

Abstract

The purpose of the paper is to evaluate and measure the effect of financial liberalization (FL) on bank risk exposure. We pursue these questions by assessing the changes in market-based asset values and risk exposure measures for commercial banks (CB) before and during a FL program. We do this for a sample of three countries: Malaysia, Taiwan and Thailand. We use a model based on the options pricing theory. We obtain estimates of the first and second moment of bank returns using an asset pricing model in which these two moments are a linear projection of a set of conditioning variables. This model was estimated using a GMM statistical procedure. Then we perform regressions explaining the evolution of bank risk measure around the FL event. The analysis and statistical test indicate that risk exposure of banks increases following a FL program, and this as a result of macroeconomic policy as well as changes in management controlled variables. This is so even for banks operating in countries that have undertaken very cautious FL processes such as Thailand and Malaysia. The results tend to support the proposition that moral hazard and bank risk taking may increase following FL. The results also suggest that banking crisis that often have followed FL may be more due to the behavior of banks managers than previously reported in the FL literature.

Financial Liberalization: Commercial Bank's Blessing or Curse? ¹

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Working Paper No 97-2
Faculté des sciences de l'administration

Working Paper No 97-2
Centre de recherche en économie et ...nance appliquées (CRÉFA)

February 15, 1997

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Financial Liberalization: Commercial Bank's Blessing or Curse?

"...a liberalization is a serious macroeconomic shock" Sussman [1992]

"few monetary authorities are prepared to accept as reasonable any interest rate level that is market determined." Pereira Leite and Sundararajan [1990]

1 Introduction

Assume you are a regulator or banking authority (BA) who receives instructions by the government to steer the banking system through a financial liberalization (FL) process. In particular, you are responsible for ensuring that the banking system rides through the FL process, suitably transformed, but in good health. Under the circumstances, institutional failures are to be avoided. How do you measure the risk exposure of banks or the probability of institutional failure as they go through the FL process? This is hard to do given the range of factors that can affect the solvency of a bank, including: managerial factors; the solvency of the bank's major borrowers; the limited value of accounting information under changing conditions; macroeconomic factors; etc.

The issue is important for a successful execution of a FL programs. The best laid plans for a structural reform program that seeks to encourage capital flows, savings and investment in a country, can stumble when one or more financial institutions face solvency problems provoking a panic in the system. The effects of such panics can be devastating, ranging from sudden monetary contraction to widespread financial difficulties in the productive sector and surges in unemployment. Bank solvency problems may originate from a number of sources: increased corporate failure by non-financial bank customers, run on deposits, imprudent lending activity by the banks, are just a few examples.¹ It is not unusual for economists planning and supervising national economic reform programs, to ignore the microeconomic effects, specially in terms of risk exposure of business of all sort, of such programs. This is not surprising considering that the change in risk exposure is generally absent of most economic planning models guiding these programs. The link between some aspects of FL and solvability of the banking sector has been addressed by some researchers. Leite and Sundararajan [21] address the issue of interest rates liberalization and bank "soundness" in a study that proposes a set of policy tools for a safe FL process. However, nowhere in the literature do we find an effort to measure bank risk exposure under FL.

¹ The 1995 Argentina financial crisis is a case in point. It was predominantly –if not only– a crisis of confidence in the banking sector. In the four months following the Mexican crisis, over 4 billion dollars (around 10% of the total deposit base in the country) left the banking sector, most of it not to leave the country, but –as the minister of economy D. Cavallo remarked– to be stored "under the mattress." The international financing package obtained by Argentina in the following months was largely used to establish a emergency deposit insurance scheme. The only purpose of this action was to restore domestic savers confidence in the banking system. The whole long-term restructuring program of the Argentina economy was in danger following this banking crisis.

Although it is true that several FL processes came and went without large (or small) scale bank failures, the risk exists. Outright institutional debacles have occurred following FL. Examples of this are Argentina, Chile, Colombia, Indonesia, Mexico, Nigeria, Norway, Sweden, Venezuela among others. In effect, many FL processes have ended, and were terminated, with a major crisis in the banking sector. These crisis sometimes represent huge losses to governments, like in Venezuela in 1994. There the government was forced to come up with a rescue package with a value equivalent to 13% of GDP of Venezuela [33]. In Argentina, in the period of six years following a FL initiated in 1977, almost 32% of the registered banking institutions disappeared. Often the actual absence of institutional failure results from the conjectural government guarantee (CGG) or forbearance extended by the state to ensure the solvency of the financial system throughout the FL process. This CGG may not have been removed as part of the FL process, or may have been reinstated when authorities perceived that the FL process puts the banking system in danger.

It is not our intention to question the legitimacy of FL. Rather, we seek to study the effect of these reforms on the functioning of the banking system and to develop instruments that allow a better monitoring of banks under conditions of FL. The exhaustion of the controlled import-substitution model of economic growth left many countries with no option but to engage markets to resume growth or escape recession. Many are doing this in a radical way. It is by no means evident that, despite the wave of FL observable in almost every continent, many forms of controls on credit and interest rates may be very useful to promote economic growth and social justice. Recently Vittas and Cho [35] have reviewed the practices of directing credit allocation, a prominent form of financial repression, and found that some experiences (such as Korea and Japan) suggest that these credit programs can promote investment and growth.

To get a better grip of the issue we make, as Kryzanowski and Roberts [20], and King [19] a distinction between economic insolvency and institutional failure. More specifically we approach Demirgüç-Kunt's [5] definition of "market value insolvency" focusing on the probability that the market value of assets exceeds the market value of liabilities.² We view the methodology used more as part of an "early warning system" (EWS) to anticipate hazardous situations rather than to obtain point estimates of bankruptcy risk or deposit insurance premiums. The model we use draws from the options pricing theory. It exploits the information contained in both, the bank accounting data and the public information pool contained in the price index of banks, about the banking system's performance. In the option pricing context securities issued by the banking sector are claims whose value is contingent upon the value of assets and liabilities of the bank. Thus, changes in the prices of bank stocks (observable) provide the researcher a window into the market's assessment of both the expected performance of the bank and the value of the portfolio of loan assets (both not observable). We go further to investigate the even more pertinent

²In her classification of failure definitions, Demirgüç-Kunt identifies four different concepts of bank failure: book value insolvency, market value insolvency, official (De Jure) insolvency, and De Facto failure. See [5], table 2, for details.

question of the change in risk of failure that these fluctuations suggest. Thus, we go on to compute probabilities of bank failure that results from comparing the value of bank's assets and liabilities. Insolvency risk is generally considered by bank supervisors and in Basle directives to be a key measure of bank performance (in contrast for example with the securities industry, where liquidation risk is considered of more importance). Bank insolvency risk is also the central point of concern in the 1993 bank capital adequacy directive (CAD) of the European Union that seeks to harmonize bank regulation across member states. We also compute an hypothetical insurer's contingent liability, valued as a put option bought by the bank from the insurer. This latter measure provides an excellent thermometer of the change in the bank's risk exposure with time, under any circumstance, including FL.³ This approach has the advantage of assessing indirectly variable that, although critical to monitor bank solvency, cannot be inferred directly from accounting data generated by banks. For the purpose of this study, the emphasis is not on the point estimates of either bank insolvency probability or fair deposit insurance premium. Rather, being preoccupied by the effect of institutional changes on bank performance, we focus on the changes in these values with time and events. Under these circumstances a bias in the estimates in one or the other direction is of little importance.

2 Financial liberalization and the banking sector

FL is complex processes and its effect on the banking sector is only partially understood. In this section we will attempt to analyze the incentives a "typical" FL introduces in the bank management process and some of the foreseeable consequences. When applicable we will refer readers to the relevant literature.

2.1 FL: what does it do to commercial banks?

FL can change considerably the business environment of financial intermediaries. This is so because it changes radically the macroeconomic, legal and regulatory framework under which banks operate. Obviously, the sector that is most affected by FL is the commercial banking sector. Commercial banks can be affected directly or indirectly. Directly, because commercial banks are often the immediate targets of the liberalization process. Indirectly, because liberalization usually modifies the decision parameters used by both banks and non-financial bank customers to make financing decisions.

The simplest possible definition of FL is removal of financial repression (FR). FR consists of a set of restrictions on market competition that yields a protected environment for financial intermediaries. The most common restrictions are: 1. Guaranteed intermediation margin through fixation of lending and deposit rates or direct subsidy programs (see for example Gibson and Tsakalotos [11]); 2. Controls on international capital flows and foreign competition; 3. Barriers to exit for financial intermediaries

³We thank Prof. Van S. Lai for convincingly suggesting the use of this latter measure as an indicator of a bank's health.

often accompanied by unlimited (conjectural) deposit insurance; 4. Barriers to exit for major industrial clients of ...nancial intermediaries, i.e. conjectural loan insurance for the largest loans in the portfolio; 5. Guaranteed business activity through government funded credit allocation programs to key economic sectors. A FL program consists of the simultaneous removal of all or part of these restrictions. Of all restriction, the one that is central to FR is ...xation of interest rates. Therefore, as Galvis[9]⁴ we take relaxation or lifting of controls on interest rates as the central event of FL.

Now, to see the impact of FL, consider the following list of measures and the consequences they may have on bank pro...tability and risk exposure. We summarize these effects in Table 1

Table 1 goes here

2.1.1 Elimination of deposit and lending rates controls.

² Description: This regulatory change has four separate effects on banks:

- Interest rate uncertainty: The immediate result of lifting controls is often an increase in the level and volatility of deposit and lending rates. Rate levels increase to bring them within a positive inflation-adjusted range. The increase in volatility may be caused by several factors of which we emphasize two: portfolio shifts and competition for funds. Portfolio shifts follow the elimination of rate controls, a form of market segmentation. These shifts occur when borrowers and lenders readjusts their positions to the new market conditions. Competition for funds is likely to be intense following a FL. Deregulation of rates can, and often do, lead to price wars as banks seek to capture market shares in a phenomenon similar to the one observed following the deregulation of the United States airline industry. These wars may be encouraged by the existence oligopolistic structure in the banking sector, a common phenomena among EM. The enhanced volatility can persist over a relatively long transition period until the market settles into an equilibrium point where speculation in, and arbitrage between different market segments, becomes less pro...table.
- Intermediation margin: Removal of controls (of borrowing and lending rates) eliminates the implicitly guaranteed intermediation margin (IM) and rent for the bank. Under the new environment banks may be forced to compete for deposits and loan costumers, squeezing their pro...t margins. The presence of oligopolistic power in the ...nancial sector could imply that while some banks strive using their relative market power position, others may ...nd the new competitive environment difficult to endure. Further, if banks accomplish any maturity transformation at all, an increase in

⁴This 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 ...nancial resources.'

deposit rates will not result in an automatic increase in rates of outstanding assets. The now almost-forgotten wave of American S&LA failures in the early eighties due to the rise (quite moderate by emerging-markets' standards) of deposit rates following President Carter's Depository Institutions Deregulation and Monetary Control Act (DIDMCA) of 1980, is a stark reminder of the effect such an unilateral shift in rates may have on bank performance.

- Risk taking: Elimination of ceilings on deposit and lending rates changes the incentives for risk taking activities by banks facilitating moral-hazard problems in the industry. More concretely, it encourages risk taking and expands the opportunities for doing so.⁵ Controlled lending rates encouraged banks to seek projects with low risk as lending rates cannot be adjusted to account for risk and moral hazard. With liberation of interest rates, increases in deposit rates practically forces banks to seek lending at higher rates in projects that are likely to be riskier. Lifting of lending-rate controls also reinforces the incentives for banks to seek to ...nance borrowers willing to pay higher rates-higher risk projects. If deposit rates would be fairly priced according to the asset risk exposure of each bank, no benefit would accrue to bank shareholders. However, in absence of such a fair pricing, given a cost of deposits (or unlimited CGG), agency theoretic arguments suggest that bank shareholders gain by seeking projects of higher risk. A fair pricing mechanism will surely not exist in the presence of a deposit insurance schemes (conjectural or explicit) at ...xed rates. If the FL reduces the intermediation margin as a result of competition, this will also encourage banks to engage in lending to more risky customers to increase returns on funds placed. The phenomena of bank risk taking has also been analyzed in the context of DIDMCA of 1980 and the Garn-St. Germain Depository Institutions Act of 1982 (see e.g. Pantalone and Platt, [28] and Keeton,[18] and [?] on empirical evidences of the link between ...nancial deregulation and risk-taking behavior in the United States)⁶.
- Quality of asset portfolio: Volatility (usually with a marked increase) in interest rates will increase both ...nancing costs and failure risk of bank non-...nancial costumers. The quality of bank assets will deteriorate accordingly.

⁵It is remarkable that, in one of the most thorough and candid analysis of the Mexican banking crisis made by a Mexican public ...gure, Mr. Miguel Mancera Aguayo [22], the governor of the Bank of Mexico, fails to even mention as a problem the shift in risk taking activities of commercial banks following the FL in that country. It is worth noting that the hughe loan default rates was one important element in the crisis that lead to the establishment by the government of a rescue package. This package consisted of over 11 billion dollars of taxpayer's money in direct ...nancing to commercial banks. In addition a parallel Support to Non-performing Borrowers' Program (Acuerdo para el Apoyo de Deudores, ADE) with loan restructuring facilities of up to 30 years was also put in place. We do not have information about the cost to taxpayers of this program.

⁶See also Corbo, de Melo and Tybout [3] for some details of bank risk-taking practices during the FL experiences in Argentina, Chile and Uruguay.

- ² Effect: The overall result of the elimination of deposit and lending rates controls is that banks may face increased profit-making opportunities. However, they will also be exposed to a considerable increase in interest rate and asset portfolio risk. The effect will generally not be uniform for banks of different size.

2.1.2 Deregulation and/or re-regulation of financial markets.

- ² Description: Again, there are several effects that come into action. These measures consist mostly of elimination of regulated specialization of financial institutions and promotion of new financial instruments and markets (e.g. bonds and stock markets, financial derivatives, etc.).

- Disintermediation. This process can generate strong incentives for market participants to engage in alternate forms of financial intermediation, in particular through securitized markets (disintermediation)⁷. Diversification of financial instruments in the economy is generally considered a desirable effect in a global sense, since it has the effect of "completing the markets". However, the consequences of disintermediation on individual banks may not be that beneficial. On the liability side, availability of new financial instruments encourage the reallocation of funds to more competitive markets. Again, DIDMCA is a good example. Massive amounts of funds shifted out of the American banking sector into, mainly, a booming mutual fund sector. Under deregulation, mutual funds could provide bank-like services to depositors. Banks are thus forced to compete for deposits increasing the costs of funds. On the asset side, non-financial enterprises find it advantageous to raise funds through alternative mechanisms such as domestic stocks or bonds, or quite often, in the international bond and stock markets. Major borrowers, usually those with the highest credit rating, may thus reduce their demand for bank originated funds. Banks are forced to shift their loan portfolio to smaller customers, often more risky and with higher information asymmetry.
- Risk taking Elimination of "firewalls" and opening the opportunities to a wider range of banking activities also provides new opportunities for risk taking and moral-hazard. In some emerging markets banks are given the chance to operate as universal banks (e.g., Mexico, Thailand) thus enabling them to profit from these new opportunities. But, even if universal banking is allowed, this is often a new line of business in which bankers may possess little or no experience. Cole et al.[?] provide evidence of moral hazard problems associated with asset diversification in S&LA in the United States after DIDMCA.

- ² Effect: The overall effect may be a fall in the relative importance of the banking sector and increased asset risk. In a rapidly expanding economy, the growth

⁷See Merton [24] for an interesting discussion on the competitive interaction between financial intermediaries and financial markets in a secular as well as a deregulatory context.

in assets may compensate for this loss. However, if FL is not accompanied by adequate growth, the effect would be a shrinking of the banks' balance sheet with reduction on both the assets and liabilities.

2.1.3 Economic reform.

² Description: Most FL programs are not undertaken in isolation. On the contrary, usually they are part of a larger package of economic reforms that include liberalization of the domestic good and international trade markets, cuts and shifts in government spending, changes in monetary and exchange rates policies, elimination of industrial subsidies, etc. Often, the package of FL is part of a "structural adjustment program" sponsored by the International Monetary Fund (IMF), that contains provisions for international trade, monetary and fiscal policies. The consequences of these reforms on the performance of firms can be quite varied. This in turn affects the credit quality of the banks' portfolios. Some bank customers may indeed succeed and flourish in this new competitive environment. Those firms unable to adapt or those that exist for the sole purpose of exploiting the rents resulting from a particular form of market segmentation, may suffer. While the success of the winners will not improve much portfolio performance (because of the non-residual nature of loan assets), the failure of the loser will reflect negatively on the performance of assets. In particular this will reflect on the non-performing portfolio of banks. Under these circumstances, banks often see the need to charge higher risk premiums on (now liberalized) loan rates charged to customers. While this may increase the profitability of banks in the short term, this higher premiums enhances the high credit-risk created by economic reforms ⁸. Roe [30] is one author that has emphasized this relationship in what he calls "the macro-micro feedback process" although in the context of highly controlled markets rather than FL.

² Effect: The resulting effect should be a short term increase in intermediation margins obtained from higher risk customers accompanied by a relative increase of non-performing loans in the long run.

2.1.4 Elimination of barriers to entry and exit.

² Description Under FR, the survival of banks and major non-financial enterprises is conjecturally but effectively guaranteed by the state. ⁹ Elimination of barriers to exit (removal of CGG) –as occurred e.g. in the early 1980's in Argentina and Brazil– changes considerably both, the liquidity of the banks and the credit quality of the banks' loan portfolios. This effect can be particularly severe in

⁸ It is now a fairly established belief among Mexican economists that the current peak of non-performing bank portfolios is largely self-induced. Firms were facing two simultaneous shocks, the high risk associated with the sudden and almost total liberalization of international trade, and the high risk-adjusted loan rates charged by banks

⁹ It is by no means unusual in repressed economies for the state to step in and rescue an enterprise whose insolvency would endanger the liquidity of a bank or an important number of jobs.

the absence of a deposit insurance scheme in place, a situation that is quite common in EM. Further, if FL also opens the market to domestic and foreign competition, elimination of barriers to entry increases competitive pressure on the banking system.

- ² Effect The effect of this particular measure can be quite complex. On the liabilities side of the balance sheet, removal of CGG reduces savers confidence in the solvability of the bank and discourages deposit—or shifts them from smaller or less solvable banks to larger or “to big to fail” banks. Thus, one effect could be a relative shrinking of deposits with smaller bank. On the asset side, elimination of barriers to exit of industrial customers could affect negatively the non-performing portfolio.

2.1.5 Adoption of international (BIS) capital standards

- ² Description: The adoption of the BIS or similar capital standards often accompanies FL. It has been argued (Breedon and Isaac, [2]; Wojnilower, [37]; Haubrich and Wachtel, [14]; Thakor, [34] and Berger and Udell, [1]) that risk-based capital standards (RBCS) can be viewed as a regulatory tax that is higher for asset items that are assigned a higher risk rating. Since equity capital is more expensive than any other source of fund, RBCS encourage substitution of risky assets for low risk assets, predominantly treasury securities. This leads to a credit crunch or reduction in the supply of credit to the business sector. This credit crunch, juxtaposed to the increase in interest rates, complicates the financing picture of business enterprises and, consequently, the value of the bank’s loan portfolio.
- ² Effect: The effects of this measures are hard to detect in the banks’ balance sheet. However, one observable effect should be a relative increase of holdings in government securities.

2.1.6 Bank supervision and enforcement powers.

Elimination of unlimited conjectural government guarantees on deposits and controls over the financial system price setting and allocation mechanisms is often accompanied by increased supervision of banks to guarantee the safety of the system. This is so because FL introduces many incentives and opportunities for profit and risk taking thus reducing the safety of the banking system. There exist a reciprocal relation between the value of the deposit insurance one side and covenant rights to surveillance and seize bank assets on the other, if one wishes to keep the safety of the system relatively constant (see e.g. Merton and Bodie, [25]). Now, the essentials components of a financially repressed system can often be eliminated quite easily given a reasonable political will. This, as we have seen, introduces considerable uncertainty into the banking system. For example, control on interest rates (deposit and lending), controls on international capital flows, economic reforms, etc. can usually be

eliminated by a simple decree. However, the same cannot be said of bank supervision. Often, central banks or bank superintendents of developing countries must perform the supervision duty using company laws that apply to standard industrial enterprises. These company laws may not provide bank supervisory bodies with the power and flexibility in terms of disclosure requirements, ability of taking over the control of the bank, etc. available to bank regulators of most industrialized countries. The case of a single insolvent bank can languish over years in court putting into question the safety of the whole banking system. Thus, a FL process that is undertaken without empowering the supervisory body to take rapid control of a critical situation through changes in company laws, adds considerably to the already inherently high uncertainty associated to the program

Although it is unlikely that all these developments will be felt simultaneously, it is very likely that several of these scenarios may present themselves concurrently in most FL processes. The overall effect of the set of measures that accompany FL is to create incentives for banks to increase profit making while increasing interest rate and asset risk. Some aspects of the effect produced by FL are similar to the ones outlined by Keeley [17], Furlong and Keeley [8], Furlong [7], Keeton [18] and others following deregulation in the United States. In the latter case the main argument is that deregulation may have decreased charter value, specially for institutions in protected local markets that had been relying on non-price competition to attract funds and borrowers. This, in turn may have reduced incentives for bankers to act prudently with regard to risk taking.

2.2 Financial liberalization in the countries under study

To help the presentation of this complex process, we provide a summary of the evolution of the regulatory and institutional framework associated to the banking system in the countries under study.

Malaysia

The FL process of Malaysia is probably one of the most gradual and also less radical. To a large extent the banking sector in this country is still one of the most protected not only of the sample used in this study but of all Asian countries that have initiated a FL process. A slow FL process started in the early 1970s, accelerated in 1978 with the freeing of several interest rates, but was halted in 1983. Interest rates on all priority sectors, that cover a very substantial portion of the bank's portfolios, came again under direct control by the central bank. This reversal accompanied a strong contraction in the fiscal deficit brought on by an attempt to soften the effects of global recession and high oil prices. Between 1985 and 1987 the banking sector went through a period of turmoil that ended with the bail-out of four major banks including Bank Bumiputra, the largest bank in the country.

In 1987 deposit rates were liberated and banks were allowed to lend up to 4% above the base lending rate (BLR, the local equivalent of the prime rate) fixed by the central bank, Bank Negara Malaysia. In 1989 the Banking and Financial Institutions Act

was implemented providing an integrated bank supervision framework. Supervision of foreign banks was made possible by forcing foreign banks to incorporate locally. Simultaneously, new risk-weighted capital adequacy standards were put in place. Banks were given until the end of 1990 to comply with these standards. Finally in February 1991 banks were allowed the freedom to set their own BLR, however they remain restricted on the premium they can charge over this rate to 4%. Consumer and mortgage rates remain controlled.

The FL process of Malaysia, given its gradualism, appears to be progressing smoothly. None of the elements of banking crisis that have accompanied other FL of Asia and Latin America appear to trouble Malaysia.

Taiwan

The banking sector comprises 13 government-controlled full service banks and a number of medium sized private banks and credit cooperatives. Liberalization started quite slowly and, as of 1995, does not appear to have run into any serious difficulties. It was argued that this restraint was due to the fact that repression suits many interest. Blue-chip borrowers enjoyed a cozy relationship with government banks, bureaucrats enjoyed power, perks and job security. A first effort towards liberalization was done in 1980 with the promulgation of the Essentials of Interest Rate Adjustment, under which interest rates on CDs and other money market instruments were partially deregulated. Also a greater range of difference between maximum and minimum loan rates was permitted.

Then, in March 1985 ten leading banks -including the Bank of Taiwan, Taipei City Bank, China International Commercial Bank- were allowed to announce their prime rate, and which were determined by banks individually according to their own position and market conditions. This is perhaps the point in the process that launches the FL of Taiwan. In 1986 the government liberalized deposit rates. Deposit categories on which the CB determined interest rate ceilings were reduced from thirteen to four, giving banks greater latitude in competing for deposits. Before, banks were locked into a fixed spread with floors and ceilings set by the government according to the Regulation for the Control of Interest Rates of 1947. The same year, some foreign banks that had been in Taiwan for at least five years were allowed to open branches but with very limited functions.

In July 1989, coinciding with the arrival of Mr. Samuel Shieh, an assiduous promoter of internationalization and liberalization of the financial markets as governor of the Central Bank, a new banking law was passed. With the law started a slow privatization program that reduced the government holdings in the three leading commercial banks: First Commercial, Huan Nan and Chang Hwa. Also, under the law, domestic banks had to meet the 8% capital/asset ratio set by the BIS and the stage was set for further interest rates deregulation. Foreign banks were allowed to take long-term deposits and make long-term loans and eventually enter the consumer lending market. Lending and deposit rates were definitively liberalized, with the abolition of ceilings and floor limits on both rates. In 1990 restrictions on US dollar holdings by Taiwanese banks were relaxed; a US dollar interbank market was created;

the amount of NT dollars that could be moved out of the country by resident was increased; and the holding of foreign currency deposits by residents in overseas banks was made easier.

In 1991, 16 new commercial banks were licensed. The new banks were permitted to open only five branches in addition to their headquarters and savings departments. Fifteen of these banks came into existence on January 1, 1992, in "one full swoop", almost doubling the number of domestic banks in the country. The China Trust was transformed into a commercial bank. In that year, the Ministry Of Finance also liberalized the credit card business and the short-term money market. In 1994, the inward flow of capital was liberalized with the permission for foreign parties to open Taiwan dollar accounts. The CB put no ceilings on inward remittances, although it retained the right to screen remittances exceeding 100,000 US dollars.

Finally, on January 5, 1995, the Cabinet approved a blueprint for a three-phase program to enhance Taiwan's capability to become a regional financial center intermediating funds for foreign and domestic firms in the Asian Pacific region. The measures include: further elimination of restrictions on operations by foreign banks, revisions to rules on international financial transactions, offering incentives for an offshore financial center and allowing domestic individuals to open currency accounts in the offshore financial centers.

Thailand

Thailand can be viewed as a case of gradual but radical FL. Whether it will be possible to say in the future that it also was "safe," is something that remains to be seen. A first gentle move of FL was undertaken in Thailand in 1980, when lending and depository rates raised by 3% from the statutory limit imposed since 1924. Ceilings have since been adjusted frequently. A stronger FL move came in 1989. In June of that year longer maturity time deposit rates were allowed to float. This was followed in March 1990 with the removal of interest rate ceilings on all time deposits and loans. Finally in January 1992, interest rates controls were eliminated on all savings deposits. This moves on interest rates were accompanied by a package of other measures including: liberalization of transactions in which banks are allowed to engage (including international, foreign exchange, debt underwriting, market making in government securities, fund management, etc.); liberalization of international capital flows and liberalization and development of alternative financial markets. In 1992, the credit allocation quota system was relaxed and new legislation allowed the establishment of Bangkok International Banking Facilities (BIBF) with eurobanking powers. Foreign and domestic banks were eligible to open BIBF. In January 1993 BIS capital requirement guidelines were put into force with all banks given until December 1994 to comply. In February 1995, the government announces that the number of full branch banking licenses would be increased by nearly 50% by May 1996, with foreign banks (already with a presence through BIBF) allowed to compete with domestic banks for those licenses. Parallel to this regulatory changes, the government reduces its ownership stake in the banking system. In 1989, 10% of the government controlled shares of Kung Thai Bank (KTB) were sold to the public. In 1993 the

government sells further stakes of the KTB and the Bank of Asia (BoA).

Even with a massive increase in lending activity following the FL, there is no indication that the Thailand banking system faces serious solvency problems.¹⁰ However, the Bank of Thailand appears to forecast some problems ahead. It has explicitly expressed a warning that smaller, weaker banks may find it difficult to survive in the increasingly competitive banking environment. Thus they may be forced into mergers with larger competitors.

3 The model and statistical methodology

3.1 The model

The model is based on the option's principle that a bank's equity can be viewed as a derived asset (a call option) whose value depends upon the value of the bank's asset, mostly the portfolio of loans. For the latter there is usually no observable market value. Book values are imperfect estimators of the true value of these assets. As is usually the case in adapting the options pricing model to corporate finance, we assume that the bank's assets follow a Wiener process,

$$dA = \mu A dt + \sigma_A A d\epsilon \quad (1)$$

where $\mu A dt$ represents the instantaneous expected change in asset value, $\sigma_A A$ is the instantaneous standard deviation of asset values changes and $d\epsilon$ is a white noise. Adding the standard "frictionless" market assumption two major results follow. First, if the bank's stock represents a call option on the bank's assets the following relation between the value of stock, V , and the value of assets, A ; σ_A , and the value (exercise price) of liabilities, D including deposits and preferred stock can be established:

$$V = AN(d_1) - DN(d_1 - \frac{\ln \frac{A}{D} + 0.5\sigma_A^2 T}{\sigma_A}) \quad (2)$$

where $N(\cdot)$ represents the standard normal cumulative distribution, T represents the expiration date of liabilities, and ¹¹

$$d_1 = \frac{\ln \frac{A}{D} + 0.5\sigma_A^2 T}{\sigma_A}$$

In contrast to Black and Scholes, in our context as in that of Ronn and Verma [1986] and Giammarino et.al.[1989], the nominal value of liabilities is the present

¹⁰This, in spite of the fact that in March, 1995, the Bank of Thailand saw it necessary to impose a limit on lending growth of 24% (in Baht and US\$) per year on all domestic and foreign banks. Bank asset expansion had reached a peak of 30.3% per year in January of 1995

¹¹The formulation given here differs from the more recent applications of the model in that it does not incorporate a coefficient for bank supervisor's forbearance, β . The reason is that in this paper we not interested in establishing whether banks pay a fair deposit insurance premium. Rather, we look at the change with time of the variables of interest. Traditionally β is introduced into equation (2) as a constant, $\beta < 1.0$. It is likely that forbearance changes with FL, but this is another issue altogether. We also ignore dividend payments (see e.g. King [19]).

value of the exercise price of the option. Thus the risk-free interest rate does not appear in the equation. Second, Merton [1974] also shows that applying Ito's lemma, the standard deviation of the stochastic process $dA=A$ can be represented as

$$\sigma_A = \frac{V \sigma_V}{A(V=A)} = \frac{V \sigma_V}{AN(d_1)} \quad (3)$$

where σ_V is the instantaneous standard deviation of the process $dV=V$. In this system of two equations (2) and (3), only the value of equity, V ; and the current face value of liabilities, D , can be observed directly. The variable σ_V can be observed only indirectly. It represents the market's estimate, at time $t_i - 1$ given the current information set, of the instantaneous standard deviation of the process $dV=V$ over the period until expiration of the option. It is, thus, a conditional standard deviation, conditioned upon the information set $\mathcal{I}_{t_i - 1}$. We will have more to say about the estimation of σ_V later. This leaves a system of two equations with two unknown variables, A and σ_A , that can be solved simultaneously.

We now proceed to compute two measures of insolvency risk. One is the probability of insolvency, $P(X) = P(A < D)$, and the other is the fair deposit insurance premium, O_d . The actual probability of institutional failure is function of many other factors besides the market's implicit assessment A and/or $P(X)$. Similarly, deposit insurance premium does not exist in most emerging markets. In those few where this type of insurance exists, banks pay, as in the United States, a fixed premium. In this study we are less interested by the actual institutional liquidation probability or the premium a bank would have to pay if it decides to insure its deposits, than by the evolution of bank risk exposure that accompanies a FL process. Thus, we will focus on the relative change of $P(X)$ and O_d with the passage of time and the application of FL.

3.1.1 Measuring insolvency risk

Insolvency occurs when the value of liabilities (excluding capital) exceeds the value of assets. We focus not on the ex-post bankruptcy states but rather on the ex-ante bankruptcy probability implied in the market's value assessment of bank stocks. Presumably, if the probability of insolvability is high enough, BA will intervene to take remedial action. More often than not, remedial action does not imply orderly liquidation of assets, but rather an exercise of CGG. The probability of bankruptcy can best be viewed in the context of options. Bankruptcy will occur if the stochastic value of assets is less than the exercise price of the option, the face value of debt. It is a well known fact of options theory, that $d_2 = d_1 - \sigma_A \sqrt{T}$ in equation (2) is standard normal variable and that the cumulative represents the probability that the price of the underlying asset exceeds the strike price. Thus the probability of bankruptcy is given by

$$\begin{aligned}
P(X) &= P(A > D) \\
&= 1 - P(A \leq D) \\
&= 1 - N(d_2) \\
&= 1 - N\left(\frac{\ln\left(\frac{A}{D}\right) + 0.5\sigma_A^2 T}{\sigma_A \sqrt{T}}\right) \\
&= 1 - N\left(\frac{\ln\left(\frac{A}{D}\right) + 0.5\sigma_A^2 T}{\sigma_A \sqrt{T}}\right)
\end{aligned} \tag{4}$$

with every term as defined before.

3.1.2 The price of deposit insurance premium

Now, given estimated values of A and σ_A , the deposit insurer's contingent liability is valued as a put option:

$$O_d = D_i N(y) + \frac{A_t D_i}{D} N(y) \tag{5}$$

where

$$y = \frac{\log\left(\frac{L}{A}\right) + 0.5\sigma_A^2 T}{\sigma_A \sqrt{T}} \tag{6}$$

and D_i is the face value of insured debt.¹² O_d represents, as the insolvency risk, a measure of the bank's risk exposure. To get values that are independent of the size of deposits we set $o_d = O_d/D_i$. Thus o_d represents the insurance a bank would have to pay for each dollar or multiple of dollar of deposits. An increase (decrease) in the insurance premium per dollar of deposit indicates an increase (decrease) in the insolvency risk of the bank. As such it represents an excellent measure of the risk exposure of banks under any context.

3.2 Statistical methodology

The statistical procedure consist of three distinct steps: i) estimation of conditional variances of stock returns, V_t^2 ; ii) solution of the system of non-linear equations (2) and (3) for the value of the bank's assets, A , and conditional variances of asset returns, σ_{At}^2 ; iii) estimation of stock price implied probability of bank bankruptcy. Now the details.

3.2.1 Estimation of conditional expected returns, $E[r_{jt} | r_{t-1}]$ and variances of stock returns, $\sigma_{jt}^2 | r_{t-1}$

The first step is to obtain an estimate of the conditional variance of returns of bank stocks. A procedure frequently used in the literature is to compute the variance over

¹²This methodology, and variations of it, have been used by several authors. Examples are Ronn and Verma [31], Giammarino, Schwartz and Zechner [10], and follows Merton [23]. We were not able to distinguish between deposits and borrowings. Thus we assumed that all liabilities are insured.

a moving window of past returns that varies from 12 months on a monthly basis [e.g. Noah and Roy, 1994; Furlong, 1988; Ronn and Verma, 1986] or on a daily basis [Giammarino et al., 1989]. We do not adopt this procedure because it supposes that, at each point in time, the historical standard error is equal to the conditional standard error. We employ an alternative methodology that makes use of recent theoretical and empirical developments in asset pricing technology. Consider a model that assumes the conditional first and second moments to be a linear function of the conditioning variables as follows:

$$\begin{aligned} E_t[r_{t;t+\Delta}] &= X_t^-; \\ \log(\sigma_{t;t+\Delta}^2) &= \log(\sigma_{t;t+\Delta}^2 | X_t^-) = X_t^0 \end{aligned} \quad (7)$$

where X_t is the vector of conditioning variables, and $\sigma_{t;t+\Delta}^2[\cdot]$ is the variance, conditional on information available at time t . This specification is very similar to that of Whitelaw [1994]. It has the advantage that it introduces very little structure into the pricing mechanism and the relation between moments. We differ in that, to guarantee a positive variance, we take the logarithm of the conditional variance, $\sigma_{t;t+\Delta}^2[\cdot]$, in an approach similar to the EGARCH of Nelson [26].¹³

We used the same conditioning set as Harvey's [12] set of 'domestic' information variables. It consisted of a constant, lagged returns on the market index, the real exchange rate, U.S. 1-mo TBills, the spread between U.S. 1-mo and 3-mo TBills, the U.S. 10-years Government Bond, domestic inflation, the world dividend yield and a dummy for liberalization (the latter not part of Harvey's set). A simultaneous generalized method of moments (GMM) estimation of the system provides asymptotically correct and heteroscedasticity-consistent standard errors. Thus, in addition of obtaining estimates of conditional moments, the procedure permits us to make inference about the set of coefficient estimates. The moment conditions are:

$$E \begin{pmatrix} (r_{t;t+\Delta} | X_t^-) X_t^0 \\ (\log(\sigma_{t;t+\Delta}^2 | X_t^-)) X_t^0 \end{pmatrix} = 0 \quad (8)$$

Once the series of $\sigma_{t;t+\Delta}$ was obtained we computed a forward-looking moving average of $\sigma_{t;t+\Delta}$, $\hat{\sigma}_{t;t+\Delta}$. The purpose of this transformation is to eliminate some of the variability of the series of $\sigma_{t;t+\Delta}$. Further, this procedure introduces some of the forward-looking information that is usually available in the market at any point in time and that cannot be captured by a purely technical forecast as the one obtained from estimating (7).

Now, estimating conditional moments by exploiting the heteroscedastic properties of the variance, is fundamentally inconsistent with the Black-Scholes options pricing model. This model assumes constant variance over the options holding period. One solution to this dilemma is to use a stochastic volatility options pricing model as

¹³We also tested a one-factor and a two-factor conditional CAPM model similar to the one applied successfully to United states data by Song [32], with up to three ARCH lags. As in Song the two factors were the market return and interest rates. We abandoned the Song model in favor of the one by Whitelaw [36] when Hansen's overidentifying restrictions tests consistently rejected the orthogonality conditions used in the estimation of both, the two-factor and the one-factor models. This latter model yields a just-identified model.

proposed by Hull and White [15]. The down side of using this methodology is that the value of an options is much harder to compute. To our knowledge no author has evaluated bank asset values using this methodology. Further, there is very little to gain because, as Hull and White themselves put it: 'the bias caused by stochastic volatility is surprisingly small.' The only exception is for deep out-of-the-money options, our equivalent of banks whose asset value are far below the value of liabilities. Essentially, hopelessly bankrupt banks. Jorion [16] encounters a similar problem when analyzing the foreign exchange market. He also chooses to live with theoretical inconsistency. Another solution is to use, as other authors before, historical standard errors. In other words, use an established methodology. The problems with this solution is that even this established methodology is forced to assume, implicitly, that volatility is time-varying. This is so because volatility is computed over a moving window of ...xed duration. Given these contradictions we decided to be pragmatic. We computed volatilities using both the conditional moments forecasting model (7) and historical volatilities using a moving window of 12 months. Then, we computed correlation coefficients between these estimates and realized volatilities. To compute realized volatilities we also used a moving window of 12 months. Forecasts using model (7) yielded correlation coefficients that were consistently higher than those using historical volatility.¹⁴

3.2.2 Solution of the system of contingent claims equations for the value of assets and variances of asset returns.

The system of equations (2) and (3) was solved for A and $\frac{3}{4}A$ once for each year and bank over the period for which data was available. The computer implementation of the procedure is based on a Mathematica routine that searches for the roots of a system using the secant method. The roots were robust for initial values within a very narrow interval around the solution values, but we never encountered the problem of ...nding more than one real root. Outside of the interval, the procedure would simply not converge even after large numbers of iterations, or would jump to imaginary roots. Thus we were forced to approach the interval within which we could ...nd the solution using the logic implicit in options model and by trial an error. Once in the useful interval, we observed a clear consistency between the sequence of numerical results obtained and the intuition suggested by the derivatives of the options pricing model.

3.2.3 Explanatory regressions of asset values and risk measures

The purpose of this portion of the study is to attempt to identify the environmental and management controlled factors that affect asset values and risk exposure. The procedure is similar to the one used by Hassan, Karels and Peterson [13] but where the questions being asked are different. Hassan, et al. seek to explain the effect of off-balance sheet activities on banking risk. We seek to explain the effect of bank management (other than off-balance sheet) and macroeconomic policy on banking

¹⁴This conclusion should not be generalized. See Figlewski [6]

risk. We identify three groups of variables: i) market based control variables that includes proxies of domestic and United States risk free rate and returns on a market wide stock index ; ii) environmental factors that include predominantly macroeconomic variables more or less under control of the government and a dummy variable that accounts for the structural change that represents FL; iii) management factors that include variables that are generally under control of the bank's management such as most bank related financial ratios. The variables used in the first set are: the domestic T-Bill rate (when available) or interbank lending rate (k_{fd}), the 3-month United States T-Bill (k_{fUS}), the domestic stock index returns based on the EMDB (k_{md}) and the United States Morgan Stanley Capital International (MSCI) index return (k_{mUS}). The purpose of including the control variables is to filter the data from the influence of market wide fluctuations –i.e. independent of the specific evolution in the banking sector–, domestic or international. The candidate variables used in the second set are: a dummy for liberalization (LIB), and a measure of money (MON)¹⁵, the change in consumer price index (INF), the exchange rate (CXR), the fiscal deficit (FDEF), the balance of trade (BOT) and a measure of the term structure of interest rates if available¹⁶. As starting point in the selection of financial ratios we used the set of ratios included in the United States Federal Reserve Board Early Warning System (EWS) and presented in Putnam [29]¹⁷. The data available in the PACAP base allowed us to compute most –but not all– ratios in the EWS. The ratios used are those that were possible to compute. They are: return on equity at market value (ROEM), returns on assets (ROA), net operating income (NOI); loan ratio (LRIO); claims on government at individual bank level (COG); cash ratio (CR); Equity to asset ratio at market value (EARM) or equity to asset ratio at book value (EARB) when the former was not available; a gap management variable, dollar gap ratio (DGR) and the sensitive funds ratio (SFR); cash dividend ratio (CDR). The ratios are defined with more precision in the Annex1. In the final regressions we eliminated all variable that displayed cross correlations higher than 0.8.

We first perform a regressions of the dependent variables A , $\frac{3}{4}A$, o_d and $P(X)$ against the two sets of explanatory variables using an OLS procedure. The model can be represented as follows:

$$y_t^B = w_t^{-1} \cdot 0 + x_t^{-1} \cdot 1 + z_t^{-1} \cdot 2 + u_t \quad (9)$$

where y represents either A , $\frac{3}{4}A$, o_d or $P(X)$, w_t , x_t and z_t represent respectively: a matrix of market control variables including a vector of 1.0's, a matrix of variables

¹⁵We chose a monetary aggregate variable out of a set of four candidates: M1; quasi-money (time, savings and foreign currency deposits); reserve money (that consists of the domestic liabilities of monetary authorities, excluding government deposits) and net claims on central government. Note that the latter, but at the individual bank level, also appears under the management controlled variables. We picked the variables that displayed the lowest correlation with other environmental variables.

¹⁶We use the difference between long-term government bond yields and the measure available of risk free (short-term) rate

¹⁷The choice of ratios is, of course, arguable. It is precisely for that reason that we chose a set that has been selected by the FRB based on its accumulated experience on bank insolvency prediction of United States.

under management control; and a matrix of environmental variables.

Another question of interest is the relative influence of management-controlled and environmental (state-controlled) variables on bank asset values and solvency risk. To determine this relative weight we use a Gauss-Newton regression (GNR). In essence, the problem of relative weight is similar to a non-nested model specification test. Suppose that the competing models are:

$$H_1 : y_t = x_t \beta_1 + u_t \text{ and } H_2 : y_t = z_t \beta_2 + v_t:$$

We can perform an artificial nesting, in which the two competing regressions are embedded into a more general model

$$H_C : y_t = (1 \text{ } \theta) x_t \beta_1 + \theta z_t \beta_2 + v_t: \quad (10)$$

In this equation θ nests the two models. An θ close to one means that environmental variables dominate management-controlled variables. The problem with this model is that it is not estimable because not all parameters are separately identifiable. In model (10) the intercept and the coefficients on the control variables r_{fd} , r_{fUS} , r_{md} and r_{mUS} should be present in either formulation. One solution to this problem was suggested by Davidson and MacKinnon [4]. It consists of replacing β_2 by $\hat{\beta}_2$, the OLS estimate of β_2 . Thus, H_C becomes

$$H_C : y_t = (1 \text{ } \theta) x_t \beta_1 + \theta z_t \hat{\beta}_2 + v_t: \quad (11)$$

A test of the null hypothesis that $\theta = 0$ is a standard t-test. We also use the linear version of this model focusing on the coefficient θ from the GNR

$$y_t - \hat{y}_t = \hat{X} \theta + a(\hat{z}_t - \hat{x}_t) + v_t; \quad (12)$$

where $\hat{x}_t = x(\hat{\beta})$ and $\hat{X} = X(\hat{\beta})$, denoting the matrix of derivatives of $x(\beta)$ with respect to β . The test is also a standard t-test. We are interested less in the test on the coefficients θ and a than in the numerical value of these coefficients.

Finally we performed (Wald) exclusion tests on the coefficients β_1 and β_2 of regression (9) to test the hypothesis that one of the two set of variables is redundant.

4 Data

We use data from four different sources: i) The source of yearly bank income statement and balance sheet is the PACAP database (Pacific-Basin Capital Markets) produced by the PACAP Research Center, The University of Rhode Island for Malaysia, Taiwan and Thailand. ii) The source of monthly stock market returns and capitalization of domestic banks is also PACAP. iii) Macroeconomic data series including interest rates, measures of money, government finances, exchange rates and price indices. This data was obtained from the IMF's International Financial Statistics for all countries except Taiwan. The Taiwan macro data was obtained from PACAP.

All data were tested for stationarity using the Augmented Dickey-Fuller and Phillippe-Perron tests, and corrected accordingly. In the case of Malaysia, the banks' ...scal year closed quite randomly. We used for each bank the value of the macroeconomic variable at the month of closure of the ...scal year, except for variables that were available on a yearly basis only. In this case, we used the data of the closest end-of-calendar-year. iv) The dates and descriptions of FL events. This data was collected from a wide range of printed and electronic sources that include every possible scienti...c and journalistic publications to which we had access and time to research, including World Bank working papers, economic journals, the Financial Times, OECD Economic Studies, World Bank Country Studies, and all publications listed in the ABI Reference Index (that lists among others The Economist, Euromoney, Banker and several regional business reviews such as Asia Business, etc.).

In studying the institutional development accompanying FL we paid attention to every form of relaxation of restriction on the ...nancial system. However, for statistical purposes, the event that was taken as key to the FL process is the lifting of controls on interest rates. For the period following this date the dummy variable LIB was given the value of 1.0 and 0.0 otherwise. The dates of relevance for the sample of countries in our study are the following:

Liberalization Dates and Sample Size		
Country	Date	No. of Banks
Malaysia	1991	10
Taiwan	1985	13
Thailand	1984	16

5 Results

Results will be presented in the following order: i) we present some graphs that illustrate the developments and the evolution of bank solvency variables surrounding FL; ii) more formally we present results for the estimation of conditional moments; iii) we present the results of the regression that seek to explain the variations in asset values and bank solvency measures.

In ...gures 1-3 we present the price indices for the banking sector (broken lines) and the complete domestic market (full lines). The gray regions represent the post-FL periods. In the case of Malaysia and Thailand we note an overall upward trend of both price indices following the FL event. The Thai banking index follows quite closely the market index. This upward trend should not be interpreted as a result of FL only, but of the whole set of economic reforms that accompany. Below this graph we have plotted conditional variances estimated with equation (7) for the market-wide index and the banking index. In the case of Malaysia, volatility was high over the period of interest rates liberalization between 1978 and 1983, falling afterwards and raising again following the 1991 event. The 1985-1987 turmoil period appears to have had a small effect on the volatility of the index. This could be explained by the fact that insolvency affected a state-owned bank and some smaller private banks. In

Taiwan, we observe a jump in volatility in both the market and the banking indices. However the jump appears to be more accentuated for the banking index. A similar description could be made for Thailand. This is an effect that we will see replicated at the individual bank level.

In figures 4-12 we have plotted respectively standard deviation of bank assets, σ_A ; bankruptcy probability, $P(X)$ and the estimated deposit insurance premium per million of dollars, σ_d . The plots include all banks over the periods for which data were available. The plots of the individual banks replicate quite closely what could be observed at the index level. In the case of Malaysia, all variables, σ_A , $P(X)$ and σ_d display peaks in the period 1978-1983, with increases again in the late 1980's but generally not after 1991. In the case of Thailand the implied variance of bank assets is relatively high following the 1980 "soft" FL. Then it dips through the early and middle 1980's. Toward the end of the decade volatilities of some banks increase dramatically. Then, starting in 1989 and through the end of the sample in 1993, volatility increases for all banks in the sample.

The use of a conditional moment forecasting model implies that we are assuming that returns of bank stocks are heteroscedastic. We test this assumption explicitly performing the GNR suggested by Engle [1982] for all series of bank returns. The statistic n times the centered R^2 is a test of heteroscedasticity distributed $\hat{A}^2(p)$. We used $p = 6$ and obtained evidence of heteroscedasticity for bank series of Malaysia, Taiwan and Thailand.

We do not report here the coefficients obtained from estimating system (7) for each bank using the GMM procedure. However in Table 2 we present the results of the GMM estimation of system (7) for the banking and market indices. Thailand is particularly difficult case to predict with almost no variable showing statistical significance. The case of Malaysia and Taiwan is much easier, with several coefficients statistically different from zero, including the ARCH term. We also mention a few details about these estimations for individual banks. To test the overall model we included a surplus of instrumental variables. In the case of Malaysia and Taiwan in all estimations the overidentification restrictions test did not reject the orthogonality conditions used to perform the estimation. In the case of Thailand, in 13 out of 16 estimations the overidentification restrictions test did not reject the orthogonality conditions. This suggests that the model is, overall, adequate. For Malaysia, the variable in the conditioning set that most often was significant to predict conditional returns was the lagged US T-Bill (5 out of 8 estimations, with a negative sign) and the lagged US 10-year bond yield (5/8, negative). In the volatility prediction the coefficient that was most often significant was the own lagged variance (the ARCH effect, 2/8, positive). For Thailand, the variable in the conditioning set that most often was significant to predict conditional returns was the lagged own stock return (8/16 estimations, negative). The second and third places went to the market index return (5/16, positive) and the US T-Bill (4/16, negative). In the volatility prediction the coefficient that was most often significant was the one corresponding to the US T-Bill (4/16, negative), followed by exchange rate (3/16, inconsistent signs) and the domestic inflation (3/16, inconsistent sign but mostly positive). All variables were

lagged. The own lagged variance (the ARCH effect) was significant in only 2/16 estimations.

In Table 3-X we report the results of estimating model (9), (11) and (12). The last of this set of tables reports the results of a regression that includes the three countries with dummies for two of them. In this table we have used as dependent variables A , $\frac{3}{4}A$, $P(X)$ and o_d , the latter three, of course, being measures of risk. In all three cases Thailand, by looking at general statistics it is evident that the variation in A and $\frac{3}{4}A$ can be relatively well explained, with adjusted R^2 ranging from 72% to 89%. Due to the presence of serial correlation in the regression, we used the procedure of Newey and West [27] with one lag whenever necessary. Thus all coefficients and test statistics have been computed using a consistent estimate (corrected for heteroscedasticity and autocorrelation) of the covariance matrix.¹⁸ The conclusion drawn from the graphs that FL tends to increase asset volatility is only partially supported by this regression. However there is a positive and significant relation between FL and $\frac{3}{4}A$ in Malaysia and Taiwan, and positive but not significant in the case of Thailand. The other two regressions yield somewhat contradictory results and a low adjusted R^2 . The regression including the three countries yields the most unambiguous results. When taken together, all tests indicate a decrease in asset value and an increase in risk at statistically significant levels.

In terms of the relative weight of management versus macro variables, in the individual country regressions the majority (7 out of 12) of the coefficients tend to be smaller than 0.5, and those that are larger than 0.5 (5 out of 12), are rarely statistically significant. However, when taking the three countries together, the weights suggest that macro variables play a bigger role in determining bank asset values and risk.

In Table 4, we report the results of the Wald test on the coefficients β_1 and β_2 of regression (9). With few exceptions (namely Taiwan for $P(X)$ and o_d ; and Thailand for o_d) the test for management controlled variables are highly significant and much larger than those for macro variables. Once again, when taking the three countries together, the results provide support to the hypothesis that macro variables are more relevant.

We do not focus on the sign and statistical significance of explanatory variables other than the variable LIB. However, note the positive and significant relation between the measures of risk and the DGR, as expected. More interesting is to see whether following FL management changed its practices and in which way this affected both bank value and risk. To see this we run the same regressions (9) but added interaction terms between LIB and two risk measures (LRIO, DGR). Details about the regression are not reported but the main results are the following:¹⁹ First, Durbin Watson statistics tended to be more often within the normal range, suggesting a certain solution to the autocorrelation problem. Second, for both Malaysia and Taiwan, there is a positive relation between the value of assets and the DGR

¹⁸We also included a trend variable in the regression, however it was not significant and was dropped from the definitive estimation reported in Table 3-X.

¹⁹Detailed results are available from the authors on request.

interaction term, and a negative relationship with the LRIO term. This suggests that the gap management tended to enhance value of the assets but the increase in credit risk had a negative effect on assets. Third, several coefficients for risk interaction terms in risk-measure regressions for Taiwan and one for Thailand were positive and statistically significant. This provides empirical support, for Taiwan and weakly for Thailand, that management practices as reflected by the LRIO and DGR were changed so as to increase the risk exposure of banks after FL. To some extent, these results could also be considered an empirical support for the proposition that moral hazard increases following FL.²⁰ The interaction coefficients were all non-significant in the all-countries regression.

6 Conclusions and Policy Recommendations.

The evidence provided by the empirical analysis carried out in this paper suggests the following conclusions and policy recommendations:

1. The stock market in which bank shares are traded is an additional instrument to gauge the evolution and health of the banking system in the context of financial liberalization. The market is sensitive to the impact of the FL process on the value of bank assets (in itself a thermometer of health in the economy) and its solvency situation. Thus, the market price can be used as an indicator of the impact of the whole liberalization process and economic cycles on commercial bank performance. It is of course an open question whether the "smart economists" of the ministry of economic affairs are ready to concede that prices and implicit valuations reflect the "aggregated wisdom" of market participants and not just volatile scare-rabbit response by uninformed investors.

2. Taken together, the results provide a reasonably strong evidence of increase in bank risk following FL, however measured. Conditional volatility of market-value of assets, implied probabilities of bankruptcy and deposit insurance premium per dollar of deposit appear to increase. This implies that the introduction of a FL increases the possibility of a banking crisis occurring some time after the initiation of the process. Further, it suggests that supervisory authorities need to scrutinize continuously all critical variables associated to bank performance following FL, more so than before.

3. The risk exposure of banks is a function of both, variable under control of management and macroeconomic variables. The effect that management variables are important in determining risk provides supports to the proposition that moral hazard (and risk taking) by banks increases following a FL. Given that most of the banking crisis that followed FL in various countries have generally been blamed on macroeconomic policy, this research provides empirical support for an alternative explanation. In effect, risk taking behavior by bank managers/owners may be more important in banking crisis than has been reported. This only emphasizes the importance of our previous recommendation that regulators and supervisory authorities need

²⁰ An alternative proposition would be that bank risk management simply becomes more difficult following FL and that this risk increase is beyond the control of management. However, the Wald test and the values of weighting coefficient, θ , lends this alternative explanation less plausible.

to keep a very close track of the management practices and risk exposure following FL.

4. There is little reason to believe that the effects described above are specific to any country. Thus, these conclusions are most probably applicable to any banking system that goes through a FL process.

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Table 1
Financial Liberalization: Measures and Effects
(Those that are of concern to regulators)

Measures			
Elimination of controls on deposit and lending rates	Deregulation/regulation of non-bank financial markets	Economic reforms (liberalization of real sector)	Elimination/lowering of barriers to entry /exit
Effect on banks			
<ul style="list-style-type: none"> *Reduction of charter value *Elimination of guaranteed intermediation margin *Increased interest rate volatility that affect the banks' interest rate risk and gap management risk *Opportunities for price wars to compete for market share *Increased clients' bankruptcy risk resulting from higher interest rates. 	<ul style="list-style-type: none"> *Reduction of charter value *Disintermediation by borrowers and depositors *Volatility in international capital flows (hot/cold money) affecting share prices and money stock *Risk associated with new business lines (e.g. universal banking) *Increased competition from quasi-bank financial institutions (depository and non-depository) 	<ul style="list-style-type: none"> *Increased loan portfolio risk 	<ul style="list-style-type: none"> *Reduction of charter value *Elimination or reduction of "conjectural government guarantees" (CGG) *Increased competition by new entrants (domestic and foreign)
Effect on banks' clients			
<ul style="list-style-type: none"> *Increased cost of short and long term debt financing or re-financing cost *Increased risk associated with financial leverage 		<ul style="list-style-type: none"> *Increased business risk *Elimination or reduction of government induced rent opportunities 	

Table 2
Estimation of Conditional Moments for the Market and Banking Indices Returns

This table reports the results of the GMM estimation of the system

$$E_t[r_{t;t+\Delta}] = X_t \beta;$$

$$\log(\sigma^2[r_{t;t+\Delta}]) = \log(\sigma^2[r_{t;t+\Delta} | X_t]) = X_t \gamma$$

where X_t is the vector of conditioning variables, and $\sigma^2[\cdot]$ is the variance conditional on information at time t . The conditioning set consisted of a constant, own returns lagged (k_l), the real exchange rate (XR), U.S. 1-mo T-Bills yield (TB1M), the spread between U.S. 1-mo and 3-mo T-Bills yields (STB13), the U.S. 10-years Government Bond yield (TB10Y), domestic inflation (INF), the world dividend yield (DIV_w) and a dummy for liberalization (LIB). For the banking index we also included the returns on the market (k_{md}), and in the equation for conditional variance we included the error on previous periods' returns (the ARCH effect, z_{t-1}^2). All variables except LIB were lagged.

Variable	Malaysia				Taiwan			
	Market		Banking		Market		Banking	
	Coef	t statistic	Coef	t statistic	Coef	t statistic	Coef	t statistic
General Statistics								
DW eq. 1	1.99	-	1.94	-	1.84	-	1.89	-
DW eq. 2	1.94	-	1.67	-	1.81	-	1.87	-
\bar{A}^2	0.43	0.51	-	-	0.49	0.48		
Conditional Returns								
Constant	0.280	3.799	0.268	3.298	0.205	2.592	0.224	2.082
k_m	0.020	0.231	0.464	2.518	0.022	0.199	-0.327	-1.684
XR	0.114	0.552	0.185	0.925	-0.043	-1.636	-0.018	-0.584
TB1M	-0.015	-3.860	-0.011	-2.497	-0.001	-0.553	-0.001	-0.375
STB13	0.007	0.895	0.010	1.334	0.012	1.240	0.022	1.517
GB10Y	-0.023	-4.450	-0.018	-3.282	-0.000	-0.167	-0.001	-0.215
INF	-0.057	-0.051	-0.078	-0.069	-0.007	-0.009	0.128	0.138
DIV _w	-0.064	-2.205	-0.092	-2.823	-0.096	-2.413	-0.107	-1.996
LIB	0.024	2.043	0.056	3.740	-0.037	-1.446	-0.057	-2.074
k_{md}			0.055	2.376			0.347	2.263
Conditional Variances								
Constant	-7.164	-2.719	-5.713	-2.146	-5.459	2.056	-7.775	-3.302
k_l	-3.693	-0.158	-3.974	-0.399	1.602	-4.137	1.186	1.236
XR	-8.582	-0.796	-7.178	-1.654	0.223	1.887	0.161	0.553
TB1M	0.237	1.752	0.095	0.621	0.023	0.749	0.215	1.413
STB13	-0.593	-0.607	-0.487	-1.912	0.132	0.264	0.197	0.687
GB10Y	0.201	0.411	0.019	0.063	0.059	0.681	0.319	1.718
INF	8.414	0.178	19.181	0.749	19.368	0.435	8.355	0.620
DIV _w	-0.288	-0.518	-0.308	-0.434	-0.337	1.603	-0.152	-0.228
LIB	-0.021	-0.038	0.383	0.724	-0.303	-0.572	-1.049	-1.483
z_{t-1}^2	-2.919	-0.015	-30.76	-0.143	7.573	2.395	2.782	0.648

Table 2 (Cont'd)
 Estimation of Conditional Moments for the Market and Banking
 Indices Returns

	Thailand			
	Market		Banking	
Variable	Coeff	t statistic	Coeff	t statistic
General Statistics				
DW eq. 1	1.82	-	1.91	-
DW eq. 2	1.41	-	2.37	-
\bar{A}^2	0.43	0.51	-	-
Conditional Returns				
Constant	0.088	0.896	0.116	1.377
k_m	0.164	1.442	0.128	0.623
XR	-0.002	-0.285	-0.001	-0.194
TB1M	0.001	0.101	-0.004	-0.882
STB13	0.006	0.757	0.010	1.271
GB10Y	0.001	0.088	-0.004	-0.674
INF	-0.565	-0.631	-0.857	-1.199
DIV_w	-0.054	-2.145	-0.038	-1.485
LIB	-0.002	-0.078	0.036	1.769
k_{md}			0.012	0.588
Conditional Variances				
Constant	-1.274	-0.222	-5.033	-1.408
k_l	-0.649	-0.104	1.678	0.619
XR	-0.011	-0.019	0.099	0.300
TB1M	-0.451	-1.143	-0.134	-0.573
STB13	-0.272	-0.780	-0.240	-0.618
GB10Y	-0.643	-1.150	-0.137	-0.413
INF	-0.292	-0.006	20.720	0.948
DIV_w	-0.099	-0.109	-0.063	-0.065
LIB	1.063	1.289	0.938	1.669
$z_{t_j}^2$	-11.195	-0.543	28.167	1.224

Table 3- Malaysia The Determinants of Bank Asset Values and Risk

This table reports the results of the regressions

$$y_t^B = w_t \bar{0} + x_t \bar{1} + z_t \bar{2} + u_t$$

where y represents either A , O_d or $P(X)$, w_t , x_t and z_t represent respectively: a matrix of market control variables including a vector of 1.0's, the domestic and US risk free rates, r_{fd} and r_{fUS} , and the domestic and US market index returns, r_{md} and r_{mUS} ; a set of variables under management control; and a set of environmental variables. We also run the models:

$$H_C : y_t = (1 \quad \beta) x_t \bar{1} + \beta z_t \bar{2} + v_t$$

$$y_t \quad \hat{x} = \hat{X}b + a(z_t \quad \hat{x}) + v_t$$

and report the values of β and a . See the text for an explanation about these regressions. The coefficients imply that the group of variables under control of management have a relative weight in determining the value of the dependent variable equal to $1 \quad \beta$ ($1 \quad a$), while environmental variables have a relative weight of β (a). All variables in real terms. Critical t-values of two-sided test for 5% and 10% significance levels are respectively 1.96 and 1.645. $\hat{\rho}_1$ represents the autocorrelation coefficient introduced to correct for serial correlation.

	logA		$\frac{3}{4}A$		P(X)		O _d	
Variable	Coe ^a	t statistic	Coe ^a	t statistic	Coe ^a	t statistic	Coe ^a	t statistic
General Statistics								
DW	1.25	-	1.25	-	1.70	-	1.97	-
adj. R ²	0.79	-	0.84	-	0.12	-	0.06	-
Control Variables								
Constant	1.401	1.22	0.189	0.94	-0.756	-0.20	-0.560	-0.14
k _{md}	-0.011	-1.94	0.001	2.11	0.042	1.52	0.041	1.31
k _{fd}	-0.007	-0.10	0.007	0.99	0.112	1.14	0.050	0.49
k _{mUS}	-0.014	-0.93	-0.001	-2.19	-0.044	-1.21	-0.038	-1.11
k _{fUS}	-0.058	-2.21	0.001	0.57	-0.030	-0.85	-0.019	-0.75
Management Controlled Variables								
ROEB	-3.038	-1.73	0.259	2.85	2.539	0.77	2.759	0.83
ROA	17.376	3.07	-1.755	-7.79	-19.194	-1.64	-17.538	-1.54
LRIO	-1.540	-1.46	-0.379	-1.86	-0.815	-0.37	-0.980	-0.40
COG	-0.345	-0.21	-0.127	-0.68	-3.324	-1.39	-3.300	-1.39
CR	-1.760	-1.74	0.080	1.24	3.573	1.58	3.006	1.42
DGR	-1.132	-1.42	0.240	1.41	0.131	0.06	0.329	0.14
EARB	11.070	-6.92	0.776	3.72	6.260	1.30	5.152	1.11
BAR	20.112	2.94	-0.623	-3.15	-13.002	-2.54	-11.214	-2.61
CDR	-0.540	-3.58	0.009	0.99	0.059	0.42	0.059	0.45
Environmental Variables								
MON	-0.0001	-2.01	-0.000	-0.13	-0.000	-0.34	-0.000	-0.49
FDEF	-0.0001	-2.32	-0.000	-1.00	-0.000	-0.19	-0.000	-0.40
BOT	0.000	1.15	0.000	1.09	0.000	1.17	0.000	0.84
CXR	0.566	1.07	0.041	1.54	0.349	0.67	0.486	0.88
INF	0.590	0.06	-0.295	-0.49	-23.754	-1.29	-22.872	-1.13
LIB	-0.069	-0.57	0.023	3.53	0.444	1.36	0.373	1.30
Relative Weight of Environmental Variables								
®	0.41	3.52	0.46	1.61	0.91	1.35	0.92	1.04
a	0.41	3.78	0.46	1.74	0.91	1.46	0.92	1.11

Table 3- Taiwan (Cont'd)
The Determinants of Bank Asset Values and Risk

	logA		$\frac{3}{4}A$		P(X)		O_d	
Variable	Coeff	t statistic	Coeff	t statistic	Coeff	t statistic	Coeff	t statistic
General Statistics								
DW	1.13	-	1.81	-	1.59	-	2.02	-
adj. R ²	0.89	-	0.72	-	0.51	-	0.24	-
Control Variables								
Constant	4.547	3.65	-0.112	-0.59	-0.040	-0.34	-44.079	-0.701
k _{md}	-0.020	-2.45	-0.000	-0.32	-0.000	-0.22	-0.033	-0.072
k _{fd}	0.103	1.98	-0.013	-1.55	-0.009	-1.82	-1.139	-0.486
k _{mUS}	-0.026	-2.14	0.006	1.78	0.001	1.02	1.300	1.066
k _{fUS}	-0.022	-0.87	-0.001	-0.35	-0.002	-1.02	-0.099	-0.122
Management Controlled Variables								
ROEM	-3.760	-2.03	-0.363	-0.87	0.037	0.12	33.446	0.31
ROA	-32.894	-3.04	-4.397	-0.79	-3.318	-1.13	-2289.2	-1.34
LRIO	-3.859	-4.65	-0.267	-2.40	-0.161	-2.64	-76.879	-2.36
COG	-4.511	-3.71	0.094	0.64	-0.007	-0.05	35.748	0.60
CR	-2.263	-2.14	-0.023	-0.16	-0.111	-1.44	-7.352	-0.17
DGR	-1.656	-2.20	0.485	1.84	0.215	1.73	156.95	1.64
EARM	-0.128	-0.55	0.232	3.49	0.001	0.03	21.685	1.07
BAR	0.865	0.92	-0.532	-1.76	-0.243	-1.71	-180.38	-1.66
CDR	-0.693	-7.15	-0.041	-2.06	-0.025	-2.40	-11.818	-1.79
Environmental Variables								
MON	0.000	1.75	-0.000	-0.77	-0.000	-1.30	-0.000	-1.58
CXR	0.020	0.78	-0.011	-1.65	-0.010	-2.77	-4.739	-1.93
INF	-0.036	-1.28	0.016	2.57	0.008	2.26	3.042	1.82
LIB	-0.176	-1.14	0.036	1.09	0.047	2.20	-2.892	-0.29
Relative Weight of Environmental Variables								
®	0.06	0.29	0.11	1.00	0.74	1.53	1.00	13.8
a	0.06	0.21	0.11	1.00	0.74	4.60	1.18	2.36

Table 3- Thailand (Cont'd)
The Determinants of Bank Asset Values and Risk

	logA		$\frac{3}{4}A$		P(X)		O_d	
Variable	Coeff	t statistic	Coeff	t statistic	Coeff	t statistic	Coeff	t statistic
General Statistics								
DW	0.98	-	1.79	-	2.12	-	2.27	-
adj. R ²	0.75	-	0.84	-	0.19	-	0.13	-
Control Variables								
Constant	-5.307	-2.17	0.099	2.78	1.359	1.54	0.103	0.60
K _{md}	0.009	2.07	-0.000	-1.98	-0.012	-1.86	-0.002	-1.33
K _{fd}	-0.055	-2.27	-0.000	-1.66	0.004	0.50	0.001	1.01
K _{mUS}	-0.008	-0.70	-0.000	-2.35	-0.005	-0.66	-0.001	-1.18
K _{fUS}	-0.028	-2.22	-0.000	-2.21	-0.027	-1.93	-0.003	-1.16
Management Controlled Variables								
ROEM	7.893	4.10	-0.000	-0.05	-1.305	-1.31	-0.237	-1.18
ROA	-60.509	-2.15	-0.459	-0.71	-23.254	-2.07	-2.166	-1.60
NOI	14.833	1.38	-0.021	-0.12	5.383	1.30	0.587	1.01
LRIO	3.178	3.26	-0.022	-1.52	0.558	1.22	0.040	0.84
COG	-10.274	-2.47	0.048	0.91	0.132	0.06	0.426	1.22
CR	12.862	4.56	-0.026	-0.83	-1.184	-1.22	-0.239	-1.16
EARM	1.556	1.12	0.380	7.35	-0.162	-0.30	-0.013	-0.14
SFR	5.465	2.29	-0.077	-2.18	-1.421	-1.38	-0.310	-1.37
CDR	-0.285	-2.90	-0.000	-3.00	-0.107	-2.31	-0.016	-1.64
Environmental Variables								
MON	-0.006	-1.63	0.000	1.18	0.007	1.95	0.000	1.32
FDEF	-0.000	-1.45	0.000	0.40	0.000	1.63	0.000	1.15
CXR	0.203	4.37	-0.000	-2.38	-0.038	-1.95	-0.002	-1.39
INF	7.470	3.52	-0.026	-0.51	-0.501	-0.46	-0.216	-1.31
LIB	0.166	0.57	0.012	1.90	-0.167	-0.94	-0.021	-0.81
Relative Weight of Environmental Variables								
®	0.93	2.39	0.14	2.59	0.20	1.93	0.04	0.25
a	0.93	2.63	0.14	2.44	0.14	1.20	0.04	1.17

Table 3- All (Cont'd)
The Determinants of Bank Asset Values and Risk

	logA		$\frac{3}{4}A$		P(X)		O_d	
Variable	Coe ^a	t statistic	Coe ^a	t statistic	Coe ^a	t statistic	Coe ^a	t statistic
General Statistics								
DW	0.613	-	1.630	-	1.452	-	1.985	-
adj. R ²	0.63	-	0.74	-	0.27	-	0.06	-
Control Variables								
Constant	10.279	15.49	0.186	3.32	1.482	3.16	0.876	1.90
Taiwan	2.606	1.77	0.661	2.86	7.251	3.99	4.566	2.06
Thailand	4.063	5.19	0.414	3.66	4.110	4.32	2.613	2.36
k _{md}	-0.002	-0.59	-0.000	-1.34	-0.012	-1.74	-0.004	-0.79
k _{fd}	-0.001	-0.04	-0.000	-2.53	-0.022	-0.96	-0.020	-0.88
k _{mUS}	-0.027	-2.03	-0.000	-0.46	-0.016	-1.87	-0.008	-0.60
k _{fUS}	-0.094	-3.33	0.000	0.85	-0.051	-2.75	-0.026	-2.11
Management Controlled Variables								
ROEM	0.051	0.02	-0.497	-3.23	-3.281	-1.24	-2.997	-1.21
ROA	-5.089	-1.13	0.425	1.80	1.763	0.78	1.178	0.70
NOI	-10.588	-1.30	0.718	1.15	-12.885	-3.74	-8.606	-2.28
LRIO	-4.569	-6.22	0.072	1.16	-0.202	-0.49	0.515	1.17
COG	-4.598	-3.35	0.297	1.76	1.980	2.49	2.075	1.71
CR	2.789	2.17	-0.020	-0.22	-0.617	-0.94	-0.154	-0.33
EARM	0.060	0.32	0.107	5.83	-0.182	-3.41	-0.066	-1.71
SFR	1.161	2.68	-0.141	-3.10	-0.417	-1.24	-0.510	-1.55
CDR	-47.014	-6.15	-0.362	-1.42	-6.604	-1.58	-3.038	-1.02
Environmental Variables								
MON	0.000	0.39	-0.000	-1.12	-0.000	-3.48	-0.000	-1.97
MXR	-0.005	-0.14	-0.017	-3.03	-0.170	-3.94	-0.112	-2.02
INF	0.130	2.93	-0.000	-1.47	-0.068	-1.77	-0.009	-0.28
LIB	0.204	1.32	0.043	3.87	0.581	5.16	0.269	2.57
Relative Weight of Environmental Variables								
®	0.998	1.61	0.96	7.39	0.99	2.54	0.99	1.11
a	1.16	2.04	0.96	6.72	1.15	3.01	1.16	2.06

Table 4 Wald Tests: all countries

This table reports the results of the Wald test performed on regression coefficients β_1 and β_2 of regression (9)

$$y_t^B = w_t \beta_0 + x_t \beta_1 + z_t \beta_2 + u_t$$

where y represents either A , O_d or $P(X)$, w_t , x_t and z_t represent respectively: a matrix of market control variables including a vector of 1.0's, the domestic and US risk free rates, r_{fd} and r_{fUS} , and the domestic and US market index returns, r_{md} and r_{mUS} ; a set of variables under management control; and a set of environmental variables. The Wald test is a test on the hypothesis that one of the two set of variables is redundant.

	logA test	signif.	$\frac{3}{4}A$ test	signif.	P(X) test	signif.	O_d test	signif.
Malaysia								
Management	81.69	0.000	137.69	0.000	064.91	0.000	4262.8	0.000
Macro	7.25	0.203	42.29	0.000	2.53	0.772	2.15	0.827
Taiwan								
Management	619.5	0.000	3204.9	0.000	14.87	0.037	8.11	0.230
Macro	7.386	0.117	24.26	0.000	44.08	0.000	30.31	0.000
Thailand								
Management	188.72	0.000	644.89	0.000	9.57	0.386	6.49	0.690
Macro	26.29	0.000	23.80	0.000	9.20	0.101	4.28	0.509
All								
Management	286.09	0.000	310.39	0.000	18.92	0.026	5.12	0.823
Macro	4.61	0.202	45.21	0.000	22.53	0.000	9.75	0.020

7 ANNEX

7.1 Data Definition

In these tables we indicate the source of data used and the name of the series in the database. I, represents the IMF's International Financial Statistics; P the PACAP database; E, the International Finance Corporation's EMDB; O, "other," including the Morgan Stanley Capital International database and the Financial Time's Actuaries database. The country codes are as follows: "FM": Malaysia; "LM": Mexico; "FT": Taiwan, "FH": Thailand and "AET" when it applies to all countries except Taiwan, and "AIT " when it applies to all countries. ²¹

MACROECONOMIC AND MARKET DATA		
SERIES	FREQ.	CTRY/SOURCE
Macro variables		
M1	Y	AET:I-34
Quasy Money	Y	AET:I-35
Reserve Money	Y	AET:I-14
Claims on Government	Y	AET:I-32an
Price Index	Y	AET:I-64
Exchange rate (local/\$US)	M-Y	AET:I-ae
Balance of trade	Y	AET:I-70,71
Fiscal de...cit	Y	AET:I-80
Market variables		
Domestic bond yield	M-Y	AET:I-61
Domestic risk-free rate	M-Y	AET:I-60b
Domestic bank index	M	FM,FT,FH:P-0002; LM:EMDB
Domestic market-wide index	M-Y	FM,FT,FH:P-1000; LM:EMDB
U.S. bond yield	M-Y	AIT:O
U.S. risk-free rate (3MTB)	M-Y	AIT:O
U.S. 1-mo TBill	M-Y	AIT:O
U.S. market-wide index	M-Y	AIT:O
World dividend yield	M	AIT:O

²¹The reason for this distinction is that the International Financial Statistics does not report Taiwan data.

7.2 Financial Ratios

The following is the list of ratios that constitute the FRB early warning system (EWS), following Putnam (1993). Not all ratios were available. The ratios for which data was available differed from country to country. The ratios actually used for each country are the ones listed in the corresponding country table.

1. Profit ratios

$$ROE = \frac{\text{Net income}}{\text{Total equity capital}}$$

$$ROA = \frac{\text{Net income}}{\text{Total assets}}$$

$$\text{Net operating income (NOI)} = \frac{\text{Total operating income} - \text{Total operating expenses}}{\text{Total assets}}$$

$$\text{Net interest margin (NIM)} = \frac{\text{Total interest income} - \text{Total interest expenses}}{\text{Total assets}}$$

$$\text{Yield spread (YLSP)} = \frac{\text{Average rate earned on assets}}{\text{Average rate paid on interest bearing liabilities}}$$

2. Asset quality

$$\text{Loan rate (LRE)} = \frac{\text{Gross loan losses charged to PLL} - \text{Gross recoveries on loans charged to PLL}}{\text{Total loans}}$$

$$\text{Loan ratio (LRIO)} = \frac{\text{Total loans}}{\text{Total assets}}$$

$$\text{Claims on government (COG)} = \frac{\text{Claims on government}}{\text{Total assets}}$$

3. Liquidity

$$\text{Cash ratio (CR)} = \frac{\text{Cash and balances due from depository institutions}}{\text{Total assets}}$$

$$\text{Cash and securities ratio (CSR)} = \frac{\text{Cash plus securities held}}{\text{Total assets}}$$

4. Gap management

$$\text{Dollar gap ratio (DGR)} = \frac{\text{Interest rate sensitive assets} - \text{Interest rate sensitive liabilities}}{\text{Total assets}}$$

$$\text{Foreign debt (FD)} = \frac{\text{Foreign debt}}{\text{Total assets}}$$

$$\text{Sensitive Funds Ratio (SFR)} = \frac{\text{Interest rate sensitive funds}}{\text{Total sources of funds}}$$

Figure 1
MALAYSIA: Price indices and volatility

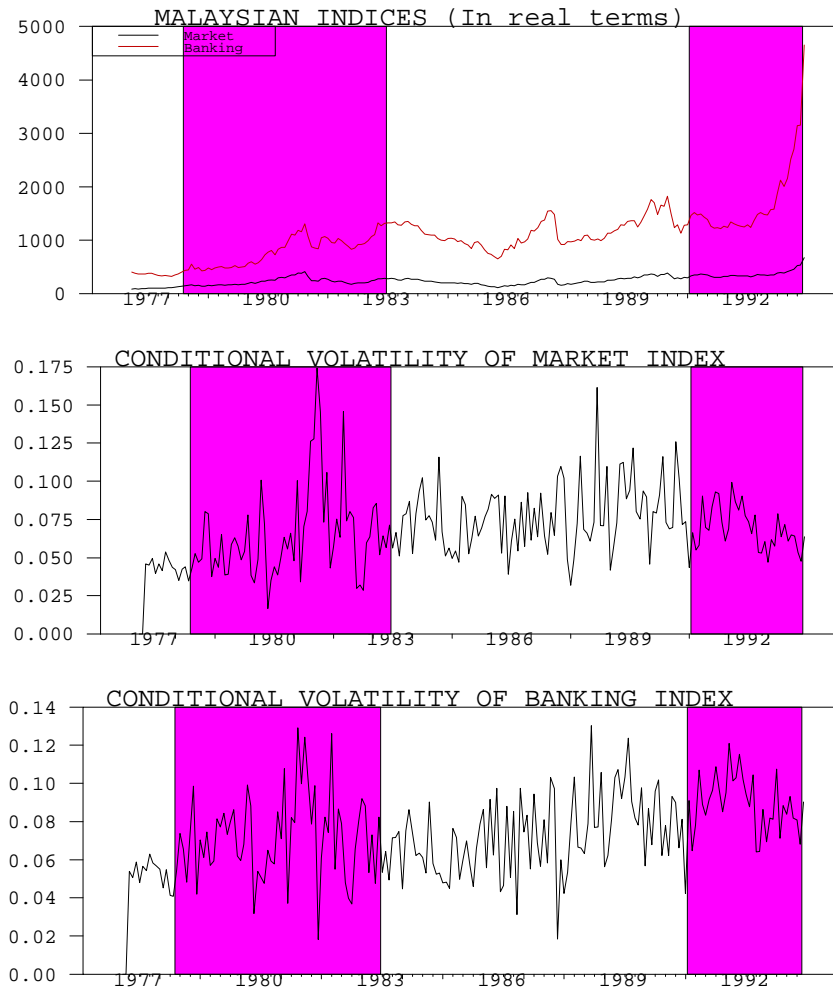


Figure 1 (Cont.)
TAIWAN: Price indices and volatility

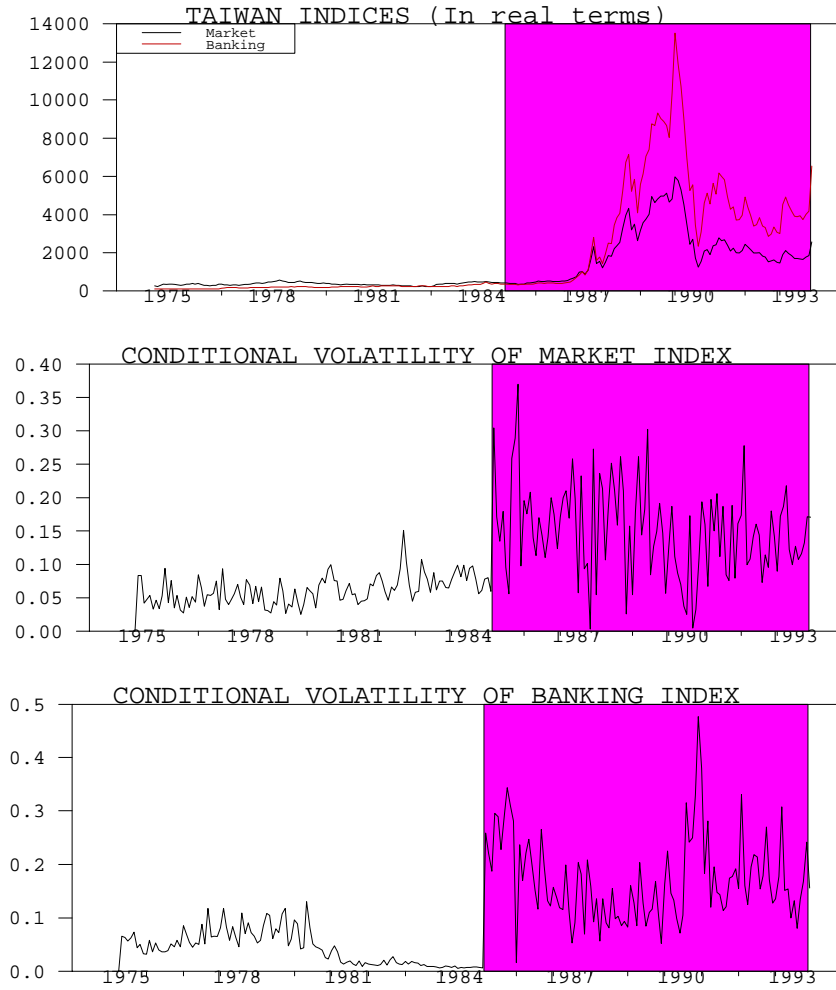


Figure 1 (Cont.)
THAILAND: Price indices and volatility

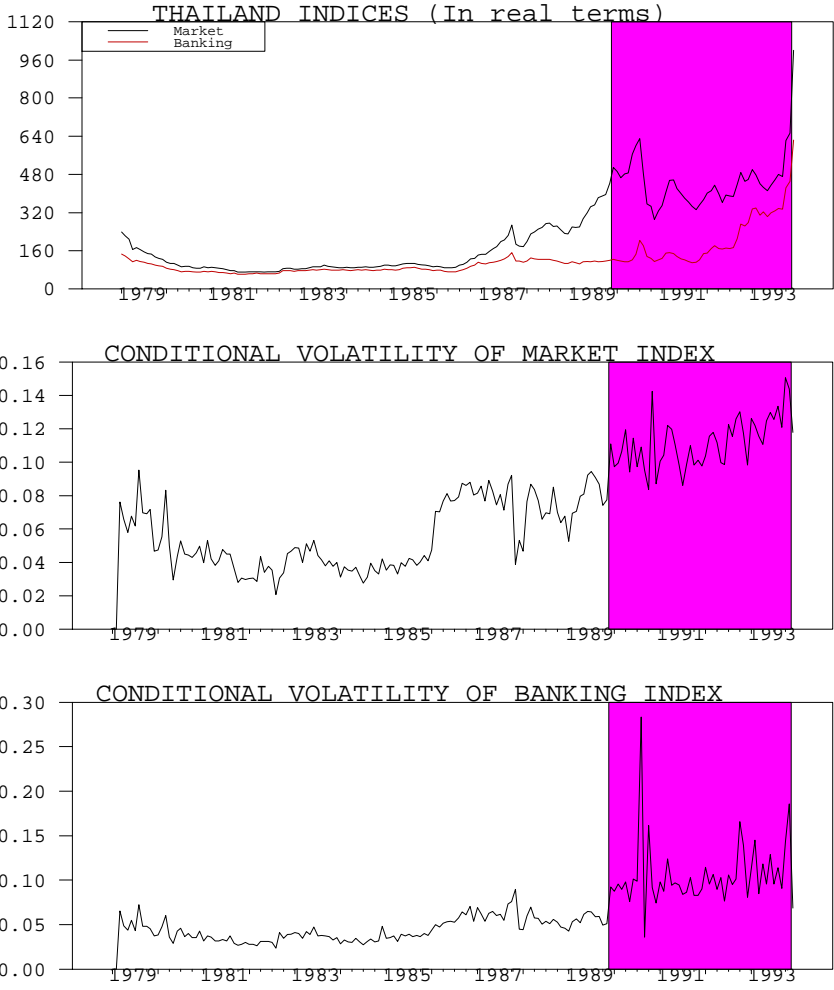


Figure 2

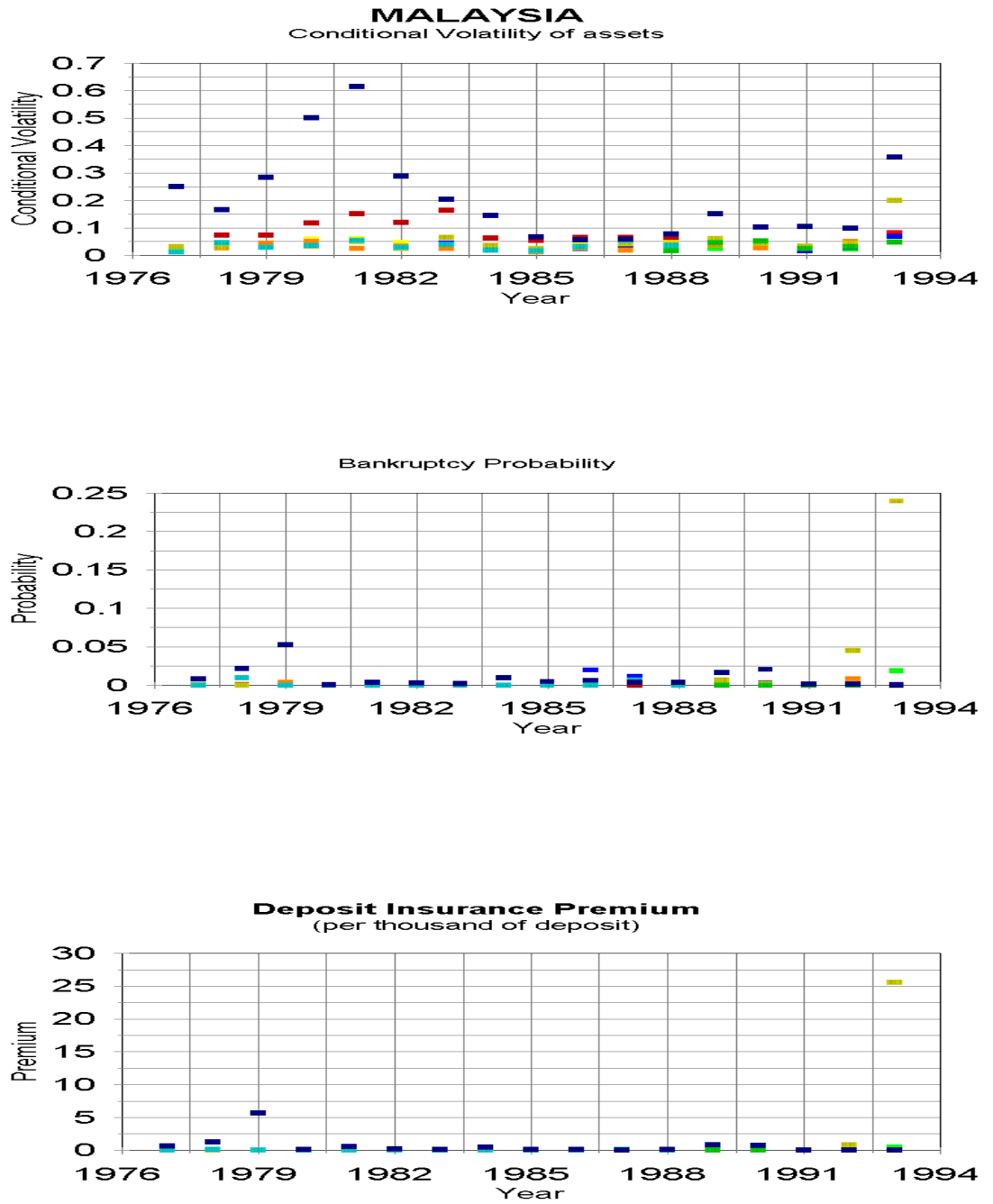


Figure 2 (Cont.)

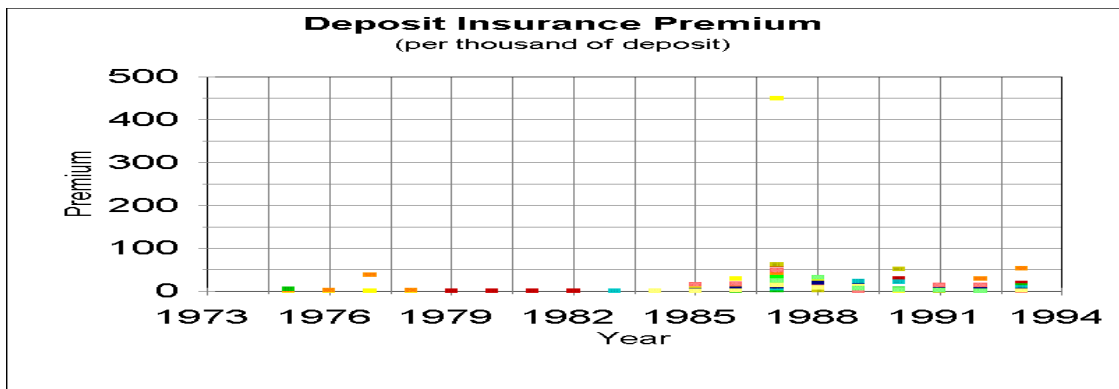
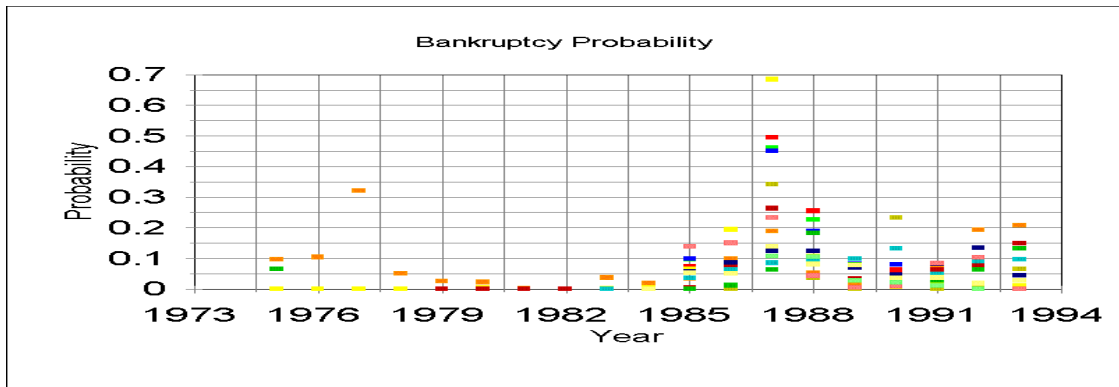
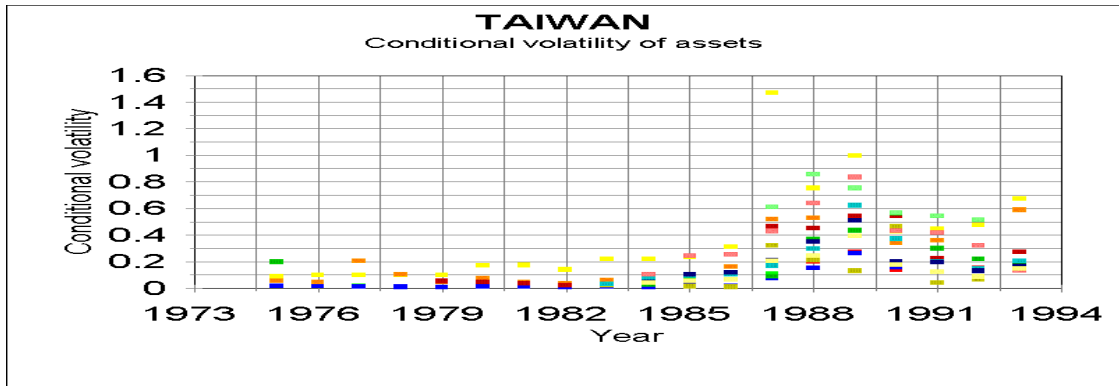


Figure 2 (Cont.)

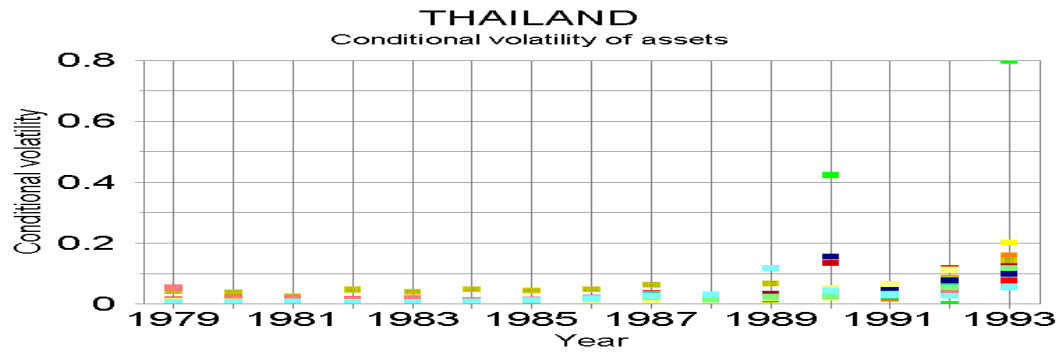


Figure 1:

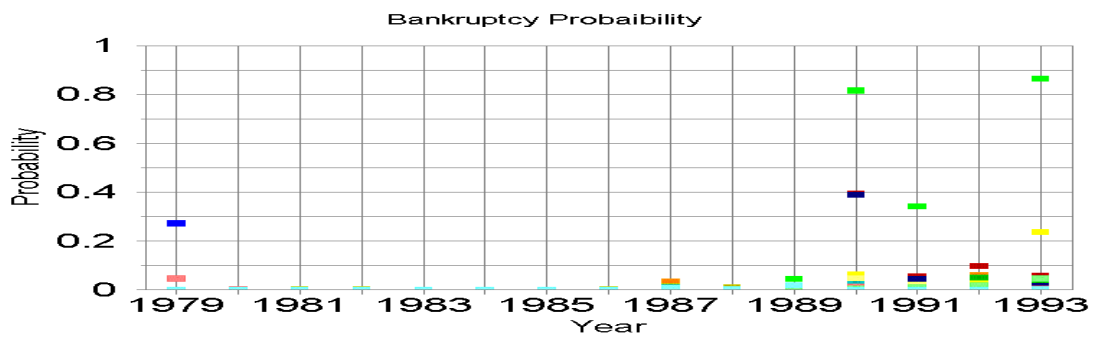


Figure 2:

