

Bank Concentration and Fragility: Impact and Mechanics

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I. Purpose & Motivation

The purposes of this paper are (1) to examine the impact of bank concentration on both systemic risk and the fragility of individual banks and (2) explore the possible explanations for these relationships. We first examine the influence of bank concentration on the likelihood of suffering a “systemic” banking crises using a panel dataset of countries over almost twenty years. Since there are inherent problems with defining and dating systemic crises, we next use bank-level data to assess the effect of nation-wide bank concentration on the fragility of individual banks. Finally, we provide exploratory evidence on the possible channels through which bank concentration influences banking system and individual bank fragility.

Theoretical disputes and public policy considerations motivate this research. First, some models (i) provide a “concentration-stability” prediction that more concentrated banking systems are less prone to failure than less concentrated systems with many small banks and also (ii) provide predictions as to why concentration enhances stability (Allen and Gale, 2000, 2003). In terms of mechanisms, some proponents of the “concentration-stability” view hold that large banks can diversify better so that banking systems characterized by a few large banks will be less

¹ Beck and Demirguc-Kunt: World Bank; Levine: University of Minnesota and the NBER. These are preliminary notes for the NBER Pre-Conference on Risk of Financial Institutions and the Financial Sector being held at the NBER, February 27, 2004. Please do not quote or distribute without the permission of the authors. The tentative views expressed in this paper are the authors’ own and do not reflect the views of the World Bank, its member countries, and anyone else.

fragile than banking systems with many small banks.² Others argue that concentrated banking systems may enjoy greater profits, which in turn (i) provide a “buffer” against adverse shocks and (ii) increase the franchise value of the bank, reducing incentives for bank owners to take excessive risk (Hellmann, Murdoch, and Stiglitz, 2000). Furthermore, some advocates of the concentration-stability view note that a few large banks are easier to monitor than many small banks, so that corporate control of banks will be more effective and the risks of contagion less pronounced in a concentrated banking system.

In contrast the “concentration-fragility view argues that more concentrated banking systems are more unstable. First, some argue that large banks frequently receive subsidies through implicit “too big to fail” policies that intensify risk-taking incentives, increasing the volatility and fragility of concentrated banking systems (Boyd and Runkle, 1992 and Mishkin, 1999).³ Second, proponents of the concentration-fragility view disagree that a few large banks are easier to monitor than many small banks. If size is positively correlated with complexity, then large banks may be more difficult to monitor than small banks, which would yield a positive relationship between concentration and fragility. Finally, Boyd, and De Nicolo (2003) stress that banks with greater market power tend to charge higher interest rates to firms, which induces firms to assume greater risk. This view predicts that if concentration is positively associated

² Models by Diamond (1984), Ramakrishnan and Thakor (1984), Boyd and Prescott (1986), Williamson (1986), Allen (1990), and others predict economies of scale in intermediation.

³ There is a literature that examines deposit insurance and its effect on bank decisions. According to this literature (e.g. Merton (1977), Sharpe (1978), Flannery (1989), Kane (1989), and Chan, Greenbaum and Thakor (1992)) – mis-priced deposit insurance produces an incentive for banks to take risk. If the regulatory treatment were the same for insured banks of all sizes, these models would predict no relationship between bank size and riskiness. Since regulators fear potential macroeconomic consequences of large bank failures, most countries have implicit “too large to fail” policies which protect all liabilities of very large banks whether they are insured or not. Thus, largest banks frequently receive a greater net subsidy from the government (O’Hara and Shaw, 1990). This subsidy may in turn increase the risk-taking incentives of the larger banks. For an analysis of the corporate governance of banks, see Macey and O’Hara (2003). Note, however that even in the absence of deposit insurance, banks are prone to excessive risk-taking due to limited liability for their equity holders and to their high leverage (Stiglitz, 1972).

with banks having market power, then concentration should increase both the expected rate of return and standard deviation of bank loans.

Finally, in terms public policy motivations, central banks and bank supervisors continuously make decisions about bank mergers and acquisitions and the entry of new domestic and foreign banks. These decisions influence bank concentration and information about the effects of bank concentration on bank fragility may feedback into the decision processes of officials around the world. Indeed, the consolidation of banks around the globe is fueling an active public policy debate on the impact of consolidation on financial stability.⁴ While this paper does consider the myriad of possible effects of bank consolidation and certainly does not resolve public policy debates about bank consolidation, this research does provide some initial evidence on the impact of bank concentration on both systemic risk and individual bank fragility and also examines competing views about the mechanisms through concentration influences bank stability.

II. Does Bank Concentration Enhance the Risk of Systemic Failure?

This paper first examines the impact of national bank concentration on the likelihood of a country suffering a systemic banking crisis. We use data on 70 countries over the period 1980-1997 and control for differences in regulatory policies and many other country-specific characteristics.⁵ The Data Appendix defines the data.

To conduct this analysis, we need a measure of whether each country is experiencing a systemic banking crisis or not in each year. It is difficult to measure and date systemic crises.

⁴ See Group of Ten (2001), Bank for International Settlements (2001), International Monetary Fund (2001), and Boyd and Graham (1998, 1991).

⁵ Demirgüç-Kunt, Laeven and Levine (2004) investigate the impact of bank concentration and regulations on bank net interest margins, but they do not examine bank fragility.

Following DD (2003), we identify and date episodes of banking sector distress using information from Lindgren, Garcia and Saal (1996) and Caprio and Klingebiel (1999). Then, these episodes of distress are classified as systemic if (i) emergency measures were taken to assist the banking system (such as bank holidays, deposit freezes, blanket guarantees to depositors or other bank creditors), or (ii) if large-scale nationalizations took place, or (iii) if non-performing assets reached at least 10 percent of total assets at the peak of the crisis, or (iv) if the cost of the rescue operations was at least 2 percent of GDP. In sum, our sample of 70 countries contains 47 crisis episodes. Table 1 lists this information.

Thus, *Crisis* is a dummy variable that equals one if the country is going through a systemic crisis, and zero if it is not. Many crises run for multiple years. We exclude the years after the initial year of the crisis because during a crisis, the behavior of some of the explanatory variables is likely to be affected by the crisis itself, leading to reverse causality. Note, however, that including the crisis years does not change the conclusions. In earlier work, we considered alternative definitions of systemic crises, but this did not alter the results reported below (Beck, Demirguc-Kunt, and Levine, 2004).

Methodologically, to estimate the crisis model, we follow DD (1998, 2003) and use a logit probability model with standard errors that are robust to heteroskedasticity.⁶ Specifically, we estimate the probability that a systemic crisis will occur at a particular time in a particular country, assuming that this probability is a function of explanatory variables ($X(i,t)$). Let $P(i, t)$ denote a dummy variable that takes the value of one when a banking crisis occurs in country i and time t and a value of zero otherwise. β is a vector of n unknown coefficients and $F(\beta' X(i, t))$ is the cumulative probability distribution function evaluated at $\beta' X(i, t)$.⁷ Then, the log-likelihood function of the model is:

$$\ln L = \sum_{t=1}^T \sum_{i=1}^n \{P(i,t)\ln[F(\beta' X(i,t))] + (1-P(i,t)) \ln[1- F(\beta' X(i,t))]\}.$$

Importantly, the estimated coefficients do not indicate an increase in the probability of a crisis given a one-unit increase in the corresponding explanatory variables. Instead, the coefficients reflect the effect of a change in an explanatory variable on $\ln(P(i,t)/(1-P(i,t)))$. Therefore, the increase in probability depends on the original probability and thus upon the initial values of all the independent variables and their coefficients. While the sign of the coefficient does indicate the direction of the change, the magnitude depends on the slope of the cumulative distribution function at $\beta' X(i,t)$. In other words, a change in the explanatory variable will have different effects on the probability of a crisis depending on the country's initial crisis probability. Under the logistic specification, if a country has an extremely high (or low) initial probability of crisis, a marginal change in the independent variables has little effect on its

⁶ Also see Cole and Gunther (1993), Gonzalez-Hermosillo et al. (1997), Demirguc-Kunt (1989), Demirguc-Kunt and Detragiache (1998, 2003).

⁷ Since observations within each country group may also be correlated, we relax the assumption that errors are independent within country observations below in robustness tests.

prospects, while the same marginal change has a greater effect if the country's probability of crisis is in an intermediate range.

Concentration is the explanatory variable of focus, and it equals the fraction of banking system assets held by the three largest banks. We average this over the sample period, 1980-1997. In robustness tests, we re-did the analysis using the value of Concentration in 1988 and then examining its ability to predict subsequent systemic banking crises. In restricting the sample to crises after 1988, we lose about half of the crises from our full sample. Nevertheless, we confirm our results using this initial value specification. We report the results using data average over the entire period because of the sample size.

We condition the results on an assortment of banking system and country characteristics. Specifically, in all of the regressions we include Real GDP growth, terms of trade change, the real interest rate, inflation, the ratio of broad money (M2) to reserves, depreciation of the currency, bank credit growth (lagged two years), and Real GDP per capita. Furthermore, we also control for the generosity of the deposit insurance system (Moral Hazard), and an index of Banking freedom, which measures the openness and degree of regulation restrictions on each country's banking system. Also, when controlling for a much broader array of bank supervisory and regulatory policies as well as an assortment of measures of the level of development of national institutions, we confirm our results.

The paper finds that crises are less likely in more concentrated banking systems and this stabilizing effect is large economically. As shown in Table 3, Concentration always enters with a negative and significant coefficient. Furthermore, the economic impact is not inconsequential. Evaluating the marginal impact of concentration on the probability of crisis at the mean values for all variables, we see that a one standard deviation increase in concentration leads to a

decrease in crisis probability of one percent. Since crisis probabilities at any point in time are quite low, with a mean value of four percent, this is a substantial reduction.

These results are consistent with the concentration-stability theory's argument that banking systems characterized by a few, large banks are more stable than less concentrated banking markets. The negative relationship between concentration and crises holds when conditioning on an array of macroeconomic, financial, regulatory, and institutional characteristics. Since the results hold when using initial levels of bank concentration, the inverse relationship between concentration and crises does not appear to be driven by reverse causality and is robust to an array of sensitivity checks.

III. Why is Concentration Stabilizing? Additional Evidence from Crisis Data

Consistent with the concentration-stability view, the results in Table 3 indicate a negative relationship between bank concentration and the probability of suffering a systemic banking crisis. The results, however, do not distinguish among possible explanations of this relationship.

Why is concentration stabilizing?

A. Is it market power and bank profits?

One possible argument is that concentration proxies for the absence of competition, which boosts bank profits, lowers incentives for risk taking, and thus reduces systemic risk. In contrast to this market power view, however, note that concentration remains negatively associated with crises even when controlling for the openness and degree of regulatory restrictions on banks (Banking freedom). Thus, to the extent that Banking freedom adequately controls for competition, the findings suggest that something else besides market power is driving the negative relationship between bank concentration and bank fragility.

While the Table 3 results hold even when including measures of regulatory restrictions on bank activities and regulatory impediments to bank entry, these indicators may not sufficiently control for competition. Thus, given the difficulty in adequately controlling for the competitive environment using regulatory indicators, the Table 3 results may be too weak to discard the market power explanation of why concentration is stabilizing. These analyses need to be complemented by bank-level regressions that more directly examine the relationships between banking system concentration, competition, and stability. We conduct these complementary analyses below.

B. Is it diversification?

Next, consider the argument that concentrated banking systems are more diversified than banking systems composed of many small banks. If this argument is correct and if we include good measures of bank diversification in the bank crisis regressions, then this should drive out the significance of bank concentration.

To proxy for the diversification channel, we use three measures. First, we use *Mean bank size*, which equals total bank assets divided by the number of banks.⁸ If mean bank size does not drive out the significance of concentration, this weakens the argument that concentrated banking systems have larger, better diversified banks than less concentrated banking systems with smaller banks. However, since bank size does not directly measure diversification, finding that mean bank size drives out concentration provides only suggestive support for the diversification argument. Second, we include an indicator of regulatory restrictions on banks' ability to diversify risk abroad. Specifically, *No foreign loans* equals one if banks are prohibited from making foreign loans and zero otherwise. A third potential indicator of bank diversification is the size of the economy. The presumption, albeit questionable, is that larger economies are

⁸ Using the mean bank size of the largest three banks does not change our results.

more diversified and therefore offer banks easier means to hold diversified loan portfolios. Thus, we include the level of *GDP*.⁹ Finally, we also try interacting mean bank size with No foreign loans to see whether countries with large – or small - banks that are prohibited from investing abroad are particularly prone to systemic crises.

The results in Table 4 (regressions (1) –(4)) provide suggestive support for the view that concentrated banking systems are composed of bigger, more diversified banks that are hence less prone to systemic failure. As the results in Table 4 show, the significance of the concentration coefficient drops to ten percent when we control for mean bank size or the size of the economy. This is consistent with the view that part of the reason that concentration enhances stability is that concentrated systems are composed of bigger, better-diversified banks. The concentration effect becomes completely insignificant when including the (i) mean bank size, (ii) no foreign loans, and (iii) the interaction term between bank size and no foreign loans. This result in column 4 indicates that countries with larger banks become significantly more prone to systemic crises if they prohibit their banks from investing abroad. While these measures of diversification are highly imperfect, the results in regression (1) – (4) suggest that the diversification explanation has some merit.

C. Is it easier monitoring?

A third argument for why concentration is stabilizing is that (i) concentrated banking system tend to have a few large banks and (ii) a few large banks are easier to monitor than many small ones. As above, if this easier monitoring argument is correct and if we include good measures of monitoring in the crisis regressions, then this should drive out the significance of bank concentration.

⁹ Replacing GDP by M2 to control for the size of the financial system does not change our results significantly.

We use three measures of monitoring. First, we use the *No. of banks*, which equals the number of banks in the economy. The easier monitoring argument relies on the presumption that concentrated banking systems have a few large banks and this is crucial in explaining better monitoring and greater banking system stability. Second, *Activity Restrictions* equals regulatory restrictions on the ability of banks to engage in securities market, insurance and real estate activities as well as restrictions on banks owning non-financial firms. The presumption is that greater regulatory restrictions will make it easier to monitor banks. So, to the extent that regulatory restrictions are correlated with bank concentration, this would help account for the negative relationship between concentration and systemic crises. Third, *Cash-flow* is the fraction of a bank's total cash-flow rights held by each bank's main owner, averaged across each country's banks. As suggested by La Porta et al (1999, 2002), countries where laws and regulations are ineffective at protecting the rights of small shareholders will tend to have corporations that do not rely on small shareholders to exert corporate control and instead have concentrated cash-flow rights to induce the main owner to exert sound corporate governance. In terms of banks, Caprio, Laeven, and Levine (2004) show that a bank's major owner tends to have higher cash-flow rights in countries where the institutions underlying monitoring of banks are weak, such as weak shareholder protection laws or ineffective bank supervision and regulation. These weak institutions discourage diffuse ownership and produce concentrated ownership of banks. Thus, we use each country's average cash-flow rights across banks as an additional proxy of each country's monitoring regime. If including cash-flow rights eliminates the significance of concentration, concerns would naturally arise about the endogeneity of cash-flow rights. But, if including cash-flow rights does not alter the results on concentration, then this simply represents an additional, if flawed, robustness check.

The results presented in Table 4 do not provide support for the easier monitoring view of why concentration reduces the likelihood of suffering a systemic crisis. Including the No. of banks, Activity Restrictions, and Cash-flows does not alter the findings on Concentration. Indeed, No. of banks and Activity Restrictions do not enter the crises regressions significantly. Cash-flow enters positively, which is consistent with the view that in countries with weak legal and corporate governance institutions and ineffective bank supervision and regulation the ownership structure adjusts such that cash-flow becomes concentrated in order to boost monitoring incentives. However, the resultant outcome is still associated with a higher likelihood of suffering a crisis. For the purposes of this paper, the point is that including proxies for the monitoring regime does not alter the results on Concentration. This suggests, to the extent that these are reasonable proxies, that Concentration is not a simple proxy for easier monitoring.

D. Taking stock

To summarize, using a cross-country, time-series panel of data on systemic banking crises, we find that greater bank concentration is associated with a lower likelihood of suffering a crisis. The stabilizing effects of concentration are robust to including various control variables, including indicators of the macroeconomic environment, the international environment, recent development in the bank credit market, and a wide array of bank supervisory and regulatory policies, and reverse causality does not seem to be driving the concentration-stability findings.

In searching for the mechanisms underlying the concentration-stability result, we find the following:

First, we do not find support for the market power view. Specifically, we do not find support for the view that concentrated banking systems are populated by a few large banks with

market power and this market power boosts profits, reduces risk-taking, and bolsters the stability of the banking system. However, our regulatory indicators of the degree of competition in national banking systems may not sufficiently control for market power, so it is important to assess the market power view using bank level data.

Second, we find suggestive support for the diversification view. The data indicate that part of the reason concentrated banking systems lower the probability of suffering a systemic crisis is that concentrated banking systems tend to have larger, better-diversified banks with a correspondingly lower probability of failure. We draw this tentative conclusion because the concentration-crisis link weakens appreciably when we include proxies for diversification. Again, however, we emphasize that these proxies are aggregate indicators and do not directly measure individual bank asset diversification, and hence we view these results as suggestive support for the diversification view.

Third, the evidence is inconsistent with the view that concentrated banking system with a few large banks are easier to monitoring than banking system with many small banks. While recognizing the limitations of our proxies, we find no evidence to support the easier monitoring explanation of why concentration is negatively associated with the probability of suffering a systemic crisis.

There is a relevant weakness to these analyses using No Foreign Loans, Activity Restrictions, and No. of banks, however. These variables are taken from the Barth, Caprio, and Levine (2001b) database, which assembled data on bank supervisory and regulatory practices in over 100 countries in 1999. The weakness is that systemic crises are measured over the period 1980-1997. Thus, the regulatory indicators are measured after the dependent variable. In defense of this practice, (i) Barth, Caprio, and Levine (2001a) show that there have been very

few changes over time in one specific regulatory indicator, regulatory restrictions on bank activities, (ii) Carkovic and Levine (2003) show that Chile has implemented very few reforms to a broad range of supervisory and regulatory practices over the last fifteen years, and (iii) Barth, Caprio, and Levine's (2004) follow-up survey indicates that there have been remarkably few substantive changes in bank regulatory regimes since their initial survey in 1999, which advertises the stability of bank supervisory and regulatory policies. Nevertheless, timing issues raises concerns about the ability of these analyses to provide convincing evidence on the market power, diversification, and easier monitoring explanations of why concentration seems to stabilize banking systems. This further advertises the importance of complementing these analyses with bank-level studies.

Finally, this entire section is based on the examination of measures of whether a country is experiencing a systemic crisis. As emphasized, it is very difficult to define and date systemic banking crises. Thus, it is crucial to reassess the entire concentration-stability results using microeconomic data.

IV. Concentration and Fragility: Bank-Level Evidence

We now use individual bank data to assess the relationship between system-wide concentration and individual bank fragility. To measure individual bank fragility, we examine each bank's *Z*-score and its components, using the BankScope database of Fitch IBCA.

Z-score equals the sum of the **Return on Assets (ROA)** and the **Capital-Asset Ratio (C/A)** divided by the **Standard Deviation of the Return on Assets ($\sigma(ROA)$)**. These values are averaged over the period 1994-2001. Higher *Z*-scores are interpreted as indicating greater bank stability. In particular, a bigger *C/A* represents a bigger cushion for absorbing shocks and

perhaps greater incentives for prudent risk taking. Similarly, greater ROA implies a bigger flow into the cushion for absorbing shocks and may also influence risk-taking. Finally, if a smaller ρ (ROA) implies some combination of a better diversified banks and a more macroeconomic environment, then this implies a concomitantly lower chance of bank failure.

A. Z-Score Results

First, we examine Z-score computed at the country, which means we treat each country's banking system as if it were a single bank. Thus, we compute RAO, C/A, and ρ (ROA) for each banking system and calculate each country's Z-score. Table 5 presents regressions of this country-level Z-score on bank concentration and a range of control variables. In particular, we control for specific characteristics of the banking system such **Fee income**, **Total loan growth**, and size of the banking system (**Log of total assets**). We also control for the regulatory system by including Banking Freedom, and also controls for features of the macroeconomic environment: (i) Standard deviation of GDP per capita, (ii) Growth of GDP per capita, and (iii) inflation. Thus, we assess the impact of bank concentration on banking system fragility while conditioning on macroeconomic conditions, the regulatory regime, and particular traits of the country's banking system.

The Table 5 country-level Z-scores, which are presented in regressions (1)-(4), indicate that concentration has a stabilizing effect. Concentration enters all of the Z-score regressions positively and significantly, indicating a positive relationship between concentration and bank stability. While the bank regulatory, macroeconomic, and banking system controls sometimes enter significantly, they do not alter the positive link between concentration and stability.

The Table 5 results also indicate that the impact of system-wide concentration on bank fragility is not inconsequential. In terms of country-level Z-scores, the coefficients in regression

(4) imply that a one-standard deviation increase in concentration would induce a an increase in the Z-score of almost four which is meaningful given that the sample mean value of the Z-score is 18 with a sample standard deviation of 12.

Next, we examine Z-scores at the in individual bank-level. We have information on 808 banks. We use weighted regressions, where we weight by total assets, because we are primarily interested in banking system risk. We continue to control for a wide array of bank traits, the bank regulatory regime, and macroeconomic conditions.

Table 5's regression (5) indicates that system-wide concentration is positively related to the stability of individual banks. Concentration enters positively and significantly at the one-percent level. This holds when controlling for an extensive conditioning set. Moreover, the economic size of the relationship is not irrelevant.

The regression (5) results using individual bank Z-scores indicate an even bigger economic impact than when using country-level Z-scores. The estimated coefficient implies that an one-standard deviation increase in concentration produces an increase in bank stability, as measured by bank-level Z-scores, that is one-half of the sample standard deviation of bank Z-scores.

B. The Components of Z-Score: ROA, β (ROA), C/A

This subsection examines the individual components of the Z-score to provide greater insights into mechanisms through which concentration reduces fragility. Although, the Table 6 regressions indicate that bank concentration does not influence the capital-asset ratios of banks, concentration does affect bank stability through the market power and diversification channels.

Consistent with the market power view, concentration is positively associated with bank's ROA (Table 6). Concentration enters regression (1) and (4) significantly at the five

percent significance level. Importantly, concentration enters significantly even when controlling for a regulatory indicators of bank competition (Bank Freedom). This suggests that this regulatory indicator does not fully capture the market structure of the banking industry.

The economic impact of concentration on ROA, however, is limited. A one-standard deviation increase in concentration increases ROA by one-tenth of one-standard deviation. Or, put differently, a one-standard deviation increase in concentration increases ROA by one-fourth of the mean value of ROA. Thus, while statistically significant, the results do not suggest that the market power view fully explains why concentration reduces bank fragility.

Note, however, these findings may reflect the efficient market view of bank concentration, not market power. Specifically, the most profitable banks may gain market share, so that concentration reflects the efficient evolution of the banking industry, not the absence of competition as suggested by the market power view. Thus, the Table 6 results alone indicate that banks are profitable in more concentrated banking systems, which may contribute to their stability by providing a buffer against shocks and by reducing risk-taking incentives. However, we do not know from Table 6 whether these results derive from market power or efficiency. Demircuc-Kunt, Laeven, and Levine (2004), however, provide complementary evidence. Their findings provide no support for the efficient market view concentration. Rather, using bank-level data on interest margins and overhead costs, they find support for the view that concentration reflects market power. Thus, we believe there are good reasons for viewing the findings in this paper as reflecting market power, not efficiency.

The evidence also advertises that concentrated banking systems tend to have banks with less volatility of returns, which is consistent with the view that concentrated banking systems tend to be composed of larger, better-diversified banks. As presented in Table 6, regressions (2)

and (5), bank concentration reduces the standard deviation of individual bank's ROA.

Concentration enters significantly at the one percent level even when controlling for regulatory impediments to bank activities.

Again, while statistically significant, this diversification channel is only part of the story. A one-standard deviation increase in concentration reduces the standard deviation of ROA by 0.004, which is a bit more the one-tenth of one-standard deviation of ROA. Or, a one-standard deviation increase in concentration reduces the standard deviation of ROA by about 30-percent of the mean value of the standard deviation of ROA. Thus, concentration may operate through a number of channels in influencing bank fragility.

Finally, we also assessed whether countries with concentrated banking systems have bigger banking crises. If (i) concentrated banking systems are more likely to have too-big-to-fail policies and if (ii) if too-big-to-fail policies induce and facilitate greater imprudent risk-taking and (iii) too-big-too fail can operate for only some fixed period of time, then this suggests that crises will be larger, though less frequent in concentrated banking systems. As shown in Table 7, we find no evidence for the contention that more concentrated banking systems have more costly crises. Concentrated banking systems do not tend to have bigger – more costly to the fiscal authorities – conditional on the country experiencing a crisis.

V. Conclusions: So far ...

Data on national banking crises and individual bank fragility both suggest that bank concentration tends to enhance stability. Thus, the data are more consistent with the concentration-stability view than with the concentration-fragility view.

In terms of explaining the mechanics underlying the stabilizing effect of bank concentration, the results are at best suggestive. We find no evidence that concentrated banking

systems with a few large banks are easier to monitor and hence more stable than less concentrated systems with more banks. This result, however, is subject to the criticism that we do not have adequate proxies for the ease of monitoring across different banking systems.

The data indicate that more concentrated banking system have a lower standard deviation of returns, which is consistent with both greater diversification and with the view that concentrated banking systems have greater market power and higher expected returns, so that banks behave more prudently than in a banking system that are more competitive. We also find direct evidence that concentration boosts the return on assets, which supports the market power explanation of why concentration induces stability. At the same time, cross-country data on crises provides some direct support for the view that concentrated banking systems are associated with better diversified banks that suffer fewer systemic crises. Thus, at this point, the results highlight the importance of market power and greater diversification as the mechanisms through which concentration enhances bank stability.

Table 1. Bank Concentration and Competition and Banking Crises

GDP per capita is in constant dollars, averaged over the entire sample period, 1980-97. Crisis period denotes the years in which each country experienced a systemic banking crisis and the duration of said crisis. 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 1988-97. Z-score is the ratio of the sum of the return on assets plus the capital-asset ratio to the standard deviation of the return on assets, averaged over the 1994-2001 period. Sources are in the data appendix.

	GDP per capita	Crisis Period	Concentration	Z-score
Australia	17913		0.65	18.81
Austria	25785		0.75	18.35
Bahrain	9398		0.93	34.41
Belgium	24442		0.64	16.46
Benin	362	(1988-90)	1.00	
Botswana	2781		0.94	17.93
Burundi	186		1.00	
Cameroon	790	(1987-93, 1995-98)	0.95	
Canada	18252		0.58	59.58
Chile	3048	(1981-87)	0.49	15.38
Colombia	1802	(1982-85)	0.49	11.26
Congo	940		1.00	
Ivory Coast	843	(1988-91)	0.96	
Cyprus	9267		0.88	20.15
Denmark	31049		0.78	21.09
Dominican Republic	1426		0.65	
Ecuador	1516	(1995-97)	0.40	9.36
Egypt	905		0.67	
El Salvador	1450	(1989)	0.84	37.70
Finland	23304	(1991-94)	0.85	4.64
France	24227		0.44	11.38
Germany	27883		0.48	10.72
Ghana	356	(1982-89)	0.89	10.47
Greece	10202		0.79	8.88
Guatemala	1415		0.37	
Guyana	653	(1993-95)	1.00	
Honduras	694		0.44	
India	313	(1991-97)	0.47	
Indonesia	761	(1992-97)	0.44	0.10

	GDP per capita	Crisis Period	Concentration	Z-score
Ireland	13419		0.74	23.04
Israel	13355	(1983-84)	0.84	45.94
Italy	17041	(1990-95)	0.35	
Jamaica	1539	(1996-97)	0.82	3.14
Japan	35608	(1992-97)	0.24	10.82
Jordan	1646	(1989-90)	0.92	24.53
Kenya	336	(1993)	0.74	9.38
Korea	6857	(1997)	0.31	2.92
Lesotho	356		1.00	
Malaysia	3197	(1985-88, 1997)	0.54	15.23
Mali	260	(1987-89)	0.91	
Mauritius	2724		0.94	17.05
Mexico	3240	(1982, 1994-97)	0.63	15.03
Nepal	179	(1988-97)	0.90	
Netherlands	22976		0.76	25.95
New Zealand	15539		0.77	11.48
Nigeria	251	(1991-95)	0.83	14.07
Norway	28843	(1987-93)	0.85	25.71
Panama	2824	(1988-89)	0.42	17.46
Papua New Guinea	1024	(1989-97)	0.87	4.65
Peru	2458	(1983-90)	0.69	
Philippines	1070	(1981-87)	0.49	13.25
Portugal	8904	(1986-89)	0.46	46.19
Senegal	562	(1988-91)	0.94	
Sierra Leone	260	(1990-97)	1.00	
Singapore	20079		0.71	10.07
South Africa	3680	(1985)	0.77	14.51
Sri Lanka	588	(1989-93)	0.86	43.20
Swaziland	1254	(1995)	0.95	16.23
Sweden	24845	(1990-93)	0.89	8.47
Switzerland	42658		0.77	13.44
Tanzania	170	(1988-97)	1.00	11.65

	GDP per capita	Crisis Period	Concentration	Z-score
Thailand	1886	(1983-87, 1997)	0.54	0.30
Togo	366		1.00	
Tunisia	1831		0.63	
Turkey	2451	(1982, 1991, 1994)	0.45	4.43
United Kingdom	16883		0.57	26.67
United States	24459	(1980-92)	0.19	26.72
Uruguay	5037	(1981-85)	0.87	
Venezuela	3558	(1993-97)	0.52	9.05
Zambia	464		0.84	8.44

Table 2. Summary Statistics and Correlations

Summary statistics are presented in Panel A and correlations in Panel B and C. Banking crisis is a crisis dummy, which takes on the value of one if there is a systemic and the value of zero otherwise. Growth is the rate of growth of real GDP. Real interest rate is the nominal interest rate minus the contemporaneous rate of inflation. Inflation is the rate of change of the GDP deflator. M2/reserves is the ratio of M2 to international reserves. Credit growth is the real growth of domestic credit, lagged two periods. Depreciation is the rate of change of the exchange rate. Moral hazard is an aggregate index of moral hazard associated with varying deposit insurance schemes. 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. Banking freedom is an indicator of the relative openness of the banking system. Sources are given in the data appendix.

Panel A: Summary Statistics:

	Mean	Median	St.Dev.	Maximum	Minimum	Observations
Banking crisis	0.04	0.00	0.20	1.00	0.00	1230
Growth	3.41	3.45	4.25	23.60	-17.15	1216
Terms of trade change	0.15	0.01	10.30	63.24	-51.45	1191
Real interest rate	1.58	2.68	19.34	151.21	-283.00	1160
Inflation	14.07	7.75	23.42	350.56	-29.17	1220
M2/reserves	19.87	6.56	68.86	1289.31	0.19	1222
Depreciation	0.10	0.04	0.22	2.62	-0.35	1238
Credit Growth _{t-2}	6.01	5.09	15.84	115.42	-54.62	1203
Real GDP per capita	7813.94	2302.37	10299.92	45950.46	134.54	1222
Moral hazard	-1.09	-2.49	2.24	3.98	-2.49	1238
Concentration	0.72	0.77	0.21	1.00	0.19	1106
Banking freedom	3.36	3.00	0.88	5.00	1.00	1184

Panel B: Correlations: Banking Crisis, Concentration, Macro Indicators, and Institutions

	Banking crisis	Real GDP growth	Terms of trade change	Real interest rate	Inflation	M2/reserves	Depreciation	Credit Growth _{t-2}	Real GDP per capita	Moral hazard	Concentration
Real GDP growth	-0.139***										
Terms of trade change	-0.021	0.046*									
Real interest rate	0.006	0.085***	-0.050**								
Inflation	0.063***	-0.103***	0.038	-0.980***							
M2/reserves	0.033	-0.098***	0.007	0.010	-0.015						
Depreciation	0.072***	-0.168***	-0.020	-0.546***	0.616***	-0.031					
Credit growth _{t-2}	0.042	0.024	0.000	0.003	-0.007	-0.045*	-0.054**				
Real GDP per capita	-0.061**	-0.055**	0.017	0.026	-0.047*	-0.033	-0.201***	-0.008			
Moral hazard	0.013	0.004	0.015	0.024	-0.030	-0.047	-0.069***	-0.010	0.478***		
Concentration	-0.032	-0.076***	-0.007	0.004	0.000	0.100***	0.044*	-0.001	-0.246***	-0.396***	
Banking Freedom	-0.072***	0.009	-0.004	-0.018	0.024	-0.053**	-0.044*	0.021	0.457***	0.174***	-0.0249***

***, **, and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Table 3. Banking Crisis and Concentration

The logit probability model estimated is Banking Crisis_[Country=j, Time= t] = α + β_1 Real GDP growth_{j,t} + β_2 Terms of trade change_{j,t} + β_3 Real interest rate_{j,t} + β_4 Inflation_{j,t} + β_5 M2/reserves_{j,t} + β_6 Depreciation_{j,t} + β_7 Credit growth_{j,t-2} + β_8 Real GDP per capita_{j,t} + β_9 Moral Hazard Index_{j,t} + β_{10} Average concentration_{j,t} + β_{11} Banking freedom_{j,t} + β_{12} . The dependent variable is a crisis dummy that takes on the value of one if there is a systemic and the value of zero otherwise. Growth is the rate of growth of real GDP. Real interest rate is the nominal interest rate minus the contemporaneous rate of inflation. Inflation is the rate of change of the GDP deflator. M2/reserves is the ratio of M2 to international reserves. Credit growth is the real growth of domestic credit, lagged two periods. Depreciation is the rate of change of the exchange rate. Moral hazard is an aggregate index of moral hazard associated with varying deposit insurance schemes. 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. Banking freedom measures the relative openness of the banking and financial system. Bank data are from the BankScope database of Fitch IBCA. The sample period is 1980-1997. White's heteroskedasticity consistent standard errors are given in parentheses. Detailed variable definitions and sources are given in the data appendix.

	(1)	(2)	(3)	(4)	(5)
Real GDP growth	-0.146*** (0.032)	-0.163*** (0.035)	-0.169*** (0.035)	-0.164*** (0.035)	-0.174*** (0.036)
Terms of trade change	-0.012 (0.011)	-0.013 (0.012)	-0.014 (0.012)	-0.015 (0.013)	-0.11 (0.011)
Real interest rate	0.009*** (0.004)	0.010*** (0.004)	0.010*** (0.004)	0.010*** (0.004)	0.012*** (0.004)
Inflation	0.008 (0.008)	0.009 (0.009)	0.008 (0.009)	0.009 (0.008)	0.009 (0.009)
M2/reserves	0.001 (0.001)	0.002* (0.001)	0.002* (0.001)	0.002* (0.001)	0.001 (0.001)
Depreciation	0.631 (1.093)	0.453 (1.142)	0.441 (1.177)	0.777 (1.133)	0.443 (1.124)
Credit Growth _{t-2}	0.014* (0.009)	0.014* (0.009)	0.013 (0.009)	0.015* (0.009)	0.013 (0.009)
Real GDP per capita	-0.003 (0.002)	-0.004* (0.002)	-0.004** (0.002)		-0.003 (0.002)
Moral hazard			0.102 (0.075)		
Concentration		-1.946*** (0.797)	-1.654** (0.853)	-1.607** (0.805)	-2.095*** (0.812)
Banking freedom					-0.405** (0.198)
No. of Crises	47	47	47	47	47
No. of Observations	989	989	989	989	955
% crises correct	70	70	66	70	75
% correct	63	63	73	61	62
Model χ^2	44.24***	47.83***	48.46***	38.19***	57.91***

***, **, and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Table 4. Banking Crisis and Concentration: Diversification vs. Ease of Supervision

The logit probability model estimated is $\text{Banking Crisis}_{[Country=j, Time=t]} = \beta_0 + \beta_1 \text{Real GDP growth}_{j,t} + \beta_2 \text{Terms of trade change}_{j,t} + \beta_3 \text{Real interest rate}_{j,t} + \beta_4 \text{Inflation}_{j,t} + \beta_5 \text{M2/reserves}_{j,t} + \beta_6 \text{Depreciation}_{j,t} + \beta_7 \text{Credit growth}_{j,t-2} + \beta_8 \text{Moral hazard index}_{j,t} + \beta_9 \text{Concentration}_{j,t} + \beta_{10} \text{Mean Bank Size}_{j,t} + \beta_{11} \text{No foreign loans}_{j,t} + \beta_{12} \text{GDP}_{j,t} + \beta_{13} \text{No. of Banks}_{j,t} + \beta_{14} \text{Activity Restrictions}_{j,t} + \beta_{15} \text{Cashflow rights}_{j,t} + \beta_{16} \text{Cashflow}_{j,t}$. The dependent variable is a crisis dummy that takes on the value of one if there is a systemic and the value of zero otherwise. Growth is the rate of growth of real GDP. Real interest rate is the nominal interest rate minus the contemporaneous rate of inflation. Inflation is the rate of change of the GDP deflator. M2/reserves is the ratio of M2 to international reserves. Credit growth is the real growth of domestic credit, lagged two periods. Depreciation is the rate of change of the exchange rate. Moral hazard is an aggregate index of moral hazard associated with varying deposit insurance schemes. 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 data are from the BankScope database of Fitch IBCA. The sample period is 1980-1997. Mean Bank Size is given by average bank asset size (in billions of US dollars). No foreign loans takes the value one if banks are prohibited from investing abroad and 0 otherwise. GDP is real GDP in billions of US\$. No. of banks is given in hundreds and Activity restrictions captures bank's ability to engage in business of securities underwriting, insurance underwriting and selling, and in real estate investment, management, and development. Both are from Barth et al database. White's heteroskedasticity consistent standard errors are given in parentheses. Detailed variable definitions and sources are given in the data appendix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Concentration	-1.576* (0.899)	-1.479* (0.879)	-2.347** (1.009)	-1.653 (1.119)	-2.234** (1.162)	-2.111** (1.061)	-3.576** (1.651)
Mean Bank Size	0.000 (0.001)			0.000 (0.000)			
No foreign Loans			0.114 (0.551)	-0.350 (0.617)			
No foreign Loans*Bank size GDP (\$)		0.003 (0.002)		1.84xe ⁻¹⁰ *** (6.81xe ⁻¹¹)			
No. of banks					0.008 (0.014)	0.000 (0.001)	
Activity Restrictions						0.141 (0.103)	
Cashflow							0.030** (0.014)
No. of Crises	46	46	34	34	34	34	29
No. of obs.	979	997	804	767	767	767	527
% crises correct	74	72	74	77	68	76	72
% correct	63	64	70	75	73	74	78
Model χ^2	48.36***	47.67***	39.09***	44.19***	43.90***	43.43***	48.31***

***, **, and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Table 5. Bank Fragility and Concentration: Z

The OLS model estimated is $Z_{(Country=j)} = \alpha + \beta_1 \text{Fee income}_j + \beta_2 \text{Total loan growth}_j + \beta_3 \text{Log total assets}_j + \beta_4 \text{Liquidity}_j + \beta_5 \text{Concentration}_j + \beta_6 \text{Banking freedom}_j + \beta_7 \text{Standard deviation of GDP per capita}_j + \beta_8 \text{Growth}_j + \beta_9 \text{Inflation}_j + \epsilon_j$. The dependent variable, the z-score, is a ratio of the sum of return on assets and capital asset ratio to the standard deviation of the return on assets. The z-score is calculated at the country level, treating each country's banking system as one bank. Fee income is the ratio of other operating income to total revenue. Total loan growth is the rate of growth of total loans. Log of total assets is the log transformation of total assets. Liquidity is the ratio of liquid assets to short-term debt. 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. Banking freedom is an indicator of relative openness of the banking and financial system. Standard deviation of GDP per capita is the standard deviation of real GDP per capita. Growth of GDP per capita is the rate of growth of real GDP per capita. Inflation is the rate of change of consumer prices. Bank data are from the BankScope database of Fitch IBCA, averaged over the 1994-2001 period. Specifications (1)-(4) restrict the sample to include only crisis countries, using z-score calculated at the country level, thereby treating each country's banking system as one bank. In specifications (5) we weight the bank-level regressions by total assets and estimate the following Maximum Likelihood model: $Z_{(Bank=i, Country=j)} = \alpha + \beta_1 \text{Fee income}_{i,j} + \beta_2 \text{Total loan growth}_{i,j} + \beta_3 \text{Log total assets}_{i,j} + \beta_4 \text{Liquidity}_{i,j} + \beta_5 \text{Concentration}_j + \beta_6 \text{Banking freedom}_j + \beta_7 \text{Standard deviation of GDP per capita}_j + \beta_8 \text{Growth}_j + \beta_9 \text{Inflation}_j + \epsilon_{j,t}$. Detailed variable definitions and sources are given in the data appendix. Note: weighted regressions replace log total assets with total assets.

	(1)	(2)	(3)	(4)	(5)
Fee income	2.187 (1.729)	3.036* (1.781)	1.883 (1.726)	2.757 (1.815)	-55.613** (26.218)
Total loan growth	0.007 (0.006)	0.012** (0.006)	0.006 (0.006)	0.115** (0.006)	1.584*** (0.151)
Log of total assets	-0.012 (0.015)	-0.019 (0.015)	-0.009 (0.015)	-0.016 (0.016)	98.766*** (41.043)
Liquidity	0.108 (0.203)	0.123 (0.227)	0.022 (0.219)	0.567 (0.246)	-10.280 (8.338)
Concentration	16.490** (7.886)	20.023** (9.251)	14.513** (7.570)	18.831** (9.283)	57.932*** (19.588)
Banking freedom			3.036* (1.616)	2.430 (1.811)	-6.444** (3.137)
Standard dev of GDP per capita		-0.003 (0.003)		-0.004 (0.003)	-0.038*** (0.010)
Growth of GDP per capita		2.814** (1.380)		2.755** (1.396)	6.325* (3.876)
Inflation		-0.025*** (0.010)		-0.024*** (0.010)	-0.231 (0.380)
No. of Observations	51	51	51	51	808

***, **, and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Table 6. Bank Fragility and Concentration: Components of Z - ROA, STD DEV (ROA), C/A

The GLS random effects model estimated is $Y_{[Bank=i, Country=j]} = \alpha + \beta_1 \text{Fee income}_{i,j} + \beta_2 \text{Total loan growth}_{i,j} + \beta_3 \text{Log total assets}_{i,j} + \beta_4 \text{Liquidity}_{i,j} + \beta_5 \text{Concentration}_j + \beta_6 \text{Banking freedom}_j + \beta_7 \text{Standard deviation of GDP per capita}_j + \beta_8 \text{Growth}_j + \beta_9 \text{Inflation}_j + \beta_{10} \text{Inflation}_j$. The dependent variables are return on assets, standard deviation of the return on assets, and unweighted capital-asset ratio (calculated as the ratio of total equity to total assets). Fee income is the ratio of other operating income to total revenue. Total loan growth is the rate of growth of total loans. Log of total assets is the log transformation of total assets. Liquidity is the ratio of liquid assets to short-term debt. 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. Banking freedom is an indicator of relative openness of the banking and financial system. Standard deviation of GDP per capita is the standard deviation of real GDP per capita. Growth of GDP per capita is the rate of growth of real GDP per capita. Inflation is the rate of change of consumer prices. Bank data are from the BankScope database of Fitch IBCA, averaged over the 1994-2001 period. Specifications (1) and (4) correspond to the dependent variable, return on assets (ROA). In specifications (2) and (5), we focus on the following dependent variable: standard deviation of return on assets. Specifications (3) and (6) correspond to the unweighted capital asset ratio. Detailed variable definitions and sources are given in the data appendix.

	ROA	?(ROA)	C/A	ROA	?(ROA)	C/A
	(1)	(2)	(3)	(4)	(5)	(6)
Fee income	0.016*** (0.006)	0.006 (0.009)	0.045*** (0.017)	0.016*** (0.006)	0.006 (0.009)	0.044*** (0.017)
Total loan growth	-0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)
Log of total assets	-0.002*** (0.000)	-0.002*** (0.001)	-0.018*** (0.001)	-0.002*** (0.000)	-0.002*** (0.001)	-0.018*** (0.001)
Liquidity	0.001 (0.001)	0.002** (0.001)	0.008*** (0.002)	0.001 (0.001)	0.002** (0.001)	0.008*** (0.002)
Concentration	0.014** (0.007)	-0.024*** (0.009)	-0.025 (0.022)	0.014** (0.007)	-0.024*** (0.010)	-0.019 (0.022)
Banking freedom				0.001 (0.002)	-0.005** (0.002)	0.003 (0.005)
Standard dev of GDP per capita	0.000* (0.000)	-0.000** (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Growth GDP per capita	-0.002** (0.001)	-0.001 (0.001)	-0.004* (0.002)	-0.002** (0.001)	-0.001 (0.001)	-0.004* (0.002)
Inflation	0.000*** (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000 (0.000)
No. of Observations	1089	1089	1089	1085	1085	1085

***, **, and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Table 7. Banking Crisis and Concentration: Cost of Crises

Both the Tobit model estimated in specifications (1)-(3) and the OLS model estimated in (4)-(6) are of the form: $\text{Cost of crisis}_{[\text{Country}=j]} = \beta_0 + \beta_1 \text{Real GDP growth}_j + \beta_2 \text{Terms of trade change}_j + \beta_3 \text{Real interest rate}_j + \beta_4 \text{Inflation}_j + \beta_5 \text{M2/reserves}_j + \beta_6 \text{Depreciation}_j + \beta_7 \text{Credit growth}_j + \beta_8 \text{Moral hazard index}_j + \beta_9 \text{Concentration}_j + \beta_{10}$. The OLS cross-section model estimated in specifications (4)-(6) is $\text{Cost of crisis}_{[\text{Country}=j]} = \beta_0 + \beta_1 \text{Real GDP growth}_j + \beta_2 \text{Terms of trade change}_j + \beta_3 \text{Real interest rate}_j + \beta_4 \text{Inflation}_j + \beta_5 \text{M2/reserves}_j + \beta_6 \text{Depreciation}_j + \beta_7 \text{Credit growth}_j + \beta_8 \text{Moral hazard index}_j + \beta_9 \text{Concentration}_j + \beta_{10}$. The dependent variables capture the fiscal cost of crisis. Growth is the rate of growth of real GDP. Real interest rate is the nominal interest rate minus the contemporaneous rate of inflation. Inflation is the rate of change of the GDP deflator. M2/reserves is the ratio of M2 to international reserves. Credit growth is the real growth of domestic credit, lagged two periods. Depreciation is the rate of change of the exchange rate. Moral hazard is an aggregate index of moral hazard associated with varying deposit insurance schemes. 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 data are from the BankScope database of Fitch IBCA. Specifications (1)-(3) are for the full sample of countries. In specification (1) we focus on one variation of the Klingebiel-Honohan fiscal cost measure, while in specifications (2) focus is on the second variation of the Klingebiel-Honohan fiscal cost measure. Specification (3) examines the John Boyd measure of cost of crisis. White's heteroskedasticity consistent standard errors are given in parentheses. Detailed variable definitions and sources are given in the data appendix.

	(1)	(2)	(3)
Real GDP growth	3.821*** (0.811)	3.614*** (0.857)	1.553** (0.814)
Terms of trade change	-0.929* (0.489)	-0.832 (0.593)	0.047 (0.444)
Real interest rate	0.235 (0.191)	0.591** (0.291)	-0.139 (0.257)
Inflation	1.050*** (0.196)	1.198*** (0.272)	0.316 (0.225)
M2/reserves	0.144*** (0.029)	0.080** (0.036)	0.126*** (0.029)
Depreciation	-57.818*** (16.742)	-141.172*** (32.809)	-26.592 (21.046)
Credit Growth _{t-2}	0.217 (0.141)	0.185 (0.155)	0.087 (0.178)
Real GDP per capita	0.000** (0.000)	0.000 (0.000)	-0.000 (0.000)
Moral Hazard Index	0.408 (0.887)	0.764 (0.912)	1.343* (0.820)
Concentration	-8.261 (7.499)	-15.006* (9.207)	-2.269 (9.355)
No. of obs.	47	49	69

***, **, and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Data Appendix

Variable Name	Definition	Source
Banking crisis	Dummy takes on value of one during episodes identified as a systematic banking crises	Demirguc-Kunt and Detragiache (2001)
Growth	Rate of growth of real GDP	WDI (World Bank)
Terms of trade change	Change in the terms of trade	WDI (World Bank)
Real interest rate	Nominal interest rate minus the contemporaneous rate of inflation	IFS (IMF)
Inflation ^a	Rate of change of GDP deflator	IFS (IMF)
M2/reserves	Ratio of M2 to international reserves	IFS (IMF)
Depreciation	Rate of depreciation	IFS (IMF)
Credit growth	Rate of growth of real domestic credit to the private sector	IFS line 32d divided by GDP deflator
GDP/CAP	Real GDP per capita	WDI (World Bank)
GDP	Real GDP in billions of US dollars	WDI (World Bank)
Moral hazard index	Principal component indicator measuring the generosity of deposit insurance, based on co-insurance, coverage of foreign currency and interbank deposits, type and source of funding, management, membership and level of explicit coverage.	DD (2003)
Concentration ^a	Degree of concentration in the banking industry, calculated as the fraction of assets held by the three largest banks. Averaged over the 1988-97 period.	Beck, Demirguc-Kunt, Levine (2000) - Financial Structures Database
Mean Bank Size	Total banking assets divided by number of banks.	BankScope database.
No Foreign Loans	Survey question 7.2 asks if banks are prohibited from making loans abroad (yes=1, no=0).	Barth, Caprio, and Levine (2001) - Survey of Bank Regulation and Supervision
No. of Banks	No. of banks in hundreds.	Barth, Caprio, and Levine (2001) - Survey of Bank Regulation and Supervision
Banking Freedom ^a	Indicator of relative openness of banking and financial system: specifically, whether the foreign banks and financial services firms are able to operate freely, how difficult it is to open domestic banks and other financial services firms, how heavily regulated the financial system is, the presence of state-owned banks, whether the government influences allocation of credit, and whether banks are free to provide customers with insurance and invest in securities (and vice-versa). The index ranges in value from 1 (very low – banks are primitive) to 5 (very high – few restrictions). Averaged over 1995-97 period.	Index of Economic Freedom (Heritage Foundation)
Fee income	Ratio of other operating costs to total revenue, averaged 1994-2001.	Bankscope database

Total loan growth	Rate of growth of total loans, averaged 1994-2001.	Bankscope database
Variable Name	Definition	Source
Log of total assets	Log of total assets, averaged 1994-2001	Bankscope database
Liquidity	Ratio of liquid assets to short-term debt, averaged over 1994-2001.	Bankscope database
Standard dev of GDP per capita	Standard deviation of real GDP per capita	Calculated from real GDP per capita data taken from WDI (World Bank)
Growth GDP per capita	Rate of growth of real GDP per capita, averaged 1994-2001	WDI (World Bank)
Inflation ^b	Rate of change of consumer price index, averaged 1994-2001	IFS (IMF)
Concentration ^b	Degree of concentration in the banking industry, calculated as the fraction of assets held by the three largest banks. Averaged over the 1994-2001 period.	Bankscope database
Banking Freedom ^b	Indicator of relative openness of banking and financial system: specifically, whether the foreign banks and financial services firms are able to operate freely, how difficult it is to open domestic banks and other financial services firms, how heavily regulated the financial system is, the presence of state-owned banks, whether the government influences allocation of credit, and whether banks are free to provide customers with insurance and invest in securities (and vice-versa). The index ranges in value from 1 (very low – banks are primitive) to 5 (very high – few restrictions). Averaged over 1994-2001 period.	Index of Economic Freedom (Heritage Foundation), 2003
ROA	Return on assets, averaged 1994-2001	Bankscope database
?(ROA)	Standard deviation of return on assets	
C/A	Ratio of total equity to total assets, unweighted. Averaged 1994-2001.	Bankscope database
Z-score	Ratio of the sum of return on assets and unweighted capital asset ratio to the standard deviation of return on assets	Bankscope database

^a denotes data as defined in crisis regressions, ^b denotes data as defined in fragility regressions