraction of the number of applications for bank license from Barth et al. (2001). Activity Restrictions is an index of whether bank activities in securities, insurance and real estate markets restricted from Barth et al. (2001). Banking Freedom is an indicator of relative openness of banking and financial systems from Barth et al (2001). State Ownership is percentage of banking system's assets in banks that are 50% or more government owned from Barth et al. (2001). The regressions also include the following variables. Bank Concentration is a measure of concentration in the banking industry, calculated as the fraction of assets held by the three largest banks in each country averaged over the sample period. Bank Competition is a measure of degree of competitive conduct in the banking industry, calculated as the sum of elasticities bank revenue to changes in input prices from Cleassens and Laeven (2004). External Terms of Trade is the logarithm of the ratio of export price index to import price index for a country. Inflation is the logarithm of average inflation rate. External Audit Stringency is a measure of the degree to which external audits are independent, professional and rigorous as reflected in bank regulations governing audit practices. Bank Disclosure is a measure of the extent and comprehensiveness of financial reporting required of banks. Crisis in 80s Dummy is an indicator variable that takes the value one if the country has undergone a systemic banking crisis in the 1980s and the value zero otherwise. Explicit Deposit Insurance is an indicator variable that takes the value one if the country has an explicit deposit fixed-premium deposit insurance scheme and the value zero otherwise. Per capita GDP is the logarithm of real per capita GDP. Numbers in parenthesis are standard errors. The sample period is 1990 through 1997. Detailed variable definitions are given in Appendix II.

	Panel A				**Panel B**						
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Growth in GDP	0.575 (0.376)			0.929 (0.604)							
Real Interest Rate		0.0014 (0.083)		-0087 (0.119)							
M2/ Reserve Ratio			-0.095 (0.115)	-0.119 (0.088)							
Restriction to Entry					16.946 [a] (5.774)				9.495 [b] (4.498)		
Restriction of Bank Activity						0.512 [a] (0.149)				0.528 [a] (0.186)	
Bank Freedom							-1.591 [b] (0.503)				
State Ownership								4.483 [a] (1.640)	4.259 (2.850)	2.658 [b] (1.406)	
Explicit Deposit Insurance											1.540 (1.461)
Bank Disclosure	**-4.523 [a] (1.243)**	**-4.949 [b] (0.971)**	**-4.483 [a] (1.243)**	**-3.694 [c] (2.045)**	**-2.079 [a] (0.600)**	**-1.562 [a] (0.541)**	**-1.542 [a] (0.555)**	**-1.104 [a] (0.460)**	**-1.620 [a] (0.557)**	**-1.179 [b] (0.640)**	**-3.167 [a] (1.084)**
External Audit Stringency	**-0.835 [b] (384)**	**-0.436 [b] (0.212)**	**-0.921 [b] (0.316)**	**-1.666 [a] (0.464)**	**-1.605 [a] (0.444)**	**-0.507 [c] (0.305)**	**-0.313 (0.288)**	**-0.709 [a] (0.261)**	**-1.272 [a] (0.376)**	**-0.456 [c] (0.275)**	**-2.751 [a] (0.797)**
Model χ^2	89.057 [a] (<.0001)	90.77 [a] <.0001	89.72 [a] <.0001	92.56 [a] (<.0001)	39.74 [a] (<.0001)	55.48 [a] (<.0001	58.18 [a] <.0001	41.44 [a] (<.0732)	59.18 [a] (<.0001)	60.47 [a] (<.0001)	92.09 [a] (0.001)
% success	95.4	95.0	94.7	93.9	88.4	88.2	85.4	83.5	89.8	89.4	95.2
Pseudo R^2	0.40	0..39	0.42	0.45	0.57	0.66	0.66	0.69	0.58	0.63	0.59

[a] significant at 1 percent; [b] significant at 5 percent; [c] significant at 10 percent

Table 6: Robustness Tests: Sensitivity to changes in Methodology

The estimated coefficients are parameter estimates of multivariate logistic models. The estimates under column (7) are maximum likelihood estimates of a random effects model with random country and year effects. The coefficient estimates of the country and year effects are not reported. The estimates in column (8) and (9) are estimates of two stage instrumental variables models, where countries' legal origins are used as instruments. The dependent variable is an indicator variable, crisis, that takes on the value one if there is a systemic banking crisis and the value zero otherwise. Bank Concentration is a measure of concentration in the banking industry, calculated as the fraction of assets held by the three largest banks in each country averaged over the sample period. Bank Competition is a measure of degree of competitive conduct in the banking industry, calculated as the sum of elasticities bank revenue to changes in input prices from Cleassens and Laeven (2004). External Terms of Trade is the logarithm of the ratio of export price index to import price index for a country. Inflation is the logarithm of average inflation rate. External Audit Stringency is a measure of the degree to which external audits are independent, professional and rigorous as reflected in bank regulations governing audit practices. Bank Disclosure is a measure of the extent and comprehensiveness of financial reporting required of banks. Crisis in 80s Dummy is an indicator variable that takes the value one if the country has undergone a systemic banking crisis in the 1980s and the value zero otherwise. Explicit Deposit Insurance is an indicator variable that takes the value one if the country has an explicit deposit fixed-premium deposit insurance scheme and the value zero otherwise. Per capita GDP is the logarithm of real per capita GDP. Numbers in parenthesis are standard errors. The sample period is 1990 through 1997. Detailed variable definitions are given in Appendix II.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
							(RE)	**IV**	**IV**
Bank Concentration	-20.464[a] (6.2325)	-21.484[b] (8.8770)	-22.3606[a] (6.9441)	4.1210[c] (2.3965)	0.3510 (7.1482)	6.4004[b] (3.1137)	0.3854 (1.573)	-2.1634 (1.531)	-2.1585 (1.5314)
Bank Competition	-29.5716[b] (14.1675)	-11.1511[a] (4.0093)	-24.6885[b] (10.1235)	-9.1419[a] (3.5171)	-11.9331 (8.1550)	-12.3598[a] (4.0134)	-5.9483[a] (2.265)	-16.459[a] (4.525)	-16.393[a] (4.5609)
External Terms of Trade	-44.0846[b] (18.5030)	-5.6872 (3.7396)	-36.4107[a] (13.8346)	-3.5655 (3.2484)	-7.3000 (6.3557)	-7.4815[c] (4.2367)	-7.6247[a] (2.628)	-2.5983 (3.025)	-2.6190 (3.0308)
Inflation	31.8420[b] (12.4148)	22.9841[a] (8.7937)	31.8411[a] (10.0900)	-2.4940 (2.7385)	6.9267 (6.6802)	-4.2299 (2.9737)	-0.0050 (2.6726)	4.6521[c] (2.433)	4.6338[c] (2.4374)
Bank Disclosure - Alternative	**-7.6168[b]** **(3.2857)**		**-6.8749[a]** **(2.537)**						
External Audit Stringency - Alternative		**-1.0738[b]** **(0.4556)**	**-0.8414[b]** **(0.4048)**						
Bank Disclosure				**-3.1645[a]** **(0.5984)**	**-2.5155[c]** **(1.4507)**	**-4.9436[a]** **(1.5489)**	**-0.6537[b]** **(0.3270)**	**-3.6860[b]** **(1.526)**	
External Audit Stringency				**-2.0935[a]** **(0.4826)**	**-1.5593[c]** **(0.9440)**	**-2.7507[a]** **(0.7968)**	**-0.6428[b]** **(0.2707)**		**-1.0180[b]** **(0.4215)**
Crisis in 80s Dummy						-1.9282 (1.3406)			
Per capita GDP	-0.00646 (0.4747)	-1.4008[b] (0.5488)	-0.3434 (0.4835)	-1.5096[a] (0.3010)	-1.0991[c] (0.5832)	-2.1154[a] (0.5896)	-0.3647 (0.2509)	-0.6021[a] (0.207)	-0.5998[a] (0.2075)
Model χ^2	95.0770[a] (<.0001)	74.5921[a] (<.0001)	100.2814[a] (<.0001)	74.4796[a] (<.0001)	11.5356[a] (<.0732)	126.7186[a] (<.0001)	527.6[a] (<.0001)	55.2715[a] (<.0001)	49.2495[a] (<.0001)
% success	94.7	92.4	96.0	93.3	95.8	93.3	NA	86.9	85.5
Pseudo R^2	0.5930	0.4652	0.6224	0.3383	0.2607	0.5755	NA	0.239	0.2845

[a] significant at 1 percent; [b] significant at 5 percent; [c] significant at 10 percent