Abstract

This paper explores theoretically and empirically the link between Financial Liberalization (FL) and the banking crisis that often follow. We also investigate the proposition, classical in development economics, that FL should result in an increase in supply of funds to the real sector. To accomplish this we first develop a theoretical model of a banking firm that operates under financial repression and is then subject to FL. The model yields the result that following FL there is an unambiguous increase in risk to the banking firm which implies a higher probability of a banking crisis following FL. Less formally, we also conclude that the presence of a explicit or implict deposit insurance scheme is likely to accentuate the incentives to engage in risk and the risk structure of the banking system. Moral hazard plays an important role in this increase in risk to the banking sector. This questions the "innocence" of the bank owners in the crisis that have often followed FL and that had been attributed to either macroeconomic policy, concomitant structural changes in the economy or left-over distortions from the financial repression period. The sign of the change in supply of credit to the real sector, however, is ambiguous.

Then we test empirically the propositions resulting from this model using data of 73 banks (some of which *may* have become technically insolvent) from Greece, Malaysia, Mexico, Taiwan and Thailand. The empirical test was based on a system of three simultaneous equations that use a measure of risk, profitability and intermediation as dependent variables. The measure of risk used was the conditional variance estimated using an empirical conditional Capital Asset Pricing Model estimated using an EGARCH specification. The tests tend to support the conclusions of the theoretical model, i.e. unambiguous increase in risk and, for the sample used, an unambiguous fall in loan supply as a proportion of funds available. Finally we draw policy implication with respect to bank supervision, forbearance and bank failure resolution procedures during the transition period, and about the so-called "liberalization sequencing."

Financial Liberalization Causes Banking System Fragility[1]

Klaus P. Fischer and Martin Chénard

Working Paper No 97-14
Faculté des sciences de l' administration

Working Paper No 97-12
Centre de recherche en économie et finance apliquées (**CRÉFA**)

June 16, 1997

[1] CRÉFA and Faculté des sciences de l'administration, Université Laval, Ste-Foy, G1K 7P4, CANADA. Ph. 418-656-2131, X3679, Internet: Klaus.Fischer@fas.ulaval.ca. This research was completed with the support of the program of economic analysis and research applied to international development (PARADI), financed by the Canadian International Development Agency (CIDA). The institutions affiliated to the PARADI program are the Montreal University's Centre de recherche et de développement en économique (CRDE) and Laval University's Centre de recherche en économie et finance appliquées (CREFA). The purchase, installation and maintenance of the data used in this research was financed by research grants of PARADI, the Social Sciences and Humanities Research Council (SSHRC) of Canada and the Fond pour la Formation de Chercheurs et l'Aide à la Recherche (FCAR) of Canada. We also thank Prof. Edgat Ortiz of the Universidad Nacional Autónoma de Mexico (UNAM) who provided the data for Mexico at a subtantial personal effort and Roger Atindehou and participants of the Finance Department of Laval University seminar for useful comments.

Financial Liberalization Causes Banking System Fragility

There is danger in reckless change, but greater danger in blind conservatism

Henry George (1839-1897)
Social Problems (1884)

1 Introduction

Mark Twain once said that Adam was the only man who could safely assume to say something with the assurance that he was the first man on earth to say it. When it comes to financial liberalization, the late Diaz-Alejandro [16] with his famous article "Good-bye Financial Liberalization, Hello Financial Crash!" was perhaps not the first, but certainly the clearest and loudest in warning against the dangers associated with financial liberalization (FL).[1] More than ten years later, as Diaz-Alejandro warned, more often than not, throwing out financial repression still invites a *major* financial-system crisis. In fact, before that time and since, two out of three members of the International Monetary Fund have experienced a major banking crisis with losses in excess of 250 billion dollars [34] and over 130 countries, comprising three-fourth of the IMF's members have experienced "significant" banking sector problems [54]. A very high share of these crisis occurred following deregulation of their financial markets and the banking system. Argentina, Chile, Colombia, Finland, Indonesia, Jamaica, Mexico, Nigeria, Norway, Spain, Sweden, Venezuela and even the United States (with the S&LA debacle shortly after DIDMCA[2]) are just some examples of major banking crisis that follow on the heels of deregulation. Even the banking system of Thailand, following one of the most carefully manicured FL in the developing world, is showing the typical symptoms of FL cum financial crisis. Kaminsky and Reinhart [41] report that in18 out of 25 banking crisis surveyed by them, the financial sector had been liberalized some time during the previous five years. Latin American countries have staged in the mid 1990's a even more expensive "encore" of the drama of the early 1980's that was at the center of Diaz-Alejandro's attention with new banking crisis of enormous proportions.[3].

The symptoms are typical: following FL and after some time has elapsed, rapid growth of banking assets, large increases in interest rates, rapid deterioration in the quality of the loan portfolio, often undercapitalization of banks and, if the rules of the game allow it, excessive lending to bank-affiliated companies and then, failures. Then come the rescue measures: introduction of a government funded deposit insurance scheme, creation of body to handle rescue operations, injection of capital, etc., most likely preventing liquidation of banks by all means, all resulting in a huge transfer of

[1] We define "financial liberalization" in a very narrow sense: elimination of government controls on interest rates (deposit and/or lending) and credit allocation. We will be more specific in section 2 of this paper.

[2] Depository Instituttions Deregulation and Monetary Control Act of 1980.

[3] See for example Arnaudo [4] for a comparison of the Argentine crisis of 1980 and 1995.

resources from the economy to the financial sector. To cap all that, governments are most likely accused by the non-failing banks of indecision in handling the crisis, thus encouraging a run on those institutions and perhaps capital flight.

This is, of course, *not* what FL was supposed to do. The substantial body of economic literature that supports the drive toward market based price and allocation of financial resources, rests on the idea that FL will improve allocation of financial resources, promote savings and increase the overall supply of credit to the real sector. More specifically, according to this theory FL should have the effect of increasing deposit rates, thus increasing the supply of savings to the financial sector. This increase of supply of savings results in an equivalent increase in the supply of loans to the real sector, *without changing the rates on loans.* This is achieved by reducing reserve requirements on the banking sector that transfers the savings to borrowers by holding lending rates constant (Fry, [20]) *and* makes the funds available for financing the real sector. That is, the expansion of credit to the real sector has two sources: first, an increase in the savings rate by investors that is captured by the banking system; second, a shift of portfolio allocation by the banks, mostly from reserves to real sector lending. The supposed outcome is an increase in level and efficiency of sustained economic growth. To our knowledge the separation between these two effects has not been empirically investigated.

While there appears to exist a reasonable agreement that a deepening of the financial system accompanied by the creation of new instruments and institutions is indeed de long-term effect of a FL process, the short term effects should rightfully be put under scrutiny. If there are a few success stories, i.e. FL processes that have been implemented leading to a smooth transition in the financial system, too many are not. In the latter cases, FL led to a crisis in the financial system accompanied with a severe slow-down in growth or contraction of the GNP.

Most authors, while attempting to explain the banking crisis, invoke a number of different reasons and resist to establish (or choose to ignore) an explicit link between FL and the banking crisis that follows. In some cases, the link has been more or less emphatically rejected (Sundararajan and Baliño [68]: "it's unfair to say that liberalization causes the crises ").[4] In most cases the crisis is attributed to:

- macroeconomic factors or wrong government fiscal and monetary policies;
- FL occurs with other structural changes that are at the root of the crisis;
- the crisis following the FL is nothing else than the process of "shaking out" misallocation of resources that had been made under the FR regime.

In most cases a direct responsibility of the bankig system is either ignored or rejected. Chan *et al* [8] put it in somewhat dramatic but clear terms: "Sometimes the

[4] However, in the case of Chile, there appear to exist an "increasing consensus " that the crisis that followed the FL, described as the worse since the 1930's , was due to "errors committed by the banking system " that were made possible or even encouraged by the FL process (see Cortes-Douglas [14]). IMF research (e.g. [54] and [67]) and discours (e.g. [10]) is also giving a higher importance to the microeconomic roots of bankig sector problems in the context of FL.

story is cast in terms of crisis in government, i.e. spendthrift fiscal policy or politicized and/or irresolute monetary policy. The commonality in all these explanations is their anecdotal quality and the implied innocence of the banks."

Another issue that is relevant is whether the supply of credit to the productive sector increases following FL. As noted before, the traditional literature predicts that the increase in funds being attracted by the banking system following the deregulation of interest rates, should be passed on to the productive sector (at similar rates to those preceding FL). This increase in credit, combined with the higher efficiency of allocation of funds to higher-quality projects is, of course, at the center of all motives for liberalizing the financial system. The model we will present allows us to evaluate the incentives banks face following FL regarding the supply of credit to potential borrowers.

Thus, in this paper we explicitly explore, theoretically and empirically, the link between FL, the banking crisis that sometimes ensue and the changes observed in the supply of credit to the real sector. To accomplish this we first develop a theoretical model of a banking firm that operates under financial repression and is then subject to FL. Then we test empirically the propositions resulting from this model using data of banks (some of which *may* have become technically insolvent) from Greece, Malaysia, Mexico, Taiwan and Thailand.[5] The model also allows us to "explain " some of the earlier empirical results presented in the literature.

The result suggest that following FL there is an unambiguous increase in risk to the banking firm. This is so even if abstraction is made of concomitant structural changes or left-over distortions from the FR period. These other sources of risk only complicate the picture further. Because this increase in risk is across-the-board it implies a higher systemic risk and probability of a banking crisis following FL. The sign of the change in supply of credit to the real sector, however, is ambiguous. Both these results are supported by the theoretical model and empirical tests. That is FL increases unambiguously the fragility of the banking system and thus the probability of banking failures or a system-wide banking crisis. In this sense it is perhaps "fair to say that liberalization *does* cause the crisis" that often follow. Further, we show that moral hazard plays a role in this increase in risk to the banking sector thus questioning the "innocence" of the banks in the crisis that have often followed FL.

A similar problem was studied by Lam and Chen [53] for the case of the United States. They focused on elimination of Regulation Q (ceilings on deposits) and the imposition of more stringent capital requirements. This is of interest in our context too, because latter FL processes have often been accompanied by imposition of BIS

[5] With the exception of Mexico, the sample of countries used biases the results against us. The other countries in the sample have experienced FL processes that have been extremely carefully and prudently managed and have not produced a banking crisis. Further, even in the carefully manicured case of FL in Thailand, the banking system and investment companies are going through a property based crisis, only seven years after the start, in 1990, of a gradual FL. Our selection of countries was based predominantly on the availability of accounting and stock market data for the banks. It is nonetheless interesting to investigate whether FL produces the effects predicted in the model, even though they may not go to the extreme of producing a system wide banking crisis. Malaysia, *did* suffer a banking crisis following its early and mild FL attempt (reversed shortly after) of the late 1970's.

capital standards (e.g. Mexico, Thailand, etc.) that are substantially more stringent than those that existed before. They find that under Regulation Q, an increase in capital requirements encourages unambiguously a shift towards more risky projects. A similar result under liberalized interest rates, would mean that the bank safety gains obtained from imposition of more stringent capital standards may have been cancelled by the incentive to take up more risk. This is not unambiguously the case, as the authors find that the directional effect of the partial derivatives cannot be determined in their model. However, they conclude that it is "possible" that in an environment of free interest rates, a more stringent capital requirement can induce the bank to shift more of its resources to projects with higher risk.[6] These findings provide further support to the results we mention in the previous paragraph and that will be presented below.

The line of arguments presented in this paper could be understood as contributing to the theory of systemic risk and financial crisis. The literature on the subject provides eight distinguishable theories of financial crisis namely: excessive debt accumulation; bank panics;speculative bubbles attributable to rational expectations; sudden credit rationing; asymmetric information; vulnerability associated with dealer markets and excessive competition due to deregulation and the erosion of entry barriers (see [5] for details). The explanation of increased systemic risk and financial crisis provided in this paper does not fall squarely into any of these categories but is related to several of them, mostly to the theories based on credit rationing [33] and competition due to deregulation and the erosion of entry barriers [15].

The study has important policy implications regarding both the motivation of FL and the way these are managed. Banking sector solvency problems appears to be a wrong reason for liberalizing the banking sector, since this liberalization will only exacerbate fragility and the probability of a system-wide crisis. The results also suggest that it is essential that financial liberalization be accompanied by a strengthening of the supervision and monitoring of the banking system. In particular, the supervision and monitoring authorities should have in place a stringent system of identification of failure prone banks and a credible bank failure resolution policy. In fact, this increase in supervision capacity should, if possible, precede initiation of the FL process. We draw more detailed policy implications in the conclusions section.

The remainder of the paper is organized as follows: In section 2 we develop the model and elaborate on the predictions that this model generates. We will focus on two issues: one is associated to risk exposure and risk taking by banks following FL; the second is about the supply of credit by the banking system to the real sector of the economy. In section 3 we present the statistical model, in section 4 the data, and finally in sections 4 and 5 we present results and conclusions respectively.

[6] See [1] [73] [30] [64] [47] [61] [22] [53] [51] for related issues on capital requirements and risk taking.

2 The model

Assume a profit maximizing banking firm subject to a number of technical and regulatory constraints. Further key assumptions are:

- the bank is risk neutral;
- projects to be financed are not divisible, this yields the result that a particular borrower is financed or not, partial financing is not allowed
- each investment, ω, generates a random end-of-period cash flow of X with density $f(X, \omega)$, where ω is an index of risk of the project and hence borrower.[7]

The objective function to be maximized could be represented as follows:[8]

$$P_b = \int_0^{Q_r R_r - K_F} (X + K_f) f(X, \omega) dX + \int_{Q_r R_r - K_F}^{\infty} R_r f(X, \omega) dX - ID - T - kK_B + Q_f R_f \tag{1}$$

where: $Q_i, i = r, f$ is the quantity of funds placed in either the risky firm (r) or the risk free asset (f); R_i,is the rate earned (charged) on these assets; $K_J, J = F, B$, is the quantity of capital raised respectively by the borrower (F) and the banking firm (B); X is a random variable representing the terminal cash flows of the borrower, I represents the deposit rate; D the amount of deposits raised by the bank, T are fixed transaction costs; and k is the cost of equity capital to the banking firm.. The risk free investment is assumed to exist always available to the banking firm. In the limit it may simply represent the reserves kept with the central bank earning a rate of $R_f \geq 0$. Like in all previous uses of this model, there is an implicit assumption of a two-period model in which the bank contracts the funds from depositors at a rate I, then turns around and decides on the portfolio allocation. The positions are liquidated in the second period. Thus, the deposit rate I, is not made a function of the portfolio allocation.[9]

[7] The parameter ω can also be considered to be the index of pessimism of Tybout [71] and Virmani [72].

[8] Variants of this objective function were used in the development of the "credit rationing" literature by Jaffe and Modigliani [37], Stiglitz and Wise [66], Virmani [72], Guttentag and Herring [32] and Tybout [71] among others. The reason for this choice of objective function is that, under FR enterprises are subject to *non-price credit rationing* by the banking sector. When FL is introduced, this form of credit rationing gives way to a new form of credit rationing that has been labeled *equilibrium credit rationing.* The restrictions imposed by the state upon the banking system under conditions of FR tend to modify the parameters of the non-price credit rationing allowing the state to influence directly the quantity and price of credit allocated to the real sector.

[9] This is a realistic assumption on the base of two considerations: i) depositors can only imperfectly observe the porfolio allocation of the bank; ii) in the presence of explicit or conjectural deposit insurance, the deposit rate will be insensitive to changes in the risk composition of the bank's portfolio. The situation is similar to the one assumed by Thakor and Beltz [69] where deposit insurance renders the deposit rate riskless. The absence of an explicit deposit insurance scheme in many of the countries that undergo FL does not invalidate the assumption. Experience has shown that, for one reason or another, governments have allways felt compelled to honor a *conjectural* deposit insurance out of fiscal resources.

In equation 1, the first term represents the cash flows resulting from the loan in case of borrowers insolvency; the second term represents the cash flows from the loan if the borrower remains solvent; $Q_f R_f$ are the cash flows resulting from the risk-free investment and all other terms represent costs (deposit, transactions, etc.)

This expression can be simplified and represented in relative terms with respect to the amount of the loan, Q_r. The resulting expression is as follows:

$$P_b = \int_0^{R_r - \kappa_F} (x + \kappa_f) f(x, \omega) dX + \int_{R_r - \kappa_F}^{\infty} R_r f(x, \omega) dX - Id - \tau - k\kappa_B + \frac{R_f}{q_r} \quad (2)$$

Were $q_r = Q_r/Q_f$ is the ratio of risky investment (loan) to risk-free investment; $\kappa_B = K_B/Q_r$ represents the proportion of the loan financed with the bank's own equity; and so on. That is all lower case symbols are the same as those of equation 1 divided by Q_r.

With respect to the risk characteristics of the borrowers, we say that a borrower G, is a "better " risk class than a borrower H, if

$$\int_0^y f(X_G, \omega_G) dX \leq \int_0^y f(X_H, \omega_H) dX. \quad (3)$$

For convenience we adopt the definition of "mean preserving risk " of Rothschild and Stiglitz [63] and will say that an increase in ω is a mean preserving risk increase if the two following conditions are met:

$$\begin{aligned} \int_0^{\infty} [dF(X, \omega)/d\omega] dX &= 0 \quad (4) \\ \int_0^{y} [dF(X, \omega)/d\omega] dX &\geq 0 \text{ for } 0 \leq y \leq \infty \end{aligned}$$

After some algebra and integration by parts the objective function 2 can be rewritten[10]

$$P_b = R_r + \frac{R_f}{q_r} - Id - \tau - k\kappa_B - \int_0^{R_r - \kappa_R} F(x, \omega) dX \quad (5)$$

where $F(x, \omega)$ is the cumulative function. We assume further that 5 is restricted by one or more of the following set of constraints:[11]

$$\begin{aligned} R_r &\leq R^* \quad (6) \\ q_r &\geq Q^* \quad (7) \\ R_r + \frac{R_f}{q_r} + \rho d - (d + \kappa_B) &= 0 \quad (8) \\ \kappa_B &\geq (1 - \frac{1}{c}) \quad (9) \end{aligned}$$

[10] The convexity of the objective function can be established by taking the first and second derivatives of P_b with respect to q_r. These yield $-(R_f/q_r^2)$ and $2R_f/q_r^3$ respectively.

[11] The third restriction results simply of dividing both sides of the equation:

$Q_r R_r + Q_f R_f + \rho D - (D + K_B) = 0$

by Q_r and substituting terms as in the objective function. In this equation the two first terms represent risk and riskless assets, the third term, ρD, reserve requirements on deposits and the last term represents liabilities (all deposits) and regulated net worth.

These restrictions are at the center of our analysis and mark the difference with the situation modeled by Jaffe and Modigliani [37] or others that followed (e.g. [66], [72], [71]). In equations (6) to (9) the third constraint represents simply the balance sheet constraint, where ρ represents the reserves requirements with the Central Bank. The first and second constraints represent two governments intervention that are characteristic of *nancial repression* (FR). Of these two constraints, the first simply says that the lending rates, R_r, cannot exceed the ceiling, R^*. The second is that lending to a particular sector, presumably a "priority sector " or type of enterprise must exceed a minimum proportion of total assets of Q^*. The goal of FL is usually to eliminate these two restrictions on the banks' portfolio choice. Therefore, as Galvis[23] [12] we take relaxation or lifting of controls on interest rates as the central event of FL. The last constraint represents a minimum capital restriction. This restriction is often not present in FR regimes but is impose with FL, specially in recent times when the capital requirement norms established by the Bank of International Settlement became the generally accepted standard.[13]

We assume FR has been in place and therefore, the first and second constraints were effective.[14] This is the only way that a FL process make political and economic sense. If this would not be the case, the banking system would be operating under a "de-facto " liberalized environment. The latter was the situation found in the United States during the early seventies. The existence of limits on lending and deposit rates was (almost) completely ineffective as market rates were generally below rate ceilings.. This was no longer case toward the end of the 1970's and beginning of the 1980's when market rates started to exceed ceilings, leaving the United States banking system operating under a FR regime. Thus, president Carter's DIDMCA (Depository Institutions Deregulation and Monetary Control Act) legislation of 1980 can be viewed as the "financial liberalization " legislation of the United States.[15]

There are specifically two areas that we will analyze in depth: the first is the question of risk exposure of banks under FL; the second is the change in supply of credit that can be expected following a FL.

[12] This author goes as far as stating 'FL is the elimination of FR, that is, increase of interest rates to an efficient equilibrium level that promotes optimal saving rates and avoids misallocation of real and financial resources.' This type of FL is by far the most common situation for developing countries. In contrast, the FL that accompanies the structural reforms of a former socialist economy in a much more complex phenomena that goes beyond the scope of this paper.

[13] Somewhat similar problems, but using different models, have been analyzed by Humphrey and Pulley [35], Lam and Chen [53], Mingo and Wolkowitz [56] among others, for the case of the United States

[14] FL consists, of course, of more than relaxation of these two constraints. But this is just a stylized representation of the FL process. However, as Galbis [23] and Chavez *et al.*[9] note, allowing market forces determine interest rates and credit allocation is the center piece of a FL. For a reasonably complete description of a FR regime and a review of the of the bundle of measures that make up a typical FL program see the study by the Centro de Estudios Monetarios Latinoamericanos (CEMLA) [7] and Chavez *et al.* [9]. Cortes-Douglas [14] also provides a very detailed description of the FL of Chile.

[15] For studies that cover the effect of DIDMCA on the banking sector see [12], [60], [2], [21], [50] and [55] among others.

2.1 The risk of the banking rm under nancial liberalization

There are two ways in which a FL can affect the risk exposure of the banking firm that we will consider here:

- by modifying the rates charged, R_r, once the restriction $R_r \leq R^*$ is eliminated.
- by switching the risk class, ω,of borrowers.

There are indeed other ways in which FL can affect bank risk. A very important one is volatility of interest rates. As Chavez *et al.* [9] and Goldstein and Turner[31] note, when interest rates are liberalized, banks loose the protection provided by a regulated and stable term structure and intermediation margin. Volatility of interest rates tends to increase, either permanently or at least during a reasonably long transition period. This latter effect will not be investigated here.

2.1.1 FL and interest rates

If FR has been in effect then $R_r = R^*$ for at least some customers (the riskier ones). Thus, FL implies the elimination of this restriction with an increase in at least some of the previously regulated rates. For simplicity let us define $\pi \equiv \int_0^{R_r - \kappa_R} F(x,\omega)dX$. This term represents the risk component in the objective function. An increase in the value of this term represents an increase in risk related to the position. It si trivial to see that

$$\frac{\partial \pi}{\partial R_r} = \frac{\partial \int_0^{R_r - \kappa_R} F(x,\omega)dX}{\partial R_r} = F(R_r,\omega) \geq 0 \tag{10}$$

where $F(R_r,\omega)$ represents the cumulative function at the point R_r (the probability of insolvency at the interest rate R_r). This derivative is positive and less than one. That is, the derivative is unambiguously non-negative and equal to zero only for a riskless loan ($F(R_f,\omega_f) = 0$). [16]. In this context one should also remember Theorem 1 of Stiglitz and Weiss ([66], page 396) that clearly shows that higher interest rates induce borrowers to undertake projects with lower probability of success but higher payoff when successful.. This implies that as interest rates increase, the mixture of projects that are being financed becomes worse. Jointly, this implies that the risk of default increases for two reasons: i) the ability of borrowers to face interest payments; and ii) the riskiness of the projects that are being financed by the borrowers.

2.1.2 Switching the risk class, ω,of borrowers

Banking deregulation processes are more often than not, part of a market oriented reform package for the economy and the financial system.. This can affect considerably the environment under which the real sector (the customers of the banks)

[16] The increase in real interest rates has been described as "extravagant " by Diaz-Alejandro [16], As examples consider the following cases: in the case of Chile these rates reached an average of 32% over the period 1976-82; in Peru, by September 1990, two months after the de-facto floating of interest rates, average real bank lending rates in domestic currency were 17% *per month.* A similar phenomena was observed in practically all FL in Latin-America..

operates including: terms of trade, real exchange rates, economic activity, etc.[17] In fact, often-times FL packages are preceded or accompanied by economic packages that seek to contract consumption and demand.. Further, liberalization of the financial sector may change the customer basis of the banks with larger and better known firms rasing a larger share of funding through securitized markets. The resulting effect on the banking sector is generally a deterioration of the risk composition of the bank portfolio. Assume that the change in ω is a mean preserving change in risk that satisfies conditions 4. Stiglitz and Weiss [66] have shown that, given a fixed interest rate

$$\frac{\partial P}{\partial \omega} = \int_0^{R_r - \kappa_R} [\partial F(x, \omega)/\partial \omega] dX \leq 0 \tag{11}$$

(the opposite is true for the enterprise). That is, any deterioration in the credit risk of the customer increases the insolvency probability of the firm and thus the risk structure of the bank's portfolio. This effect is beyond the control of bank managers.

We see then, that bank portfolio risk is likely to increase under financial liberalization as a result of two concurrent effects that are largely beyond control of bank managers: increase in interest rates and increase in the underlying risk of the clients' cash flows.

2.1.3 Bank risk taking behavior and moral hazard

But what happens to new projects that are financed after FL? The bank, in this case, has full control of the risk exposure that it assumes when financing a new project or refinance old ones. Under conditions of FL they are free to set the rates charged to borrowers and, presumably, will adjust the same to the riskiness of the underlying project. As shown, it is evident that an increase in R_r will result in an increase in the probability of client insolvency. However, what is the effect of such an increase on the whole objective function of the banking firm and which could be considered a rational response on the side of the banker? This can easily be seen from the FOC

[17] It is quite common for FL to be part of a package of reforms that eliminate restrictions and protections on the economy as a whole. Most likely, the FL will be accompanied by commercial policies of free trade that leaves local business exposed to international competition. The effect of these measures on business risk can be quite variable depending upon the competitiveness vis-à-vis the rest of the world. However naive one may appraise the effect of such policies, it is clear that substantial portions of the domestic business sector will see deep changes in the markets they serve, and many will invariably fail to adapt. One simple but dramatic example is the case of the toy industry in Argentina. Between 1991 and 1996 the share of imports in the toys market passed from 6% to 80%. One result was that 170 toy manufacturers, out of approximately 200 that were in operation in 1991, either went bankrupt or were forced to close toy manufacturing plants over this five-years span ("Papa Noel viene de China", *Clarin*, 16 December 1996, pp.1). The issue of domestic macroeconomic volatility associated with financial liberalization has been addressed in a more or less direct way by several authors. See [31], [18], [9],[41],[38] among others for a more detailed treatment of these links. It is also interesting to note that in e.g. the case of the Southern Cone, FL was followed by a drop in GNP 11% in Argentina, 15% in Chile and 14% in Uruguay. Such dramatic effects on the real economy of FL are bound to influence considerably the riskiness of bank clients.

of equation (5) (subject to restrictions 6 to 9) that

$$\frac{\partial P}{\partial R_r} = 1 - F(x, \omega) \tag{12}$$

This FOC is unambiguously positive since $F(x, \omega) \leq 1$. Thus, banks will be encouraged to profit from the new-found freedom for setting interest rates as long as gain of increasing interest rate is larger than the loss from increased risk.[18] More exactly,

$$\frac{\partial P}{\partial R_r \partial \omega} = -F_\omega + R_\omega F_R \tag{13}$$

where R_J and F_J represent derivatives with respect to the variable in the subscript. From equation (13) it is evident not only that for this derivative to be negative, it must be that $F_\omega > R_\omega F_R$. If the increase in interest rate that the bank is able to charge to the borrower is more than proportional than the increase in risk, then $R_\omega > 1.0$ and then F_ω must be larger than F_R by a factor of R_ω before the bank will be restrained from taking additional risk. A $R_\omega > 1.0$ is, by no means, an unlikely situation under conditions of FL where it is not unusual to observe massive increases in lending rates.[19]

[18] In fact, a very careful study performed by the IMF on five FL processes (Argentina, 1976-81; Chile, 1974-80; Indonesia, 1983-88; Korea, 1980-88 and Philippines, 1980-81) and reported by Johnston [38] is quite revealing. In all cases not only did interest rates increase following FL, but the gross intermediation margins also increased despite decreases in reserve requirements. If the facts are of interest, the justification that follows is arguable. According to this author, elimination of interest rates and credit controls "enables "banks to perform a better credit risk assessment. If anything, performing risk assessment becomes more difficult following FL and macroeconomic reforms. Further, under FR, credit rationing can easily and effectively be implemented to maintain only the best quality borrowers in the portfolio. Given the controls on interest rates there is little incentive to lend to more risky borrowers. When controls are eliminated and the risk/return trade-off of loans can be exploited by banks, efficient risk assessment becomes critical, however difficult it may be in the new environment. The propositions that follows these observations made by Johnston [38], although perfectly in line with traditional thinking, could turn out to be dangerous!. To reduce cost to financial intermediaries (and thus intermediation margin) reserve requirements should be reduced drastically. Following this recommendation means also than an important cushion against fluctuations in asset values (and thus bank solvency) es being removed. Beyond a reasonable reduction of reserve requirements to *above* international standards, unless further reductions are accompanied by a commensurate increase in capital requirements (about which little is said), the risk of a banking crisis is being increased considerably.

[19] This phenomena was particularly evident in the Mexican case. There, following FL expansion of credit to the private sector was mainly channeled to the more profitable, and under the circumstances risky, segments of the market such as financing of durable consumer goods, mortgages and credit cards. See [25] for a detailled description of the Mexican case. By large majority, FL processes have been implemented either without an increase in prudential supervision or even by a relaxation of supervision practices. This has often led to dramatic increases in risk taking following FL. Examples of this risk taking in South America are described in rich details by Diaz-Alejandro [16] and Corbo *et all.* [13]. Diaz-Alejandro also describes how the FL processes have attracted new business people into the banking sector and encouraged the formation of banking-industrial conglomerates. These new business owners where rather inclined to take large amounts of risk in a sector where, experience has over and over again shown, the threat of bankruptcy is not credible. The conglomerates, on their part, encouraged large bank exposures in affiliated companies. For example, toward the end of

But, is this "moral hazard"? By formulation, the model fixes deposit rates to I. Thus, by definition this rates are not sensitive to changes in the risk of the bank's loan portfolio. Presumably, if this variable would be set as a function $I = I[f(X, \omega)]$, then one should expect that $\partial I/\partial \omega \gtrless 0$ and the solution of the problem would presumably be different. Most likely, this would have a restraining effect on the risk taking incentives of the bank. In a game-theoretic framework this would mean that the bank and depositors agree on a contract (the deposit) at price I, but then the bank takes an action (increasing risk) that by assumption is unobserved to the depositor. Thus, the incentive to increase risk taking by the bank just identified falls squarely under the definition of moral hazard with hidden information that has come to be accepted in the literature (see for example [62], pp133-136).[20]. In Guttentag and Herring [32], Stiglitz and Weiss [66] and Keeton [49] moral hazard also plays a role but a different one. In these authors' models, moral hazard, defined by the conflict between the bank and the *borrower* makes, is the crucial feature that leads to equilibrium credit rationing.

If liberalization in the banking sector is part of a larger process of deregulation of financial markets, the process *may* be accompanied by capital inflows. These inflows, if not sterilized , boost bank deposits, bank liquidity, and tempt banks to increase lending as predicted by standard FL theory.[21] *If* a lending boom ensues, it is likely to be accomplished by an aggressive lending policy that accepts a larger-than-usual level of risk taking in the loan portfolio. Rapid rates of credit expansion have sometimes paradoxically coincided with high real interest rates in the wake of FL. This further enhances the risk associated to the lending boom.[22] Lending booms,

1982, several Chilean banks had lend over one fourth of their resources to affiliated companies [16]. This companies, at the same time, displayed a leverage that was high in historical terms. Cortes-Douglas [14] describes management practices by Chilean bank owners during the 1975-1982 period that limited in the reckless and illegal. It is tempting to draw some paralels with the Mexican FL process that started in 1988-89.

[20] This form of moral hazard is different from that resulting of the existence of guarantees on the deposits of the bank, whether *conjectural government guarantees* or an explicit deposit insurance scheme, with insurance premiums that are not tied to the riskiness of the bank's loan portfolio. With respect to this form of moral hazard, it has been shown that when one ignores charter value considerations, option theory suggests that bank owners are unambiguously encouraged to increase risk exposure in the loan portfolio. Keeley [48] and Marcus [55], on the other hand, show that when potential losses in charter values are included in the analysis, bankers incentive to increase loan portfolio risk is not unlimited, a result similar to the one obtained in the current analysis.

[21] For example, net inflows in the capital account roughly doubled (as a share of host-country GDP) from 1984-88 to 1989-93, the period of FL in some countries (e.g. Malaysia and Thailand) ([40]). On the other hand, banks may not just be passive recipients of capital inflows over which they have no control. In fact, they may profit from the deregulation environment by actively seeking funds in international financial markets at a cost well below domestic interest rates. This is a way to increase the profit of lending operations by reducing the cost of borrowing which is possible in international financial markets. This operations, while increasing the profit margin of lending operations also increase risk of banking operations by augmenting the "currency gap " in the bank's balance sheet. This form of moral hazard was extensively used by banks in Chile and Mexico following FL. Diaz-Alejandro [16] reports that in the case of Chile, the majority of capital inflows to the country following FL was in form of debt to financial and non-financial business enterprises. In both cases the exposure contributed considerably to the ulterior failure of the banks.

[22] See Goldstein and Turner [31], Fry [20], Kaminsky and Reinhart [41] and Galbis [24] for examples

just as shifting to more profitable portfolios, results in conscious increase in ω by bank owners, contributing to the fragility of the banks.

2.1.4 Deposit insurance as an additional source of moral hazard

The form of moral hazard argued above is different from that resulting of the existence of guarantees on the deposits of the bank, whether *conjectural government guarantees* or an explicit deposit insurance scheme, with insurance premiums that are not tied to the riskiness of the bank's loan portfolio. With respect to this form of moral hazard, it has been shown that when one ignores charter value considerations, option theory suggests that bank owners are unambiguously encouraged to increase risk exposure in the loan portfolio.[23] Keeley [48] and Marcus [55], on the other hand, show that when potential losses in charter values are included in the analysis, bankers incentive to increase loan portfolio risk is not unlimited, a result similar to the one obtained in the current analysis. This latter form of moral hazard is not explicitly modeled here. However it is possible to speculate what the effect of FL could be on the value of the put option for bank owners, and thus on the incentives to engage in moral hazard.

As we have seen, the model yields unambiguously an increase in the level of risk of the banks porfolio and, under quite plausible conditions, an incentive to increase the risk of the portolio by financing riskier projects up to a point where credit rationing set is. The immediate consequence of these combined efffects is to increase the conditional variance of the banks assets. This increase in variance will, in turn, enhance the value of the put option available to bank shareholders. The overal result is that the presence of a explicit or implict deposit insurance scheme is likely to accentuate the incentives to engage in risk and the risk structure of the banking system.

2.2 The supply of credit

Another issue of crucial importance in a context of FL is that of the change in supply of credit to the business sector following the liberalization. To a large extent, the purpose of eliminating FR is to eliminate distortions in the supply of credit to business[24] and, most of all, increase the global amount of credit available in the economy by augmenting the savings rate. However, as we will show below, this in by no means and unambiguous result. Diaz-Alejandro[16] already observed in the case of the "southern cone " (Argentina, Chile, Uruguay), that the FL of the late 1970's did not stimulate intermediation beyond a small increase in short-term assets.[25]

---

of this phenomenon. Unfortunately, these lending booms are not of the type one could qualify as "desirable." In the Mexican case, a very subtantial portion of the credit expansion that followed the FL/privatization was in the form of consumer loans while credit to the productive sector was kept very tight.. The high default rate of these consumer loans contributed substantially to the banking crisis of 1995-97.

[23] See specially Kaen [42], [44] for a comprehensive treatment of the issue in the United States context.

[24] One of the distortions of FR that is of most concern to economists, is the transfer of wealth from savers to large business owners (Fry, [20])

[25] In Chile,at the peak of growth in financial intermediation that followed FL, the growth in bank liabilities was limited to six month deposits. Further, although the use of alternative savings instru-

The loan offer function of the bank under conditions of FL can be obtained from the FOC of the Lagrangian. More specifically by investigating the effect of a marginal change in loan quantity restriction, Q^*, associated with a marginal change in lending rate restriction, R^*. That is:

$$\begin{aligned} \frac{dq_r}{dR_r} &= -\frac{\partial L/\partial R_r}{\partial L/\partial q_r} = \frac{{q_r}^2\ (-1+\lambda_1+\lambda_3+F(R_r(\omega),\omega))}{-\left(\lambda_2\ {q_r}^2\right)-R_f+\lambda_3\ R_f} = \\ &= \frac{(\lambda_3+\lambda_1-1)+F(R_r(\omega),\omega)}{\frac{R_f}{{q_r}^2}(\lambda_3-1)-\lambda_2} \lesseqgtr 0 \end{aligned} \tag{14}$$

Clearly, the sign of this expression is ambiguous and a function of the absolute value of shadow prices of the FR restrictions, the risk free rate, the amount of loan already outstanding and the bankruptcy probability of the borrower. These shadow prices are, in turn, complex functions of d_r, κ_B, R_f, ρ and R_r. Even in the simple case that FR does not exist (and thus λ_1 and λ_2 are zero), a change in the quantity of loan offered along the loan supply function is

$$\frac{dq_r}{dR_r} = -\frac{\partial L/\partial R_r}{\partial L/\partial q_r} = \frac{R_f}{{q_r}^2}\left(1+\frac{F(R_r(\omega)-\kappa_f,\omega)}{\lambda_3-1}\right) \lesseqgtr 0 \tag{15}$$

with ambiguous sign. It will be negative if

$$F(R_r(\omega)-\kappa_f,\omega)+\lambda_3 < 1.0 \tag{16}$$

and positive otherwise.

As predicted by traditional FL economists, other thing equal, a reduction in reserve requirements is likely to reduce the lending rates charged by banks. This can be seen in the following result of the FOC:

$$\frac{dR_r}{d\rho} = -\frac{\partial L/\partial \rho}{\partial L/\partial R_r} = \frac{d_r\lambda_3}{1-F(R_r(\omega)-\kappa_f,\omega)-\lambda_3}$$

which will be negative if

$$1-F(R_r(\omega)-\kappa_f,\omega)-\lambda_3 < 0.$$

To get a better idea of what is happening in equation (14) we will use a graphical approach. Note that the graph is used only to illustrate the mathematical results. The ambiguity we will illustrated finds its support in the results of equations (14) and (15).

ments increased substantially [3], paradoxically the total *domestic* savings did not increase in the Southern Cone experiments of the 1970-80. In the case of Chile, it actually *fell* from 16.3 from the early 1970's to 12.4% in the 1975-81 period. Most of the increase in financial liabilities was due to the increase in foreign capital inflows. Domestic investment was also not up to expectations suggested by FL literature. In Chile, like domestic savings, it fell from 20.2% to 15.5%. It is possible that this drop was more due to policies that accompanied the FL than to the process itself. However, in all three cases the "package " (FL plus structural adjustments) was typical of a FL environment.

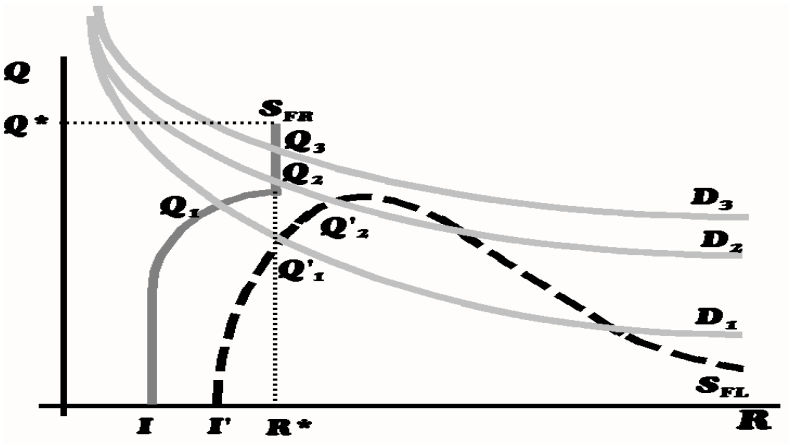

Figure 1:

The shape of the loan supply and demand functions are well known following the works of Jaffee and Modigliani [37] and Stiglitz and Weiss [66]. Under FR the shape of this function is modified to satisfy restrictions 6 and 7. The resulting supply function has been used by Cebenoyan *et all.* [6] to analyze problems of capital structure under FR. We present it in Figure 1. The horizontal axe represents interest rates (R) and the verticals axe quantity (size of loan,Q). The loan supply function under FR, S_{FR}, is drawn as a bold continuous line . This loan supply function reflects the fact that banks are forced to supply funds to enterprises up to Q^*at interest rates that cannot exceed the ceiling, R^*. In the situation depicted in Figure 1 all three entrepreneurs demanding funds, originating in three different risk classes, ω, will obtain these at the respective intercepts of their demand functions, $D_j, j = 1, .., 3$. As in earlier credit rationing models, the demand functions represent a measure of the interest rates the borrower is willing to pay and thus acting as a screening device.[26] In the case presented the intercept of the demand and supply functions are all in the upward sloping portion of the supply function. Thus in the cases illustrated, no credit rationing exists.[27]

The credit supply function under a liberalized regime, S_{FL}, presented in Figure 1 as a broken line, represents a very simple situation. Overall, the elimination of restriction on rates and quantity has restored the classical supply function of Jaffee and Modigliani [37] and Stiglitz and Weiss [66] where equilibrium credit rationing exists due to imperfect information. We assumed here that only a trivial shift of the supply function occurred related to an increase in deposit rates from I to I'. This shift to the right reflects the overall increase in interest rates (deposit and lending) in the economy. It is clear in this situation that customers of *all* risk classes receive

[26] See Stiglitz and Weiss [66] for details about interest rates as screening devices in the context of credit rationing models.

[27] Credit rationing is perfectly possible in this situation. This would occur if the demand function passes above the floor of Q^*.

lesser funds at higher rates, with customers of risk class 3 being cut off completely. It is possible to conceive much more complex shifts including shift in the Northeast direction, a lending boom that would increase overall supply of funds at higher rates (with a corresponding increase in overall risk for the bank as new, riskier customers are accepted) or a Southeast shift toward lower supply of funds at higher rates. We will not present these cases as the purpose of this graphical exercise is only to illustrate the ambiguity in the change in supply of funds that can accompany a FL process. The simple case presented in Figure 1 illustrates this point amply. In fact, increased supply at lower rates (a result that should supposedly follow FL in the classical literature) would consist of a shift of the supply function to the NW, a most unlikely situation.

This result contradicts the established intuition that FL, and in particular liberalization of interest rates with elimination of credit controls, will result in an unambiguous increase in credit (see e.g. Johnston [38]). With the elimination of credit controls and excessive demand for credit, so the argument goes, bank respond to the excess demand by expanding credit at an accelerated rate.[28] Our result suggests, instead, that following the FL event, a credit crunch may occur, even if in the long term the established believe holds. This will occur if the incentive for credit contraction in the short term is larger that the increase in supply of funds to the system by savers that will, presumably, be channelled to financing the real sector. A crucial variable for this to happen or not, is the strength of the financial position of the non-financial sector when the FL occurs.[29]

3 Statistical Methodology

We test the results of the theoretical analysis with a statistical model similar to the one used by Schranz [65]. This author analyzes the effect of bank mergers and takeovers on the performance of a sample of United States based banks. The setting is certainly quite different, however the methodology used is perfectly applicable to the problem at hand. To test the hypothesis resulting from our predictions we build a model of three equations. This model relates three variables profitability, risk and liquidity to a dummy variable representing the FL event and a set of control variables. The variable "liquidity" is a reverse measure of the level of performance in terms of intermediation. A high liquidity ratio supports the hypothesis that banks tend to restrain their lending activities and place a larger portion of assets in the form of liquid assets such as marketable securities and government bonds. The reason we include a set of control variables in the regression is that the three variables under investigation depend on a number of factors besides the FL event.

The statistical model used can be described as follows:

[28] This argument is at the root of the optimal sequencing proposition that credit expansion should not be totally decontrolled in the initial stages following FL, or alternatively, financial resources in the economy should be increased by fiscal contraction and external borrowing.

[29] A similar result was obtained recently by Isard et al. [36] in the context of a multiperiod general equilibrium framework.

$$
\begin{aligned}
PROFv &= \alpha_1 + \beta_{11} LIBD + \beta_{21} RISKv + \beta_{31} LIQv + \sum_j \beta_{j1} CTRY_j + \sum_i \beta_{i1} CONTRv_i + \varepsilon_1 \\
RISKv &= \alpha_2 + \beta_{12} LIBD + \beta_{22} PROFv + \beta_{32} LIQv + \sum_j \beta_{j2} CTRY_j + \sum_i \beta_{i2} CONTRv_i + \varepsilon_2 \\
LIQv &= \alpha_3 + \beta_{13} LIBD + \beta_{23} \text{RISKv} + \sum_j \beta_{j3} \text{CTRY}_j + \sum_j \beta_{i3} \text{CONTRv}_j + \varepsilon_3
\end{aligned} \tag{17}
$$

where

- $PROFv$ profitability measure
- $RISKv$ risk measure
- $LIQv$ liquidity (intermediation) measure
- $CTRY_j$ is a country dummy (Greece was taken as the intercept)
- $CONTRv_i$ control variable i, j, a different subset for each dependent variable

The $CONTRv_i$ variables were selected using a stepwise elimination procedure for each individual equation out of a list of about 20 candidate ratios/variables. This procedure used an $F-statistic$ as the criteria of selection of the variables that would be eliminated. The significance level used for the selection process was 0.15. For each of the dependent variables we used several candidates based on book and market value. The variables for concentration ($CONC$) and growth (GTA) were forced into the equation. The liberalization dummy, $LIBD$, changed the value from zero to one at the dates indicated in Table 1 in the following section.

As measure of intermediation, $LIQv$, we will use the ratio of loans to deposits. Admitedly, this measure is only partially a measure of the financing supplied by the banking sector to the economy. The reason is that it only reflects the internal shift in portfolio allocation by the banking sector and does not take into consideration the overall growth in financial liabilities in the economy. A further distortion is introduced by the fact that the data does not allow us to differentiate between commercial and consumer loan. For this reason, the variable only measures that incentives to which banks are subject in terms of portfolio allocation between loans and other banking assets..

The measure of risk, $RISKv$, used throughout the statistical analysis were the conditional variance of stock market returns and the net interest revenues over earning assets. The conditional variance was computed exploiting the heteroschedastic properties of stock return series. To do this we used a conditional moment a model that has become quite standard in the finance literature seeking to measure stock price volatility:

$$
E[r_{jt} \mid \quad _{t-1}] = a + b r_{jt-1} + c h_t + \varepsilon_t
$$

where $_{t-1}$ represents the set of conditioning variables, not including r_{jt} but containing its past history, and where h_t represents the conditional variance at time t. That is, the return on the stock, conditional upon the information set $_{t-1}$ is equal to an expected value plus a random error. See Nelson 1991], Hsieh [1993] and Glosten, Jagannathan and Runkle (GJR) [1993] for theoretical supports of this choice of model. The error, ε_t, can be assumed to be conditional on the same information set, $_{t-1}$, and normally distributed, i.e.$(\varepsilon_t \mid _{t-1}) \sim N(0,_t)$, or $(\varepsilon_t \mid _{t-1}) \sim t(0, h_t, \nu)$. We choose to give this conditional variance an EGARCH (exponential generalized autoregressive conditional heteroscedastic) parametrization. The complete model can thus be written as follows:

$$\begin{aligned} r_{jt} &= b_0 + b_1 r_{jt-1} + b_2 h_{t-1} + b_3 LIB + \varepsilon_t \\ (\varepsilon_t \mid _{t-1}) &\sim t(0, h_t, \nu) \quad if\ \nu \geq 30 \\ (\varepsilon_t \mid _{t-1}) &\sim N(0, h_t) \quad otherwise \\ \ln(h_t) &= \alpha + \delta_1 LIB + \beta \ln(h_t) + \theta g(\varepsilon_{t-1}) \\ g(\varepsilon_{t-1}) &= \left(\left| \frac{\varepsilon_t}{\sqrt{h_t}} \right| - \sqrt{\frac{2.0}{\pi}} - \gamma \frac{\varepsilon_t}{\sqrt{h_t}} \right) \end{aligned} \tag{18}$$

We augmented both the conditional mean and conditional variance equations of the conventional EGARCH model to incorporate a dummy variables for financial liberalization (LIB). The t-tests on the coefficients b_3, δ_1 are tests on the hypothesis that FL affects the level and volatility of bank stock returns. The parameters of the system were estimated using a FIML estimation procedure assuming (and testing) a t-distributed vector of errors. A t-test on the statistic representing degrees of freedom on the t-distribution is a sufficient statistic to test the restriction that the distribution is normal. When the estimates of ν where large (>30) and non significant, errors were assumed to be distributed normal. An alternate specification, a GARCH-M with leverage (e.g. GJR [1993]) was also tested. This latter model was difficult to estimate and sensitive to initial values of the coefficients. Further, the coefficients were often outside of their expected range. Thus we continued working with the EGARCH model despite the critic of Engle and Ng [1993]. We test the implicit assumption of heteroscedasticity in bank stock returns using a Gauss-Newton regression.

4 Data

The empirical analysis was performed on annual observations of accounting data for a sample of banks originating in five countries that have been exposed to a FL event and for which reasonably "good" detailed financial information at the level of individual banks was available over the relevant period. In table 1 we present the countries, the dates of FL, the number of banks in the sample of each country and the period covered (years for which data was available). The sample does not suffer of survival bias because we included all banks available, whether or not they eventually disappeared by liquidation, merger or acquisition. The portion of the analysis that

uses market data (computation of conditional risk) was performed using monthly observations of the banks' stock.

Table 1

Country	Date of FL	# of banks	Period
Greece	February 1987	8	1984-93
Malaysia	February 1991	8	1976-93
Mexico	November 1988[30]	16	1982-94
Taiwan	March 1985	18	1975-93
Thailand	March 1990	16	1975-93
Total		**73**	

The source of the data is the following: for Greece data was obtained from DISCLOSURE; for Malaysia, Taiwan and Thailand we obtained the data from the PACAP (Pacific Basin Capital Markets) database; and for Mexico we used accounting data from the Mexican *Superintendencia de Bancos* and market data obtained from the *Bolsa Mexicana de Valores*.

5 Results

The model was estimated using a Seemingly Unrelated Regressions (SUR) technique. The main interest of the study is on the link between FL and the three key dependent variables: profitability, risk and intermediation efficiency. Thus we focus on the *LIBD* coefficient of each equation. We ran two simultaneous equations models, the first using the conditional variance and the second the net interest earnings over earning assets as proxy of risk. The first system provided results that were statistically superior to the second. In particular, for the second system the Durbin-Watson statistic for the profitability equation was such that we could not reject the hypothesis of presence of autocorrelation in the sample.[31] Thus, although the results are very similar for both systems, we report only the results for the system that uses the conditional variance of stock returns as proxy of risk. From table 2 it can be seen that the presence of autocorrelation is rejected for the $RISKv$ and the $LIQv$ but is less certain for the $PROFv$ despite the fact that the variable was lagged for two periods.[32]

The most notable results are: profitability *falls* following FL with a significance level of 3%!; risk of banks measured by the conditional variance of stock returns *increases* with FL with a significance level of at the 2% level; finally the measure of supply of funds *falls* with a significance level of less than 1%. This empirical result is consistent with the two main theoretical propositions that FL consistently increases the instability of the banking system and that the sign of the change in supply of

[31] The d_l and d_u at the significance level of 1% for a system with over 100 observations and 3 independent variables are 1.48 and 1.60 respectively.

[32] In the process of lagging we lost almost 40 observations bringing the total number of usable observations down from 456 to 417. However, the introduction of the lags improved the DW for the equation from 1.25 to the current 1.48, just on the lower limit, d_u.

funds may not be that suggested by traditional FL literature. In fact for the sample investigated the proportion of available funds placed in the real sector falls. *This means that if FL does not produce an a signi cant expansion of nancial assets in the economy to compensate for the shift in portfolio allocation, a credit crunch may result.*[33] A detail of some interest is the fact that while there is little of no difference between the risk measure of Greece banks and the banks of the other countries (t-statistics are not significant with the exception of Thailand), the same is not true for the other variables where important differences appear to exist between countries. In Table 2 we present detailed results for the estimation of system (17) for each of the countries in the sample.

We do not report the results of estimating equation (18) since one model was estimated for each bank in the sample (i.e. 73 times). These estimation were based on monthly observations of bank stock returns. Then we extracted the value of the estimated conditional variance at the end of each year for which accounting data was available.

6 Conclusions and policy implications

This paper explores theoretically and empirically the link between Financial Liberalization (FL) and the banking crisis that often follow. We also investigate theoretically and empirically, the proposition that FL should result in an increase in supply of funds to the real sector. To accomplish this we first develop a theoretical model of a banking firm that operates under financial repression and is then subject to FL. The model yields the result that following FL there is an unambiguous increase in risk to the banking firm. This increase implies a higher probability of a banking crisis following FL. Less formally, we also conclude that the presence of a explicit or implict deposit insurance scheme is likely to accentuate the incentives to engage in risk and the risk structure of the banking system. Moral hazard plays an important role in this increase in risk to the banking sector. This questions the "innocence" of the bank owners in the crisis that have often followed FL and that had been attributed to either macroeconomic policy, concomitant structural changes in the economy or left-over distortions from the financial repression period. The sign of the change in supply of credit to the real sector is ambiguous.Our result suggests, instead, that following the FL event, a credit crunch may occur. This will be the case if the incentive for credit contraction in the short term is larger that the increase in supply of funds to the system by savers that will, presumably, be channelled to financing the real sector. A crucial variable for this to happen or not, is the strength of the financial position of the non-financial sector at the moment of the FL event.

We test empirically the propositions resulting from this model using data of a sample of 73 banks (some of which may have become technically insolvent) from

[33] Note once again the reported fact that, "paradoxically" the total *domestic* savings did not increase in the Southern Cone experiments of the 1970-80. In the case of Chile, it actually *fell* from 16.3 from the early 1970's to 12.4% in the 1975-81 period. Most of the increase in financial liabilities was due to the increase in foreign capital inflows.

Greece, Malaysia, Mexico, Taiwan and Thailand. The empirical test was based on a system of three simultaneous equations that use a measure of risk, profitability and intermediation as dependent variables. The measure of risk used was the conditional variance estimated using an empirical conditional Capital Asset Pricing Model estimated using an EGARCH specification. The test tend to support the conclusions of the theoretical model, i.e. unambiguous increase in risk and for the sample, an unambiguous fall in credit supply to the real sector as proportion of total portfolio allocation by banks.

6.1 Policy implications

If FL exposes banks to increased risk and even encourages more risk taking, then obviously the probability of failures occurring after FL increases accordingly. Only those banks that operate prudently supported by an appropriate risk management and capital base will be able to survive in the new environment. This has implication with respect to bank supervision in the transition period, forbearance and bank failure resolution procedures,[34] the conditions that must exist before undertaking FL and about the so-called liberalization sequencing. The policy implications we draw with respect to these issues are the following:

- Governments wanting to implement FL should be clear that, by doing so, the likelihood of bank insolvencies and even a system-wide crisis is automatically increased. Thus they should prepare for it by establishing a failure resolution procedures that is credible and timely, where both banks and supervisors are given clear guideline under what conditions banks should be restructured or liquidated.[35] This is absolutely essential to prevent the expansion of likely individual bank insolvencies into a system wide crisis with a huge cost to the taxpayers. This expansion can happen easily when excessive forbearance encourages increasingly risky behavior by near-insolvent banks and provides a wrong signal to solvent banks. This resolution policy should also include clear provision for the funding of failure resolution expenses that are likely to occur. This may or may not consist of an explicit deposit insurance scheme/fund financed by the banking system itself. This is essential to prevent negative fiscal impacts (sometimes of massive proportions) such as those that have occurred in

[34] The experience of the United States, following the FL of 1980 and the property and energy booms of the 1980's, points clearly to the fact that excessive forebearance on the side of banking authorities (supervision, deposit insurer and Central Bank as lender of last resort) can whorsen rapidly the conditions in the banking system.See [58] [26] [39] [57] [27] [17] [28] [46] [52] [11] [29] and [19] for various aspects of the forebearance issue. Interestingly, the forebearance issue became a topic of particular interest to United States regulators only after the S&L debacle that followed the DIDMCA reform. This would suggest that forebearance is a problem that takes a particularly important place in the contect of a system wide crisis.

[35] The issue being raised here is a complex one. Not only the banks are subject to incentives, but also the bank supervisors. In effect, as proposed by Kane [43] and tested by Thomson [70], delayed closure of inolvent banks is a function of the incentive system facing the bank regulators. Thus, regulators thermselves must be given clearcut intervention rules (incentive compatible bank regulation) to prevent self-interest harmful forebearance.

Mexico (1995-96), Venezuela (1995-96), Chile (1980-84) and Argentina (1979-83), among others.

- The results also suggest that it is essential that financial liberalization be accompanied by a strengthening of the supervision and monitoring of the banking system. In particular, the supervision and monitoring authorities should have in place a stringent system of identification of failure prone banks. In fact, this increase in supervision capacity should, if possible, precede initiation of the FL process.

- Some of the propositions of the traditional FL-sequencing literature should be reviewed or the caveats made clear. One example is the proposition of reducing reserves requirements in the face of increasing lending rates (to stop the raise). This action, while possibly having the desired effect, is also likely to increases the insolvency risk of the banks by sliming down a cushion for asset value fluctuations. This policy of reduced reserves requirements should be implemented only if appropriate capital standards are in place.[36] FL-sequencing should be modified to take into consideration several of the elements incorporated in the previous points including: failure resolution policies, resolution expenses financing, implementation of extra-situ and in-situ early warning system, etc.

- Policy makers should not expect that FL will necessarily fuel an economic expansion by increasing the supply of credit to the real sector. In fact, the contrary may occur in the short run, as the banks may be subject to incentives to contract credit to its costumers following FL, and thereby, contributing to a contraction in economic activity. This result is supported by both the theoretical model and the empirical test.

- Authorities facing a banking system that has serious solvency problems may be tempted to liberalize the system with the hope that, given a freer operating environment, banks may grow in strength. This is a wrong reason for liberalizing the banking sector, since this liberalization will only exacerbate fragility and the probability of a system-wide crisis. The solvency of the banking system can be controlled much easily under financial repression where risk taking is much easily and automatically discouraged (via controls on interest rates). This does not imply that FL should not be eventually be undertaken to encourage the development of the banking and financial sector as a whole.

[36] Reserve requirements should also be viewed as the safety system for sound banking. In fact, capital *and* reserves should be sufficient to support the risk that arises from the banks lending activity. In other words capital and reserves are two sides of the same coin when it comes to bank safety. In this latter sense see the recently BIS-released *Core Principles for Effective Banking Supervision (CPEBS)* [59]. It should be remebered that the Mexico banking crisis happened with BIS capital standards in place. This means that, as Kane [45] noted, "adequate capital" does not mean BIS-standards, in fact it may mean much higher capital requirements. The recommendations of the *CPEBS* go in the same direction: "Each country should...supplement these standards with additional requirements to address particular risks and general conditions prevailing in its own market" ([59], pp.10).

Overall, it appears that it is a bad idea to implement FL as a quick remedy to either problems in the banking system or as a means to rapidly fuel economic growth. In both cases FL may actually backfire yielding the contrary effect and thus complicating the problem. In both cases, if FR is in place, it is often tempting to undertake a FL because it easy to implement, often through a few government decrees or Central Banks directives. Further, it provides voters and international agencies a sense that "something is being done" in terms of reforms. Rather, FL should be undertaken after careful preparation and most of all establishment of an effective and capable bank supervision body that it is also armed with clear and timely bank failure resolution procedures. They will, very likely, be called upon to be put to good use. As the Basle Committee on Banking Supervision [59] noted, "while the cost of banking supervision is indeed high, the cost of poor supervision has proved to be even higher."

Table 2: Statistical Test of Bank Performance under Financial Liberalization

The statistical model used can be described as follows:

$$
\begin{aligned}
PROFv &= \alpha_1 + \beta_{11} LIBD + \beta_{21} RISKv + \beta_{31} LIQv + \sum_j \beta_{j1} CTRY_j + \sum_i \beta_{i1} CONTRv_i + \varepsilon_1 \\
RISKv &= \alpha_2 + \beta_{12} LIBD + \beta_{22} PROFv + \beta_{32} LIQv + \sum_j \beta_{j2} CTRY_j + \sum_i \beta_{i2} CONTRv_i + \varepsilon_2 \\
LIQv &= \alpha_3 + \beta_{13} LIBD + \beta_{23} \mathrm{RISKv} + \sum_j \beta_{j3} \mathrm{CTRY}_j + \sum_j \beta_{i3} \mathrm{CONTRv}_j + \varepsilon_3
\end{aligned}
$$

where $PROFv$ profitability measure; $RISKv$ risk measure; $LIQv$ liquidity (intermediation) measure; $CONTRv_i$ control variable i, j. The $CONTRv_i$ variables were selected using a stepwise elimination procedure for each individual equation and for each of the five countries used in the empirical analysis. The liberalization dummy, $LIBD$, changed the value from zero to one at the dates indicated in Table 1. The measure of risk, $RISKv$, used throughout the statistical analysis was the conditional variance of stock market returns. This variance was computed exploiting the heteroschedastic properties of stock return series.

Variable		Consolidated Sample of 5 Countries		
Number of Obs.		417		
		PROFv (NP/SC)	RISKv (CV)	LIQv (TL/TD)
DW (adj R^2)		1.482 (0.73)	1.651 (0.01)	1.818 (0.86)
Liberalization	LIB(#)	-0.0186 (-2.169)	1.057 (2.319)^c	-0,0465 (-2.808)^c
Country	Mal	0.1344 (5.623)	0.8817 (0.718)	-01265 (-2.582)
	Mex	0.0825 (2.955)	1.2584 (0.946)	-0.0089 (-0.164)
	Tai	0.1418 (7.400)	0.6517 (0.658)	-0.1617 (-3.948)
	Tha	0.0598 (2.638)	1.7758 (1.780)	-0.1167 (-2.617)
Profitability	NP/SC	–		
	OP/TA	0.7506 (15.564)	-28.02 (-1.587)	
	NP/TA	–		-1.702 (-1.638)
	NPM	-0.0105 (1.866)	0.466 (0.144)	0.156 (1.312)
Risk	CV			0.029 (29.66)
	NIE/IEA			-0.200 (-0.495)
Liquidity (risk)	TL/TA	-0.1701 (-4.340)		0.2495 (4.666)
	LA/TA	0.1938 (4.176)		-0.6447 (-11.514)
	TL/TD	0.4561 (14.05)		
Intermediation	IE/IR	0.353 (5.143)	3.434 (1.016)	-0.179 (-1.341)
efficiency	IE/TA	0.154 (2.463)		-0.247 (-2.867)
Financial	SC/TA	-1.308 (-13.687)		0.496 (4.141)
leverage	TD/SC	0.009 (11.43)		-0.018 (-22.39)
	TL/SC	-0.011 (-11.96)		0.025 (59.16)
Growth	GTA	0.0023 (0.208)	-0.0587 (-0.085)	0.0011 (0.0459)
Market conc.	CONC	-0.0153 (-2.908)	0.3909 (1.652)	0.0000 (0.204)
Lagged dep.var.	1 lag	0.0960 (3.001)		
	2 lags	0.0582 (1.889)		

The symbols used in this table stand for: *LIB* the FL dummy, *NP/SC* net profits over shareholder capital, *OP/TA* operating profit over total assets, *NP/TA* net profit over total assets, *NPM* net profit margin, *CV* conditional variance on the stock price, *NIE/IEA* net interest earnings over interest earning assets, *TL/TA* total lending over total assets, *LA/TA* liquid assets over total assets, *TL/TD* total lending over total deposits, *IE/IR* interest expenses over interest revenues, *IE/TA* interest expenses over total assets, *SC/TA* shareholder capital over total assets, *TD/SC* total deposits over shareholder capital, *TL/SC* total lending over shareholders capital, *GTA* growth in total assets, *CONC* market concentration.

References

[1] Sankarshan Acharya. Charter value, minimum bank capital requirements and deposit insurance pricing in equilibrium. *Journal of Banking and Finance*, 20:351–375, 1996.

[2] Paul R. Allen and William J. Wilhelm. The impact of the 1980 didmca on market value and risk: Evidence from the capital markets. *Journal of Money Credit and Banking*, 20:364–380, August 1988.

[3] José P. Arellano. El financiamiento del desarrollo. In CIEPLAN, editor, *Reconstrucción Económica Para la Democracia*, pages 189–237. Editorial Aconcagua, Santiago de Chile, 1983.

[4] Aldo Arnaudo. Comparacion de dos crisis financieras: 1980 y 1994-5. *Actualidad Economica*, 5:3–8, September-October 1995.

[5] Philip F. Bartholomew and Gary W. Whalen. Fundamentals of systemic risk. In G. G. Kaufman, editor, *Banking, Financial Markets, and Systemic Risk*, chapter 1, pages 3–17. Jai Press Inc., New York, 1995.

[6] A.Sinan Cebenoyan, Klaus P. Fischer, and George J. Papaioannou. Corporate financial structure under inflation and financial repression. *Global Finance Journal*, 6:25–46, 1995.

[7] CEMLA. Reflexiones sobre la reforma financiera. In CEMLA, editor, *Reformas Y Reestructuracion de Los Sistemas Financieros En Los Países de América Latina*, pages 3–27. CEMLA, Mexico, 1994.

[8] Yuk-Shee Chan, Stuart I. Greenbaum, and Anjan V. Thakor. Information reusability, competition and bank asset quality. *Journal of Banking and Finance*, 10:243–253, 1986.

[9] Jacqueline Chavez, Klaus P. Fischer, and Edgar C. Ortiz. Financial liberalization and bank solvency: A multicountry study. *Research in International Business and Finance*, 12, 1996.

[10] David Cheney. Banking crises: What do we know? *IMF Survey*, page 383, November 25, 1996.

[11] Rebel A Cole. When are thrift institutions closed? an agency theoretical model. *Journal of Financial Services Research*, 7:283–307, 1993.

[12] Rebel A. Cole, Joseph A. McKenzie, and Lawrence J. White. Deregulation gone awry: Moral hazard in the savings and loan industry. In A.F. Cottrell, M.S. Lawlor, and J.H. Wood, editors, *The Causes and Coswts of Depositoty Institutions Failures*, pages 29–57, Boston, 1995. Kluwer Academic Publisher.

[13] Vittorio Corbo, Jaime de Melo, and James Tybout. Por que fracasaron las recientes reformas en el cono sur. In Santiago Roca, editor, *Estabilización y ajuste estructural en América Latina*, pages 403–443. Escuela de Administración de Negocios (ESAN), Lima, Perú, 1985.

[14] Hernan Cortes-Douglas. Financial reforms in chile: Lessons in regulation and deregulation. In Dimitri Vittas, editor, *Financial Regulation: Changing the Rules of the Game*. EDI Development Studies, World Bank, Washington, D.C., 1992.

[15] E.P. Davis. *Debt, Financial Fragility and Systemic Risk*. Oxford University Press, New York, 1992.

[16] Carlos Diaz-Alejandro. Good-bye financial repression, hello financial crash. *Journal of Development Economics*, 19:xx–xx, 1985.

[17] Jean-Francaois Dreyfus, Anthony Saunders, and Linda Allen. Deposit insurance and regulatory forebearnace: Are caps on insured deposits optimal? *Journal of Money, Credit, and Banking*, 26:412–437, 1994.

[18] Klaus P. Fischer, Jean-Pierre Gueyie, and Edgar Ortiz. Financial liberalization: Commercial bank blessing or curse? *Journal of International Finance*, 4, forthcoming 1996.

[19] Mark D. Flood. The great insurance debate. *Review of the FRB of St. Louis*, pages 51–77, July/August 1992.

[20] Maxwell J. Fry. Politicas para el desarrollo financiero. In C.M. Carstens, editor, *Liberalizacion e Innovacion Financiera En Los Paises Desarrollados Y America Latina.*, pages 121–142. CEMLA, Mexico, D.F.„ 1995.

[21] Frederic T. Furlong. Changes in bank risk taking. *Economic Review*, pages 45–56, Spring 1988. FRB of San Francisco.

[22] Frederick T Furlong and Michael C. Keeley. Capital regulation and bank risk taking: A note. *Journal of Banking and Finance*, 13:883–891, 1989.

[23] Vicente Galbis. Liberalizacion del sector financiero bajo condiciones oligopolicas y la estructura de los holding bancarios. In Santiago Roca, editor, *Estabilización y ajuste estructural en América Latina*, pages 289–315. Escuela de Administración de Negocios (ESAN), Lima, Perú, 1985.

[24] Vincente Galbis. High real interest rates under financial liberalization: Is there a problem? Working Paper WP/93/7, IMF, 1993.

[25] Celso Garrido. The mexican financial system in the nineties. *Journal of International Finance*, 5:forthcoming, 1996.

[26] Veronique Genin. Bank-specific closure thresholds for depository institutions. WP No. 38, Centre de Recherche et D'etudes Appliquées,Groupe ESC Nantes Atlantique, January 1995.

[27] Alton R. Gilbert. Federal reserve lending to banks that failed: Implications for the bank insurance fund. In A.F. Cottrell, M.S. Lawlor, and J.H. Wood, editors, *The Causes and Costs of Depository Institutions Failures*, pages 93–118, Boston, 1995. Kluwer Academic Publisher.

[28] R. Alton Gilbert. Federal reserve lending to banks that failed: Implications for the bank insurance fund. In *Bank Structure and Competition Conference*, pages 229–240, Chicago, 1994. FRB of Chicago.

[29] R. Alton Gilbert. Implications of annual examinations for the bank insurance fund. *Review of the FRB of St. Louis*, pages 35–52, January/February 1993.

[30] Oystein Gjerde and Kristian Semmen. Risk-based capital requirements and bank portfolio risk. *Journal of Banking and Finance*, 19:1159–1173, 1995.

[31] Morris Goldstein and Philip Turner. Banking crises in emerging economies: Origins and policy options. Technical Report 46, Bank of International Settlements, Monetary and Economic Department, Basle, October 1996.

[32] Jack Guttentag and Richard Herring. Credit rationing and financial disorder. *Journal of Finance*, 39:1359–1382, 1984.

[33] Jack Guttentag and Richard Herring. Prudential supervision to manage systemic vulnerability. In *Bank Structure and Competition*. Federal Reserve Bank of Chicago, 1988.

[34] Patrick Honohan. Banking system failures in developoing and transition countries: Diagnosis and prediction. Technical Report 39, BIS, January 1997.

[35] David B. Humphrey and Lawrence B. Pulley. Bank's responses to deregulation: Profits, technology and eficiency. *Journal of Money, Credit, and Banking*, 29:73–93, 1997.

[36] Peter Isard, Donald J. Mathieson, and Liliana Rojas-Suarez. A framework for the analysis of financial reforms and the cost of official safety nets. *Journal of Development Economics*, 50:25–79, 1996.

[37] Dwight M. Jaffee and Franco Modigliani. A theory and test of credit rationing. *American Economic Review*, 59:850–872, December 1969.

[38] R. Barry Johnston. Sequencing financial reform. In Patrick Dowes and Reza Vaez-Zadeh, editors, *The Evolving Role of Central Banks*, chapter 20. International Monetary Fund, Washington, D.C., 1991.

[39] David S. Jones and Kathleen Kuester King. The implementation of prompt corrective action: An assessment. *Journal of Banking and Finance*, 19:491–510, 1995.

[40] Mohsin Kahn and Carmen Reinhart. Capital flows in the apec region. Occasional Paper 122, IMF, 1995.

[41] Graciela Kaminsky and Carmen Reinhart. The twin crises: The cause of banking and balance of payment problems. Board of Govrnors of the Federal Reserve System and the International Monetary Fund. Manuscript, 1995.

[42] Edward J. Kane. *The Gathering Crisis in Federal Deposit Insurance*. on the Regulation of Economic Activity. The MIT Press, Cambridge, Mass., 1985.

[43] Edward J. Kane. Apparance and reality in deposit insurance reform. *Journal of Banking and Finance*, 10:175–188, 1986.

[44] Edward J. Kane. *The Savings and Loans Insurance Mess: How Did It Happen?* The Urban Institute Press, Washington, D.C., 1989.

[45] Edward J. Kane. Difficulties in transferring risk-based capital requirements to developing countries. *Paci c Basin Finance Journal*, 3:193–216, 1995.

[46] Edward J. Kane and Min-Teh Yu. How much did capital forebearance add to the tab for the fslic mess? In *Bank Structure and Competition*, pages 241–259, Chicago, 1994. FRB of Chicago.

[47] Gordon V. Karels, John M. Geppert, and Arun J. Prakash. Deposit insurance, capital adequacy requuirements and interest rate dynamics. Financial Management Association, New York, 1995.

[48] Michael C. Keeley. Deposit insurance, risk and market power in banking. *American Economic Review*, 80:1183–1200, 1990.

[49] William R. Keeton. *Equilibrium Credit Rationing*. Garland Publishing, Inc., New York, 1979.

[50] William R. Keeton. Deposit insurance and the deregulation of deposit rates. *Economic Review*, pages 28–47, April 1984. Federal Reserve Bank of Kansas City.

[51] M. Koehn and A. Santomero. Regulation of bank capital and portfolio risk. *Journal of Finance*, 35:1235–1244, December 1980.

[52] Van Son Lai. The effects of variation in laxity (or strictness) of closure rules on the valuation of deposit insurance. Technical Report WP 94-14, Laval University, CREFA, 1994.

[53] Chun H. Lam and Andrew H. Chen. Joit effects of interest rate deregulation and capital requirements on optimal bank portfolio adjustment. *Journal of Finance*, 40:563–575, June, 1985.

[54] Carl-Johan Lindgren, Gillian Garcia, and Mathew E. Saal. *Bank Soundness and Macroeconomic Policy*. IMF, Washington, D.C., 1996.

[55] Alan J. Marcus. Deregulation and bank financial policy. *Journal of Banking and Finance*, 8:557–565, 1984.

[56] John Mingo and Benjamin Wolkowitz. The effect of regulation on bank balance sheet decisions. *Journal of Finance*, 32:1605–1616, 1977.

[57] S. Nagarajan and C.W. Sealey. Forebearance, deposit inurance pricing and incentive compatible bank regulation. *Journal of Banking and Finance*, 19:1109–1130, 1995.

[58] Michael J Rebello Noe, Thomas H. and Larry D. Wall. Managerial rents and regulatory intervention in troubled banks. *Journal of Banking and Finance*, 20:331–350, 1996.

[59] Basle Committee on Banking Supervision. Core principles for effective banking supervision, April 1997. Consultative paper issued by the BCBS.

[60] Sangkyun Park. Explanations for the increased riskiness of banks in the 1980's. *Economic Review*, pages 3–23, July/August 1994. FRB of St. Louis.

[61] David H. Pyle. Capital regulation and deposit insurance. *Journal of Banking and Finance*, 10:189–201, 1986.

[62] Eric Rasmusen. *Games and Information: An Introduction to Game Theory*. Basil Blackwell, Inc., Cambridge, 1989.

[63] Michael Rotschild and Joseph E. Stiglitz. Increasing risk: I. a definition. *Journal of Economic Theory*, pages 225–243, 1970.

[64] Anthony Saunders and Berry Wilson. Bank capital structure: An analysisi of the charter value hypothesis. Technical Report S-94-14, New York University Salomon Center, New York, 1994.

[65] Mary S. Schranz. Takeover improves firm performance: Evidence from the banking industry. *Journal of Political Economy*, 101:299–323, 1993.

[66] Joseph Stiglitz and A. Weiss. Credit rationing in markets with imperfect information. *American Economic Review*, 71:394–410, June 1981.

[67] V. Sundararajan. The role of prudential supervision and financial restructuring of banks during transitions to indirect instruments of monetary control. *Journal of International Finance*, 4, 1996. forthcomming.

[68] V. Sundararajan and Tomás J.T. Baliño. *Banking Crises: Cases and Issues*. International Monetary Fund, Washington, D.C., 1991.

[69] Anjan V. Thakoor and Jess Beltz. A "barter" theory of bank regulation and credit allocation. *Journal of Money, Credit, and Banking*, 26:679–704, 1994.

[70] James B. Thomson. Modeling the bank regulator's closure option: A two-step logit regression approach. *Journal of Financial Services Research*, 6:5–23, 1992.

[71] James R. Tybout. Interest control and credit allocation in developing countries. *Journal of Money, Credit, and Banking*, 16:474–487, November 1984.

[72] Arvind Virmani. The nature of credit markets in developing countries: A framework for policy analysis. Technical Report 524, The World Bank, 1982.

[73] Larry D. Wall and Pamela P. Patterson. Bank's responses to binding regulatory capital requirements. *Economic Review*, pages 1–17, March/April 1996. Federal Reserva Bank of Atlanta.