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Financial liberalization, prudential supervision, and the onset of banking crises

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Abstract

We examine what is perceived as one of the main culprits in the occurrence of banking crises: financial liberalization. As is typically argued, if liberalization is accompanied by insufficient prudential supervision of the banking sector, it will result in excessive risk taking by financial intermediaries and a subsequent crisis. Having evaluated the empirical validity of this hypothesis, we conclude that such a development is, at worse, only a medium run threat to the health of the banking sector. We find that a more immediate danger is the loss of monopoly power that liberalization typically entails. We base our conclusions on an empirical investigation of a panel-probit model of the occurrence of banking crises using macro-economic, institutional and political data.

JEL classification: G21; G28; F36

Keywords: Banking crises; Prudential supervision; Liberalization

1. Introduction

Extravagant failures of the banking industry in the last decade have brought banking crises back into the spotlight. In a recent article on the cost of the Indonesian banking crisis to the Indonesian taxpayers, the *Economist* estimated it as US$ 75bn and quoted an analyst calling it "the most expensive bail-out in world history" (*Economist*, 10/16/2003). While

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economic theory started dealing with banking sector failures earlier—the most prominent is Diamond and Dybvig's (1983) contribution—the empirical investigation into the causes and consequences of banking crises in developing countries has only started to attract professional attention in the last several years.

We examine one of the more important policy questions facing this empirical literature—the role of financial liberalization—in its comprehensive attempt to provide policy makers with advice on preventing crises, identifying their onset earlier, and mitigating their adverse effects. Díaz-Alejandro (1985), in an early contribution titled "Goodbye Financial Repression, Hello Financial Crash," skillfully described the association between financial liberalization and financial crises based on his observations of the Latin American experience—we empirically examine this hypothesized association in this paper.

All empirical papers that construct early warning systems or consider the determinants of crises identify a narrow set of macro-economic and financial variables that predict banking crises. One of the most robust results within this literature is that recent liberalization of the domestic financial sector will increase the likelihood of a banking crisis (the literature is surveyed in Arteta and Eichengreen, 2002). However, there is no available evidence on the exact role that financial liberalization plays in the emergence of problems in the banking sector; it is not clear how much the increased risk to the banking sector is conditional on the shape or speed in which liberalization occurs, and, more importantly, what is indeed the chain of events that leads from liberalization to crises.

While there is little formal theoretical attempt to explain the role of financial liberalization in the appearance of systemic problems in the banking sector, two contending (but not mutually exclusive) explanations emerge: henceforth, the 'lax supervision' and 'monopoly power' hypotheses. We describe them in this section and then outline the methodology we use to empirically evaluate of their relative merits.

1.1. Lax supervision

The first plausible channel focuses on the inherent micro-economic imperfections facing the banking industry, i.e. adverse selection, moral hazard, principal-agent issues and other micro-imperfections due to informational asymmetries and uncertainties. Since financial liberalization implies a change in the 'rules of the game' and since agents (bank managers) are not yet familiar with their consequences they may take on excessive risk in an attempt to use the more flexible and open operating environment to increase profits.

As banks are a pivotal ingredient in the payments system and are important for macroeconomic health, the government—typically the central bank[1]—regulates and prevents this excessive risk taking. However, following liberalization, previous prudential supervisory practices (even if those were enforced) are no longer viable. Furthermore, since supervisors are also unfamiliar with the new 'rules', their effectiveness decreases (Dewatripont and Tirole, 1993; Martinez Peria and Schmukler, 2001; Niel and Baumann, 2002). This effect will be stronger the weaker is the underlying supervisory regime.

[1] The supervisory body usually resides within the central bank or as another government agency that cooperates or is closely affiliated with the central bank (Cukierman, 1992).

Thus, financial liberalization that motivates and enables risk-taking behavior will likely contribute to a banking crisis only if it is accompanied by inefficient supervision. If an efficient supervisory structure is in place, excessive risk-taking will not occur, and financial liberalization is unlikely to have adverse effect on the stability of the banking sector.

1.2. Monopoly power

The alternative explanation for the role of liberalization in the onset of banking crises is focused on the increased competition that results from financial liberalization. Typically, a pre-liberalized sector is one in which only a small number of domestic banks operate (or are allowed to operate). Foreign banks, and sometimes even new domestic banks, cannot enter and there is usually a ceiling on the interest rate that banks are allowed to offer their depositors. Without free entry and with a binding price floor (maximum deposit rate), existing banks enjoy considerable monopoly power. Liberalization of domestic interest rates will, therefore, shrink profit margins as banks start competing on deposits by increasing deposit rates and the entry of foreign banks presents domestic banks with increased competition (Freixas and Rochet, 1997). As competition intensifies, inefficient institutions will go bankrupt (Boyd et al., 2003). The narrowing of profit margins also puts banks in a more vulnerable position with respect to fluctuations in the environment they operate. In addition, future expected profits also shrink, making the cost of bankruptcy lower and driving banks to take on more risky investments as long as the regulatory constraints are not yet binding.

This process is not unlike the Schumpeterian 'creative destruction' that is typical of markets in flux (Caballero and Hammour, 2000). Under this scenario, therefore, systemic problems in the banking sector are an almost inevitable, and arguably desirable, result of financial liberalization in and of itself—even if liberalization is accompanied by efficient prudential supervision.

1.3. Empirically differentiating between the two effects

The above mentioned characteristic of the 'monopoly power' channel—namely, its independent effect from any other institutional characteristic of the economy—enables us to devise an identification strategy that allows us to empirically differentiate between the two different channels.

We start with a probit model for the occurrence of banking crises. Our model, discussed in more detail in Section 4, contains both a liberalization variable and an interactive term as explanatory variables. The interactive term is composed of the interaction of financial liberalization and the strength of the prudential supervisory regime. We estimate this model using a panel data set using annual observations for a broad range of countries.

We focus on the coefficient of the financial liberalization variable (γ) and the coefficient of the interactive term of financial liberalization and supervision (δ). Were the 'lax supervision' hypothesis the important channel operating from liberalization to crises, we would expect the second coefficient (δ) to be significant and the first (γ) insignificant. While if the 'monopoly power' hypothesis describes the banking sector risks inherent in

financial liberalization, we would expect the opposite—the second coefficient to equal zero while the coefficient on financial liberalization (γ) to remain significant.

Our identification strategy for the 'monopoly power' hypothesis rests on the assumption that, holding constant the degree for which 'lax supervision' attributes to the occurrence of banking crisis, the residual effect from liberalization to crisis is completely attributable to the second channel ('monopoly power'). Stated differently, we assume that no other channel, besides the two we suggest, operates between domestic financial liberalization and the occurrence of banking crises. If this assumption is not maintained, then our model empirically evaluates only the 'lax supervision' hypothesis.

Furthermore, it might be the case that banking crises occur as a result of some fundamental problem in the ways banks operate (for example, their accounting standards).[2] If this fundamental problem can only be unmasked when liberalization occurs and if a crisis will erupt only if the problem is observed, than we would observe an empirical association between liberalization and crises even though no true causal link exists. Using our methodology, we cannot empirically differentiate the role of an unobserved factor unmasked by liberalization from our 'monopoly power' hypothesis. Nevertheless, we provide some evidence with respect to the robustness of our results by using several different proxies for the supervision and liberalization components of our empirical model.

We find that, in direct contrast to what is usually perceived, the 'monopoly power' channel appears more important than the 'lax supervision' channel in the short term. For a longer horizon (3–5 years), we find some evidence that a combination of domestic liberalization with lax supervision by the authorities does indeed yield a significant increase in the likelihood of financial crises. We also find that international liberalization (of the current account, the capital account or of regulations on repatriation of export proceeds) does not seem to be an important predictor for banking crises.

We will first survey, in the next section, previous literature on financial liberalization and banking crises. In Section 3, we describe the data and detail the various measures we use to proxy for financial liberalization and the strength of the supervisory regime; in Section 4, we detail our methodology and summarize results and in Section 5 we conclude with some caveats.

2. Banking crises and financial liberalization—the literature

2.1. Theory

The pivotal role played by financial intermediaries implies that any disruption to the smooth functioning of financial intermediation is bound to have adverse effects on economic performance (King and Levine, 1993; Hutchison and Noy, in press). Many different ills can cause systemic distress within the banking sector. Goldstein and Turner (1996) identify, for example, the adverse effects of macroeconomic shocks, lending booms (bubbles) and surges in inflows, liability or currency mismatches, government involve-

[2] Desmet (2000) found evidence of such a channel for the Mexican Tequila crisis of 1995.

ment in the financial sector, lack of transparency, opaque accounting standards and legal framework, and distorted incentives for supervisors, bank owners, managers, and depositors as some of the possible reasons behind banking distress, contagion, and systemic failure of the banking sector.

Especially interesting, for our purposes, are the various microeconomic anomalies inherent in the functions of financial intermediaries (Freixas and Rochet, 1997). The most oft-mentioned failure is due to moral hazard in the presence of deposit insurance.[3] While deposit insurance poses a challenge to both financial firms and regulators, other agency failures can play a role as well. Adverse self-selection of loan requests, for example, can pose a serious challenge as it leads banks to sell loans to riskier borrowers, which, in the face of a downturn might result in a banking sector collapse. The lender-of-last-resort promise to provide liquidity in face of liquidity shortages might also introduce inefficiencies and, in addition, pose a practical problem to authorities to differentiate between illiquid and insolvent banks.[4]

Dewatripont and Tirole (1993) state that "these [microeconomic failures] suggest a role for a public agency like FDIC that would: (1) regulate banks ex ante, forcing adjustments in the liability structure to counter the perverse incentive problem; and (2) intervene ex post, thereby acting on behalf of small depositors in turbulent times. Regulation practices often discussed in the literature include: development of honest and impartial legal systems, mandating stricter information disclosure practices, establishment of limits either on the rate at which banks can expand credit or on the rate of increase in their exposure to certain sectors, such as real estate ('speed bumps'), requiring greater diversification of bank portfolios, tougher capital and liquidity standards—accounting for different risk exposures, stricter definitions of non-performing loans, more widespread mandatory provisioning once a loan is nonperforming, and establishment of a more transparent and efficient operating environment (Barth et al., 1997).

A recent line of research, pioneered in Hellmann et al. (2000), investigates the channels through which competition, in an environment of informational imperfections, might affect the stability of the banking sector. Hellmann et al. (2000) find that competition can undermine prudent behavior in the presence of moral hazard and may lead to inefficient (excessive) risk taking by banks. Boyd and De Nicoló (2003) present an opposite effect from competition to financial fragility. Thus, there is little agreement among theorists on the connections between liberalized financial markets and banking sector distress. In spite of these theoretical disagreements, and the substantial empirical evidence (reviewed in the next section) of the role of financial liberalization in the onset of banking sector distress, the case for domestic financial liberalization has not been widely contested in academic research.

In the previous section, we offered two contending explanations for the role of liberalization in destabilizing the financial sector. The first, the 'lax supervision' hypothesis, sees the root of the problem in liberalization that is unaccompanied by efficient and

[3] For surveys of deposit insurance experiences and schemes in place, see Demirgüç-Kunt and Kane (2002), Garcia (1999) and Kyei (1995).

[4] The traditional view, as in Baghot's 19th century dictum, is that the lender-of-last-resort should provide liquidity at high interest and only against good collateral (and thus only to illiquid banks). Diamond and Rajan (2002) challenge this view and provide a theoretical justification for last-resort-lending to insolvent banks as well.

innovative supervisory practices. The second hypothesis, previously referred to as the 'monopoly power' explanation, sees banking crises as 'creative destruction' of inefficient or corrupt institutions once they become exposed to competition.

Various liberalizing actions in the banking sector are, of course, possible, and each will plausibly have different effects on the channels outlined above. Reducing restrictions on the range of activities in which banks can engage, eliminating constraints on their geographical range of operations, allowing and even actively promoting a greater presence of foreign banks, or abolishing rate ceilings on bank deposits are all possible liberalization schemes.[5]

2.2. Empirics

Arteta and Eichengreen (2002) provide an extensive survey of empirical macroeconomic research on banking crises. They identify a list of macro-economic and financial variables that are found to be significant in the determination of banking crises. We make use of their list in defining the control variables in our own regressions. In their Section 6, they focus on financial liberalization as a determinant of crises and find that "[domestic financial liberalization] enters with a strong positive coefficient which differs from zero at the 99% confidence level, confirming [others'] finding that domestic financial liberalization heightens crisis risk, presumably by facilitating risk taking by intermediaries" (p. 21).[6] Here, we precisely examine whether the mechanism that leads from liberalization to crises is indeed through facilitation of increased 'risk taking by intermediaries'—a question that has not been empirically resolved (or even examined). Earlier papers that found the same correlation between liberalization and banking crises are Demirgüç-Kunt and Detragiache (1998), and Glick and Hutchison (2001).[7]

In line with most other research, Barth et al. (1998) find that restrictions on operations of the financial sector increase the long-run likelihood of a banking crisis. They also find that countries with weaker financial systems will impose harsher regulatory standards. However, most empirical research finds that the period immediately following the withdrawal of these restrictions will also increase instability in the banking sector and the probability of systemic failures.

A number of papers have taken a different approach to the research on the causes of banking distress and have utilized micro-economic data sets on specific financial institutions. Bongini et al. (2001) examine the evolution of the East Asian crisis, which was accompanied by large-scale banking problems. While they do not explicitly look at financial liberalization, their results do support some of the main conjectures that we use to justify the interpretation of our empirical findings. They find that, for the East Asian crisis, foreign-owned banks were less likely to get into a liquidity crisis and none of the foreign-owned financial institutions in their sample was closed. Furthermore, the institutions that

[5] De Nicoló et al. (2003) and Gelos and Roldós (2004) present empirical evidence of trends during the last two decades in consolidation, internationalization, and conglomeration within the financial sector worldwide.

[6] In a footnote they state, "these conclusions are robust to alternative estimation methods."

[7] Beck et al. (2003), Demirgüç-Kunt and Detragiache (2002), and Mehrez and Kaufman (1999) provide more comprehensive institutional details on the causes of banking crises but do not examine the question of liberalization.

were 'connected' with industrial groups or influential families were more likely to be distressed during the crisis although such connections did not make closure more or less likely as compared to other distressed institutions. Their findings are consistent with our arguments. In additional support, Claessens et al. (2001) find that foreign owned banks tend to have higher profit margins and that foreign presence is correlated with lower profit margins for domestically owned banks in developing countries. This is consistent with the channel described in our 'monopoly power' hypothesis. Utilizing banks' balance sheets data sets to identify and differentiate between our 'lax supervision' and 'monopoly power' hypotheses is a direction for future research.

3. Data

Our data set is for the years 1975–1997 and covers the 61 non-OECD countries for which at least 10 years of consecutive GDP, banking crises and liberalization data was available. Since for many of the variables data is available only for a subset of country-years, sample sizes for regressions are typically smaller. We run all regression for the whole sample, and for a subset of emerging economies (29 countries).

3.1. Banking crises

The banking crisis series is based on criteria developed by Caprio and Klingebiel (1996, 1999) and Demirgüç-Kunt and Detragiache (1998). We use a binary variable with 1 denoting the onset of a banking crisis and 0 otherwise. To prevent a continuing banking crisis to be included more than once, we imposed a 2-years window around each banking crisis identified—see Appendix A for a detailed list. There are 53 episodes of crises identified for a total of 210 crisis-years.[8]

3.2. Financial liberalization

For the domestic financial liberalization variable, we used a binary series where 0 denotes the presence of interest rates control (ceiling) on bank deposits and 1 when there is no such control. Following all previous literature, we use this indicator to proxy for domestic financial liberalization. The data series is from Demirgüç-Kunt and Detragiache (1998) but has been augmented by Glick and Hutchison (2001) to cover additional countries. We examined only the onset of a liberalized period as our hypothesis and previous empirical evidence indicate that the advent of liberalization rather than its presence is a destabilizing force for the banking industry. Since our focus here is to evaluate the relative merits of the previously discussed 'lax supervision' and 'monopoly power' hypotheses we are only interested in the immediate period following domestic

[8] For additional details on this data and the exact definition used to differentiate between standard and major banking crises, see Hutchison and Noy (in press). Arteta and Eichengreen (2002) compare alternative sources for banking crises data and find they yield very similar results in their empirical work.

liberalization. As banking trouble take time to manifest and even longer to get noticed, we defined an onset variable with 1 for the first 2 or 3 years after liberalization and 0 otherwise.[9] We found 59 cases of domestic financial liberalization for our 61 countries set.[10]

Our data on banking crises and domestic financial liberalization is provided in Appendix A. An obvious observation from that list is that almost all the banking crises in our sample occurred when there was no interest rate control (liberalized markets) and most of these occurred within a few years of the liberalization itself. An interesting exception is the banking crisis that accompanied the turmoil in East Asia in 1997. Indonesia, Malaysia, and Thailand all had liberalized financial markets for a decade or more before the crisis hit.

We also consider three measures of international financial liberalization: liberalization of the capital accounts, liberalization of the current account, and the removal of surrender-of-export-proceeds requirement. The variables are taken from the IMF's classifications contained in the Annual Report on Exchange Arrangements and Exchange Restrictions (various issues). For all, a country is classified as either "liberalized" (1) or not (0). We find 37 cases of capital accounts liberalization, and 47 cases of removal of a surrender of export proceeds requirement.[11] Since these measures proxy for openness to international financial markets, they should be highly significant for predicting currency crisis but should have much less effect on the stability of the domestic banking industry. This is indeed the case—when these are used as a proxy for liberalization instead of the domestic liberalization variable the results are almost always insignificant. Bekaert et al. (2004) investigate the effect of liberalization of equity markets. As for much of our sample banks were not publicly traded in active equity markets, we do not expect that opening up equity markets to foreign investment will have much effect on the banking sector.

3.3. Supervision

The paper attempts to evaluate the 'lax supervision' hypothesis that is almost always cited in previous literature as the reason behind the high significance found for the liberalization variable. It might be that lax supervision is the result not of the absence of prudential regulation but rather the absence of its enforcement. We therefore require a proxy for the strength of the supervisory body and the likelihood that it will actually implement enacted prudential regulation (a de facto rather than a de jure measure).

We employ three different proxies. The first is a measure of the degree of corruption taken from Göttingen University's *Internet Center for Corruption Research* (a joint project with Transparency International). The time-series for the 50 countries covered in their data is based on four observation points: the first two have been constructed by ICCR based on

[9] We have experimented with different time spans—from 2 to 5 years—following liberalization but results are qualitatively the same.

[10] Some countries went through more than one period of liberalization as controls were repeatedly lifted and reinstated.

[11] We do not present results with the current account liberalization variable, as it is never found to be a significant indicator of banking crises.

surveys conducted by Business International and Political Risk Service, East Syracuse, NY. We used these points to represent 1975–1984 and 1985–1989. The last two points are based on the surveys of businessmen and consultants conducted by *TI* and published annually. The first represents 1990–1994 and the last 1995–1997.[12] The index runs from 0 to 10 where 0 is the least corrupt and 10 is the most (only Bangladesh during the late 1980s received this distinguishing mark). The index differs substantially across the 46 countries for which it is available—for the latest survey Denmark ranked first with 0.06 and Nigeria last with 8.24.

For the second alternative for a 'lax supervision' proxy variable, we use data taken from an annual assessment of the state of political freedom published by Freedom House since 1972 and available electronically (Gwartney and Lawson, 1997). Since the existence of efficient supervision is most likely dependent also on the presence of a free press and freedom of expression, we stipulate that without political freedom the 'under-the-table' financial incentives that are inherent in the activities of banking sector supervisory bodies will overcome any attempt to strictly implement prudential regulations. The index we constructed from the Freedom House data assigns each country the status of "Free," "Partly Free," or "Not Free" (0, 0.5, 1, respectively) by averaging their political rights and civil liberties ratings. Those whose ratings average 1–2.5 are considered "Free", 3–5.5 "Partly Free", and 5.5–7 "Not Free". The index is available for 83 countries.

A third proxy for the 'lax supervision' variable used in this project is an independence of the Central Bank index constructed by Cukierman (1992). Cukierman (1992) notes that banking supervisory bodies reside within the central bank almost universally. A more independent central bank will therefore contain a more resilient supervisory body that can withstand political pressure and implement its prudential regulations judicially. Cukierman's index does not vary over time in his original index for the 1980s and no update for his measure is available. We used his index to construct a dummy for each country where the measure ranges from 0 (perfectly independent central bank) to 1 (perfectly dependent). Actual data runs from 0.14 to 0.67 and is available for 56 countries.

While all three proxies are admittedly imperfect, they provide qualitatively similar results, which seems to support our contention that all three can be used as proxies for the same underlying phenomena.

3.4. Macroeconomic variables

To prevent identification of spurious correlations due to omitted variables, we included several financial and macroeconomic variables that have been consistently identified in the literature as significant in the determination of banking crises. We based our list on Arteta and Eichengreen (2002), Glick and Hutchison (2001) and Mehrez and Kaufmann (1999). The control variables included in all regressions were: inflation, change in export proceeds, change in ratio of money to international reserves, change in per capita real gross domestic product, foreign interest rates (trade-weighted average of the G-3 interest rates), and a measure of real exchange rate over-valuation (deviation from the average of

[12] In a few cases where the last point was unavailable, we extended the 1990-1994 data to 1997.

the previous 5 years). All data was obtained from the *International Financial Statistics* CD-ROM. As data is annual, we minimized possible simultaneity and reverse causality problems by lagging all variables by 1 year.

As a burgeoning 'Twin Crises' literature suggests, currency crises are closely related to the occurrence of banking crises and might offer some predictive power in their forecasting. We therefore included a measure for currency crises. The measure is constructed by identifying "large" (mean plus two times the country-specific standard deviation) changes in an index of currency pressure. The currency pressure index is defined as a weighted-average of monthly real exchange rate changes and monthly (percent) reserve losses.[13]

4. Descriptive statistics and estimation results

4.1. Conditional probabilities

In Table 1, we examine the correlations between the different proxies we use for supervision and between those proxies and the domestic liberalization variable. The financial liberalization variable is not significantly correlated with any of the supervision variables. With a significant correlation, our identification strategy of using an interactive term would have been invalid. For the supervision variables, the corruption and freedom indices are significantly correlated (correlation is 0.58) which validates our assumption that these measure related institutional characteristics. We observe a very low correlation between the central bank' independence index and the other two proxies for supervision (freedom and corruption). This is most likely because the CBI index is time invariant while the other two proxies do change over time (the freedom index changes annually). We present our regression results for all three measures.

Table 2 presents conditional probabilities and clearly shows that the introduction of domestic financial liberalization is highly correlated with the advent of banking sector distress. Such results are reported for a 3-, 4- and 5-year period after domestic financial liberalization, and the two international liberalization variables previously discussed together with a χ^2 probability test for independence of the two series.

For the emerging markets sample, the international liberalization variables (capital account liberalization and cancellation of a surrender of export proceeds requirement) are not correlated significantly with the onset of banking crises. This is an interesting result as the cause of the East Asian banking crisis is occasionally identified as liberalization of the capital account that enabled 'hot money' to flow in and then reverse at the first signs of stress.[14] For the poorer developing countries sample, liberalization of the surrender of export proceeds requirement does appear to be correlated with occurrence of banking

[13] The weights are inversely related to the variance of changes of each component over the sample for each country. A more extensive discussion of this variable is found in Hutchison and Noy (2002a).

[14] For empirical discussions of the effects of flows and their sudden stop, see Glick and Hutchison (in press) and Hutchison and Noy (2002b).

Table 1
Correlations for supervision and liberalization variables

	Central Bank independence	Corruption	Freedom index
Domestic financial liberalization	− 0.02	0.06	0.05
Central Bank Independence		− 0.09	− 0.03
Corruption			0.58

crises. In terms of magnitude, though, this observation does not seem to be different than for the emerging markets sample (where the variable is insignificant).

4.2. Probit estimation methodology and results

For this paper's purpose, we examine the sources of the correlation reported above in a multivariate framework by examining the interaction of financial liberalization with the prudential supervisory variables previously discussed. We postulate a probit model of the form:

$$[\text{prob}(\text{BNK}_{it} = 1)] = F(\beta X_{it-1} + \gamma \text{FL}_{it} + \delta FL_{it} \cdot \text{SPR}_{it})$$

where, BNK is a binary variable for the onset of banking crises, X is a vector of lagged macroeconomic and financial variables that affect the likelihood of a future crisis, FL is the financial liberalization variable (described in Section 3.2) and SPR proxies for the strength of the prudential supervisory regime in place—we use the three alternatives described in Section 3.3. We estimated this equation as a pooled multivariate probit model using maximum likelihood estimation with annual data.[15]

We focus on the coefficient of the financial liberalization variable (γ) and the coefficient of the interactive term of financial liberalization and supervision (δ). Were the 'lax supervision' hypothesis correct, we would expect the second coefficient (δ) to be significant while if only the 'monopoly power' reason behind the significance of financial liberalization is appropriate we would expect that second coefficient to equal zero (H_0 not rejected) with the first one (γ) significantly negative. Thus, while we hold constant the 'monopoly' channel by including the liberalization dummy, we directly test the significance of the 'lax supervision' hypothesis as a leading indicator and cause for banking crises.

We check for robustness by using different specifications, samples and proxies. We also present results for a major-crises list and report these in Table 4. For the financial liberalization variable, we used the standard proxy for domestic liberalization, namely the withdrawal of deposit rate restrictions.

The three other liberalization variables used by Glick and Hutchison (in press) are not significantly correlated with the advent of banking crises as we observed in Table 2. We, therefore, do not report results of these regressions. For the supervision variable, we used three different alternatives—corruption, political freedom and central bank independence—and report all results. The results are qualitatively similar for all three.

[15] Some of the variables we alternatively use for SPR do not change over time and thus we are unable to employ country fixed effects. In any case, using such effects will deprive us of much of the cross-sectional variation in the data that we would like to utilize to examine the effects of our institutional variables.

Table 2
Onset of banking crises conditional on previous liberalization

Liberalization...	Occurred in last 3 years	Occurred in last 4 years	Occurred in last 5 years
Full sample			
Of domestic interest rates	20**	34.4***	40***
Of capital account	7.2	9.2	10.3
Of surrender of export proceeds	11.2	13.2	14.3
Developing economies			
Of domestic interest rates	15.5**	26.8***	41***
Of capital account	4.8	5.7	6.7
Of surrender of export proceeds	10.4*	11.4**	11.4**

All numbers are in percent terms out of the whole sample of banking crises. For example, the first upper-left cell notes that 20% of the banking crises in our sample occurred within 3 years of liberalization of interest rates. Null hypothesis of independence is distributed as $\chi^2(1)$. ***, **, and * indicate rejection of null at 1%, 5%, and 10% significance levels, respectively.

The results of a benchmark probit estimation excluding the interactive term are presented in Table 3 column (1) for the whole sample, column (2) for the developing countries' sub-sample and column (3) for the emerging economies' sub-sample. Results are mostly consistent across these three different samples. As we focus in this paper on the institutional variables' significance as determinants of banking crises, we report the results for the coefficients of the control variables only for our baseline regression. In the tables that follow (Tables 4 and 5), we do not report results for the control variables although these are always included in estimation.

In Table 3, all the coefficients of our macro-economic and financial variables, excluding change in export proceeds, are highly significant in all regressions.[16] An increase in the inflation rate, an increase in the M2/reserves ratio, a decrease in GDP growth rate, a depreciating real exchange rate, and a decrease in foreign interest rates are all found to contribute to the likelihood of a banking crisis as theory suggests. For the emerging markets sample, the effect of the change in M2/reserves appears to be significantly weaker than for poorer developing countries and the effect of a downturn in GDP growth rates stronger.

The coefficient for the currency crisis dummy is insignificant across all samples. This result is in line with Kaminsky and Reinhart (1999) and Glick and Hutchison (2001) in which causality appears to run from banking crises to currency crises but not vice versa. Again, this contrasts popular explanations of the East Asian banking crises in which the devaluation of the Korean, Thai and Indonesian currencies is maintained to be the major cause behind the banking crisis, as banks carried most of their borrowings in foreign denominations while their lending was in the local currencies.

While these are mostly only confirmations of previous results—our estimation of the interactive-institutional variables provide new insights into the institutional determinants of banking crises. Most significantly, the financial liberalization variable remains significant in most cases when the interactive institutional term is included suggesting that the

[16] While statistically indistinguishable from zero, the coefficient for change in export proceeds also has the expected (negative) sign.

Table 3
Probit estimates

	Whole sample	Developing countries	Emerging economies
Domestic financial liberalization	0.412***	0.483***	0.225
Inflation rate ($t-1$)	0.003**	0.003**	0.003**
Change in export proceeds ($t-1$)	−0.004	−0.004	−0.006
Change in M2/reserve ratio ($t-1$)	0.038***	0.038**	0.006**
Growth rate of per capita real GDP ($t-1$)	−0.039***	−0.035**	−0.053***
Foreign interest rates ($t-1$)	−0.184***	−0.197***	−0.150***
Deviation of real exchange rate ($t-1$)	0.008***	0.008***	0.013***
Currency crisis	−0.045	−0.147	−0.255

LHS: Onset of Banking Crises (crisis = 1, no crisis = 0).
Model estimated as a multivariate probit for the probability of the onset of banking crises. The various samples are defined in Section 3 and in Appendix A. ***, **, and * indicate rejection of null at 1%, 5%, and 10% significance levels, respectively.

Table 4
Banking crises

		Whole sample		Developing countries		Emerging economies	
(A) Corruption							
Financial liberalization		0.21	0.15	0.37**	0.30*	0.25	0.23
Interactive term	Liberalization in the last 2 years	0.05		0.02		0.03	
	Liberalization in the last 3 years		0.07**		0.05		0.02
(B) Political repression							
Financial liberalization		0.40***	0.34***	0.49***	0.41***	0.21	0.17
Interactive term	Liberalization in the last 2 years	0.08		0.03		0.21	
	Liberalization in the last 3 years		0.59**		0.52*		0.38
(C) Central Bank dependence							
Financial liberalization		0.44***	0.334**	0.53***	0.43**	0.34*	0.29
Interactive term	Liberalization in the last 2 years	0.07		0.13		−0.20	
	Liberalization in the last 3 years		0.52*		0.57*		0.18

Probit estimates for banking crises with domestic financial liberalization variable and interactive (Liberalization∗Supervision) variable.
Model estimated as a multivariate probit for the probability of the onset of banking crises. Samples and variables are defined in Section 3. Each regression also includes the following lagged variables: inflation rate, change in export proceeds, change in M2/reserves, per capita real GDP growth, foreign interest rate, real exchange rate appreciation and currency crises. ***, **, and * indicate rejection of null (coefficient = 0) at 1%, 5%, and 10% significance levels, respectively.

Table 5
Major banking crises

		Whole sample		Developing countries		Emerging economies	
(A) Corruption							
Financial liberalization		0.18	0.10	0.38*	0.31	0.21	0.24
Interactive term	Liberalization in the last 2 years	0.06		0.02		0.04	
	Liberalization in the last 3 years		0.09**		0.05		0.01
(B) Political repression							
Financial liberalization		0.42***	0.33**	0.54***	0.44***	0.30	0.26
Interactive term	Liberalization in the last 2 years	0.04		−0.15		0.30	
	Liberalization in the last 3 years		0.75**		0.62*		0.52
(C) Central Bank dependence							
Financial liberalization		0.49**	0.35*	0.62***	0.48**	0.50**	0.43*
Interactive term	Liberalization in the last 2 years	0.42		0.38		− 0.16	
	Liberalization in the last 3 years		0.89***		0.91**		0.36

Probit estimates for banking crises with domestic financial liberalization variable and interactive (Liberalization∗Supervision) variable.
Model estimated as a multivariate probit for the probability of the onset of major banking crises as defined in Caprio and Klingebiel (1999). Samples and variables are defined in Section 3. Each regression also includes the following lagged variables: inflation rate, change in export proceeds, change in M2/reserves, per capita real GDP growth, foreign interest rate, real exchange rate appreciation and currency crises. ***, **, and * indicate rejection of null (coefficient =0) at 1%, 5%, and 10% significance levels, respectively.

'monopoly power' hypothesis should deserve more careful consideration than it is usually given. Two interesting exceptions emerge.

The first exception is the apparent insignificance of the liberalization variable for the emerging markets sample. Glick and Hutchison (2001) also noticed this result. Curiously, though, their financial liberalization variable (without an interactive term) maintains its significance in their model of simultaneous probit estimation for banking and currency crises for the same emerging markets sample. This is attributable to the strong correlation found between the onset of banking and currency crises in emerging market countries, which we control for.

The second interesting exception is that when the interactive term (the liberalization variable multiplied by a supervision proxy) includes the corruption index (Table 4, panel A and Table 5, panel A) the significance of the financial liberalization variable disappears altogether. This leads us to suspect that the corruption index might proxy for some other institutional characteristics as well—in contrast to the two other proxies

we use—characteristics that have an important role in the determination of banking crises.[17]

Besides the corruption index, the two other proxies we use—political freedom and central bank independence indices—yield identical results. While in both the lone financial liberalization term comes out highly significant, when it is also interacted with our proxies it is typically insignificant while the financial liberalization variable maintains its significance. The interactive term is weakly significant in a few specifications (at the 10% confidence level) but only for the longer time horizon after the onset of financial liberalization.

For estimation of the determinants of major crises (Table 5), results are stronger (larger coefficients and higher significance levels) for the central bank independence measure suggesting it might be a better measure of the regulatory environment. As before, results for the emerging markets sub-sample are weaker in general. Even so, once central bank independence is controlled for, the financial liberalization variable emerges as a significant determinant of banking crises; and as reported for other specifications, the interactive term for central bank independence remains insignificant.

The pronounced statistical significance of financial liberalization, the insignificance of the interactive term and the other results just noted, all lead us to suspect that the 'monopoly power' hypothesis deserves more serious attention. Arguing that the 'lax supervision' channel is unimportant, as a source of danger in the immediate aftermath of financial liberalization, is most certainly premature; yet, our results do cast a doubt on this hypothesis pervasiveness in all discussions of liberalization.[18]

An interesting alternative can be deduced from the fact that the interactive term is positive and significant for the longer time horizons. This can be interpreted to mean that the narrowing of the bank-monopolies' profit margins (the 'monopoly power' hypothesis) is an immediate result of liberalization and therefore an immediate threat to the health of the banking industry. In contrast, the increased risk taking that might result from liberalization (the 'lax supervision' hypothesis) is a longer time-horizon phenomenon and can cause banking sector instability that will become evident only years later. Both of the alternative interpretations of our findings have important policy consequences that are beyond the scope of this paper.

5. Caveats

Although the onset of financial liberalization seems to be a significant destabilizing factor for the financial industry, there appears to be professional consensus that, in the long

[17] A possible scenario is one in which, in a liberalizing and corrupt environment, bank managers can siphon money off bank ledgers thereby increasing the likelihood of crises. This scenario does not necessarily involve lax prudential supervision but rather agency problems within the bank—a problem we do not attempt to examine in this project.

[18] Israel, for example, has recently opened up its retail-banking sector to international competition in the face of strong objections from its major domestic banks. While these objections were generally ignored, our analysis seems to add empirical support to their assertion that rapid opening up might lead to serious problems for domestic banks, even if prudential supervision is considered adequate.

run, a liberalized financial market will be both stabilizing and conducive for a more rapid and sustainable growth (King and Levine, 1993; Bekaert et al., 2004). Even so, in the face of professional disagreement over the short-term substantial adverse effects of liberalization documented here and elsewhere it is all the more interesting that international financial bodies such as the *IMF* and the *Bank of International Settlements* continue to recommend liberalization of the banking sector wholeheartedly.[19]

A few additional words of caution appear warranted. First, the financial liberalization proxy—the deposit interest rate ceiling—is widely used in the literature but represents only one aspect of domestic liberalization. We have been unable to find any other variable or any other research that makes use of other measures of domestic liberalization of the banking sector though it is likely that other measures will be highly correlated with our own. As we discussed in Section 3, the international liberalization variables yield very weak results.

Second, our supervision variables—corruption, political freedom and central bank independence indices—are all imperfect. As we mention in Section 2, we are unaware of any attempt to proxy for a supervision variable by any other index (or the ones we use, for that matter). The fact that they all yield similar results seems to support our assumptions, though. Different measures of institutional quality and strength have recently been made publicly available at the World Bank for recent years. These new measures have much more institutional detail but are only available for a cross-section of countries (with no variation over time). Even so, a direct measure of the relative merits of the supervisory regime in place is still, perhaps not surprisingly, unavailable.

Third, our identification of the 'monopoly power' channel is not perfectly robust. We attribute, by default, all the unexplained (by 'lax supervision') part of the contribution of liberalization to crises to this channel. A more direct test of the 'monopoly power' hypothesis is called for. Specifically, a variable that measures banking concentration or competition might provide us with a direct ability to critically examine this channel.

It should also be noted that while coefficients in most of our regressions appear highly significant (for the 1% confidence level) the predictive power of this model is far from perfect. It appears that the onset of banking crises is a process that embodies a lot of institutional and political details that have been, until now, beyond the reach of econometric research.

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[19] Occasionally, this recommendation is made conditional on existence of regulatory safeguards.

Appendix A. Banking crises and domestic financial liberalizations

Argentina*	1980–1982 (3), 1989–1990 (2), 1995 (8)	Indonesia*	1997 (14)
Bolivia	1986–1987 (1), 1994–1997 (7)	Korea*	1997 (6)
Brazil*	1990 (1), 1994–1996 (5)	Lao P. D. R.	
Chile*	1976 (2), 1981–1983 (8)	Malaysia*	1997 (19)
Columbia*	1982–1987 (2)	Nepal	1988 (2)
Costa Rica*	1987 (1)	Pakistan*	
Dominican Republic		Philippines*	1983–1987 (2)
Ecuador	1980–1982, 1996–1997 (4)	Singapore*	
El Salvador	1989	Thailand*	1983–1987, 1997 (10)
Guatemala		Botswana*	
Haiti		Burundi	1994–1997 (5)
Honduras		Cameroon	1987–1993, 1995–1997 (5)
Mexico*	1981–1991 (4), 1995–1997 (6)	Ethiopia	
Paraguay	1995–1997 (4)	Ghana*	1982–1989
Peru*	1983–1990 (3)	Kenya*	1985–1989, 1992–1995 (1)
Uruguay*	1981–1984 (5)	Madagascar	1988 (3)
Venezuela*	1994–1997	Malawi	
Grenada		Mali	1987–1989
Guyana	1993–1995 (2)	Mauritius*	
Belize		Morocco*	
Jamaica	1994–1997 (3)	Mozambique	1987–1997
Trinidad and Tobago*		Nigeria	1993–1996 (3)
Cyprus		Zimbabwe*	1995–1997 (3)
Jordan*		Sierra Leone	1990–1997 (3)
Syrian Arab Republic		Tunisia*	
Egypt*	1980–1985	Uganda	1994–1997 (3)
Bangladesh*	1987–1996	Zambia	1995 (3)
Myanmar		Fiji	
Sri Lanka*	1989–1993 (9)	Hungary	1991–1995 (4)
Hong Kong*		Romania	1990–1997
India*			

An * denotes countries that are included in our 'emerging markets' sub-sample (classification is taken from Glick and Hutchison, 2001). The years represent the duration of the banking crisis (dates of banking crises are taken Caprio and Klingebiel, 1999). The number in parentheses indicates the number of years after domestic financial liberalization in which the banking crisis started. If there is no number, the crisis occurred when deposit rates (our indicator for liberalized financial markets) were still restricted (data on liberalization is described in Section 3.2—complete dates of domestic and international financial liberalization episodes are available in the working paper version (Noy, 2004).

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