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Could Tighter Prudential Regulation Have Saved Thailand's Banks?

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Abstract

The improvement of prudential regulation in the crisis-ridden Asian countries is suggested by international organizations as a major lesson to be implemented. The effect from tighter regulation can be estimated by simulating the crisis with new rules. The analysis for Thailand's commercial banks shows that more effective prudential regulation could have lowered the impact from credit risks to some degree. More important for the financial meltdown were, however, certain macroeconomic risks. These are not covered by any existing regulatory arrangements. Consequently, even many tightly regulated German banks would not survive a macroeconomic shock as happened in Thailand.

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Kurzfassung

Als eine zentrale Lehre aus der Asienkrise empfehlen internationale Organisationen die Verbesserung der präventiven Regulierung in den betroffenen Ländern. Die Wirkung einer strikteren Regulierung kann man durch Simulation der Krise mit diesen neuen Regeln erfassen. Die Analyse für Thailands Geschäftsbanken zeigt, daß effektivere Regulierung die Auswirkungen des Kreditrisikos graduell gebremst hätte. Wichtiger für den finanziellen Zusammenbruch waren allerdings makroökonomische Risiken gewesen. Diese sind in keinem derzeit bestehenden Regulierungsrahmen abgedeckt. Folglich würden selbst viele strikt regulierte deutsche Banken einen Makroschock, wie ihn Thailand erlebt hatte, nicht überstehen.

1   Introduction

Many causes have led to the onset and severity of the Asian crisis and thus also to Thailand's economic crisis. It is, however, a conspicuous characteristic of most analyses that financial sector weaknesses and fragilities play a dominant role (e.g. IMF 1997, IMF 1998 p.73, BIS 1998, World Bank 1998). It is often precisely these financial sector problems that are identified as the core element of the new type of crisis to be seen in Asia, which would differentiate it from many earlier crises (Corsetti et al. 1999, Dooley 1997, Krugman 1998).

There can therefore be no question that financial institutions in the crisis countries indeed exhibited severe shortcomings. Three areas of concern are mentioned: first, the internal evaluation mechanism for loan extensions was inefficient, if not nonexistent. Second, the management of risky portfolios displayed a severe lack of experience. Third, prudential regulation was often lacking or not enforced. These three aspects led in combination to a dark scenario as the institutions neither had the experience to address credit and market risks appropriately, nor did they feel strong incentives to improve.

To cure the central problem of financial sector weakness it seems to be an obvious solution to implement established prudential standards. These had been harmonized for industrialized countries by the 1998 Basel Accord, named after the location of the consultations which were held under the auspices of the Bank for International Settlements (BIS). In some respect, this Accord is, however, rather a framework than a set of detailed regulations. So one needs more precisely defined information, which we take from the established German case. The question is then, of whether the timely implementation of tighter, i.e. here German, prudential regulation could have prevented the financial disaster that happened in Thailand in 1997? Or, and this would be the competing proposition, were the macroeconomic shocks that happened to Thailand's banks so great that even tighter regulation could not have saved the financial institutions?

Any answer to these questions must necessarily be hypothetical. We follow two ways to approach a plausible argumentation. First, empirically based considerations are presented for the 1990s, applying German prudential regulation standards to banks in Thailand (see Menkhoff 1999). The effect of tighter regulation would have been lower credit growth and then consequently a less severe downturn which would lessen the burden on banks. Second, the opposite "perspective" is chosen by exposing German banks to the Thai macroeconomic environment. The extremely great shock shows very severe problems even for banks which are regarded as being well managed and prudentially regulated (see also Demirgüc-Kunt and Detragiache 1998).

Thus, our results indicate that tighter prudential regulation could have reduced the burden on Thailand's financial institutions, but that it would not have been sufficient in case of a great adverse shock. The calculations further hint at severe weakness in the established regulatory framework: the improvement from tighter regulation would definitely help to control the credit risk but it would have been inefficient in dealing with the kind of market risk that also shattered Thailand's financial institutions. The economics of bank regulation has been mainly discussed in a microeconomic perspective emphasizing problems of asymmetric information (e.g. Dewatripont and Tirole 1994, Freixas and Rochet 1998, Bhattacharya, Boot and Thakor 1998). Our results support, however, the argument of Blum and Hellwig (1995) that macroeconomic shocks also challenge the stability of the banking system. As this inherent limitation of regulation is heavily debated in industrialized countries, our case study from Thailand amplifies the concerns expressed. To overstate the argument, the Asian crisis provides evidence in favor of the established prudential regulation but this is almost trivial – what may be shocking, however, is that the crisis uncovers severe limitations, revealing existing regulations in a major sense as probably ineffective (see also Bonte et al. 1999). A related lesson seems to be that institutional capacities matter at a much deeper level than the laws existing for regulation.

The paper starts in Section 2 by reviewing Thailand's pre-crisis prudential regulations and comparing them with the German framework of the years until 1997. Section 3 provides the calculation for reproducing the core element of prudential regulation, i.e. the capital adequacy norm, of commercial banks in Thailand. This delivers the basis for assessing their situation in Section 4 under the assumption of German standards being implemented. Section 5 then simulates the situation of German banks under Thailand's macroeconomic shocks. Conclusions are discussed in Section 6.

2 Banking Supervision in Germany and Thailand

Bank regulation typically relates to both credit risk and market risk. With respect to credit risk, Germany as well as Thailand introduced the 1988 Basel Accord in 1993. Although both countries use the same regulatory framework differences remain for at least two reasons: first, the Basel Accord only states a minimum standard, leaving room for more restrictive rules. Second, the Basel Accord rests in many aspects on items of the balance sheet. Due to different accounting rules in Germany and Thailand the same regulatory rule need not have the same economic content.

The central rule of the Basel Accord is a minimum standard ratio (solvability coefficient s) of equity capital (E) to risk weighted (r) assets (A) of 8%, of which the ratio of core capital (tier one capital s_I) is at least 4%:

$$E \geq s \cdot r \cdot A \quad , \text{where} \quad s = 0.08 \quad \text{and} \quad s_I = 0.04 \tag{1}$$

Thailand started with a capital adequacy standard of 7% in 1993, which was gradually raised to 8.5% in October 1996, of which 6% had to be core capital (Bank of Thailand 1997, p.5). Germany uses the 8% minimum ratio with the exception that 4.4% has to be tier one capital if the revaluation reserves are included in the regulatory capital which is outlined in Table 1.

Table 1: Capital adequacy standard and definition of regulatory capital

	Basel Accord 1988[i]	**Thailand 1993-1996[ii]**	**Germany 1993-1996[iii]**
Capital adequacy standard	Capital $\geq 0.08 \cdot$ risk weighted assets Core (tier one) capital ≥ 0.04 risk weighted assets	$\text{Capital} \geq \begin{cases} 0.070 \ (1993) \\ 0.075 \ (1994) \\ 0.080 \ (1995) \\ 0.085 \ (1996) \end{cases} \cdot$ risk weighted assets $\text{Core (tier one) capital} \geq \begin{cases} 0.050 \ (1993) \\ 0.050 \ (1994) \\ 0.055 \ (1995) \\ 0.060 \ (1996) \\ 0.0425 \ (1998) \end{cases} \cdot$ risk weighted assets	Capital $\geq 0.08 \cdot$ risk weighted assets Core (tier one) capital ≥ 0.04 risk weighted assets (0.044 when revaluation reserves are used)
Tier one capital (Core capital)	• Paid-up share capital/ common stock • Disclosed reserves	• Paid-up share capital/common stock • Disclosed reserves	• Paid-up share capital/common stock • Disclosed reserves
Tier two capital (Supplementary capital)	• Undisclosed reserves • Asset revaluation reserves (discount of 55% with respect to latent reserves) • General provisions/general loan loss reserves • Hybrid (debt/equity) capital instruments • (Long term) Subordinated debt (maxium of 50% of tier one capital)	• Asset revaluation reserves: discount of 70% for land, 50% for buildings • Hybrid (debt/equity) capital instruments (i.e. preferred stock, SLIPs, etc.)	• General provisions/general loan loss reserves • Asset revaluation reserves (discount of 55% for real estate and 65% for securities; maximum of 1.4 % of all risk weighted assets) • Hybrid (debt/equity) capital instruments (i.e. preferred stock, liabilities represented by participation rights) • (Long Term) Subordinated debt • uncalled commitments of members Maximum of 50% of tier one capital

Sources: [1] See: Basel Commitee on Banking Supervision (1988)   [2] See: Bank of Thailand (1996)   [3] See: Federal Banking Supervisory Office (1997)

Apart from institutional peculiarities, the elements of the regulatory capital are identical. Germany seems to have a more restrictive limit concerning the asset revaluation reserves.

Presumably more important are differences in accounting rules: until 1995 commercial banks in Thailand were allowed to record accrued interests on loans that were fully secured without a time limit; in July 1995, a time limit of one year was set. Furthermore, Thai banks were not required to set reserves against sub-standard debt. In Thailand debt instruments are valued in the balance sheet according to their market value, in Germany they are valued as the lower of historical cost or market value. In all of these cases the Thai standard is more generous for banks, which leads, under otherwise equal circumstances, to increased profitability in the short run. The flip side of these rules is a lower consideration of risks entered into than in the German case.

Risk weighted assets consist of on-balance and off-balance sheet assets as indicated in Table 2.

Table 2: Credit risks of on-balance and off-balance sheet positions

Risk weighted assets (credit risks)	Basel Accord 1988[1]	Thailand 1993-1996[2]	Germany 1993-1996[3]
	Risk weight:		Principle I
• On-balance-sheet assets ($\rightarrow$ risk weight)	0 % { • Cash • Claims on domestic central banks and governments within the OECD 20 % { • Claims on banks incorporated in the OECD and on multilateral development banks[4] • Claims on banks outside the OECD with a residual maturity up to one year • Cash items in process of collection 50 % ◄ • Loans secured by mortgage 100 % { • Claims on the private sector (loans, securities) • All other assets		
• Off-balance-sheet assets (conditional liabilities)	Conversion Factor 100 % { • direct credit substitutes • sale and repurchase agreements • forward asset purchases, forward forward deposits 50 % { • NIF's and RUF's • Standby facilities, credit lines with an original maturity over one year 20 % ◄ • Collateralised documentary credits 0 % ◄ • Commitments with an original maturity up to one year		
• Foreign exchange and interest related contingencies[5]	• Current exposure method *or* • Original exposure method	• Only original exposure method	• Current exposure method or • Original exposure method

Source: [1-3] See Table 1
[4] Domestic banks in Thailand are treated in the same way as banks from OECD countries
[5] Counter party risks of derivatives

The risk exposure is calculated by multiplying the nominal amount by a risk weight reflecting the different riskiness of the counterparty. Off-balance sheet assets are transformed into credit risk equivalents by multiplying the nominal amounts by a conversion factor according to the risk category and then applying the risk weights. The only difference between Germany and Thailand concerns the credit risks of derivatives. German banks can choose between the current exposure and the original exposure method, where strict preference is given to the former. In Thailand only the original exposure method seems to be in practice. But the difference might not be too important because the volume of derivative markets is rather small in Thailand.

The 1998 Basel Accord does not refer to market risks. An international agreement about the regulation of market risks was reached no sooner than 1996 and was adapted into the German regulatory rules only in 1998, i.e. after the outbreak of the Asian crisis. Due to the lack of an internationally accepted standard for the regulation of market risks there are differences between Germany and Thailand in this field, as seen in Table 3.

Table 3: The regulation of market risks

Market Price Risks	Basel Accord 1988[1]	Thailand 1993-1996[2]	Germany 1993-1996[3]
	Not contained in the Basel Accord		Principle Ia
• Foreign exchange risks		Sum of the open positions in all currencies — Long end *(£20 %)* Short end *(£15 %)* Tier one capital. Emphasis on internal control systems. Since 1995 foreign currency denominated loans to high risk activities and non-productive sectors are excluded from being included in the net open position.	Sum of the open positions in all currencies and gold — ≤ 21 % of — Regulatory capital (Tier one plus tier two capital)
• Interest rate risks		No explicit regulatory rule	Sum of the open positions in interest rate futures and short positions in interest rate options as far as the net open position of other positions is augmented — ≤ 14 % of — Regulatory capital (Tier one plus tier two capital)
• Other market risks (e.g., positions in shares)		No explicit regulatory rule	Positions in futures if not used for hedging and short positions in options — ≤ 7 % of — Regulatory capital (Tier one plus tier two capital)

Source: [1]-[3] See Table 1

Whereas in Germany foreign exchange risks, interest rate risks and other market risks were regulated, the Bank of Thailand only controlled the banks' foreign exchange exposures. Both countries used a limit system demanding that the sum of the open positions in all currencies should not exceed a certain percentage of the regulatory capital. The rule applied in Thailand is stricter than the German rule because the percentage is lower and because the percentage refers only to tier one capital and not to the total regulatory capital as in Germany. Furthermore, the open position also contains long positions in options in Thailand, whereas in Germany long positions in options were only relevant to the extent that they reduce an open position. The absence of any explicit rule concerning the exposure to other market risks may be a difference of minor importance because the German rules only refer to exposures resulting from positions in derivatives, which are rather unimportant in Thailand. The majority of the derivative transactions in Thailand were in the form of foreign exchange swaps, which are contained in the open position in currencies.

In summary, the Thai regulations are very similar to the German ones as they are both based on the Basel Accord. Thailand may, superficially, appear the even more restrictive country because the capital ratio demanded is higher and the market risk is in some respects considered tighter. This tough stance has to be weighted against the obviously looser accounting rules, an issue addressed in Section 4.

Above and beyond these differences between Germany and Thailand, the Basel Accord and particularly the regulation of market risks are exposed to severe criticism (e.g. Hellwig 1999). It is far beyond the scope of this paper to discuss this at length; instead, we want to concentrate the discussion on three points which concern the general way risk exposures are measured and which are relevant for Thailand's case:

- The limit system used to restrict the market risk has the major drawback that the same amount of capital can be used as a cushion against risk exposures several times. This can become a problem if the risks included in separated categories effectively cumulate due to certain developments. Thus recent reforms, such as the 1998 amendment of the German bank regulation, rest upon the principle that capital can be used only once;

- Exposures to different forms of risks are regarded as separate items. This ignores the fact that credit risks and market risks may not be independent. The widespread use of borrowing and lending in US dollars may have led to a low open net position of Thai banks, but as far as the foreign exchange risks were handed over to the debtors, the reduction in market risk could result in higher credit risk not being covered by the regulation;

- A possible mismatch in maturities is not taken into account in the Thai regulatory framework. This may be justified in situations of liquid markets, but if the refinancing

of banks becomes difficult, e.g. because foreigners pull their funds out the country, then this mismatch possibly translates into a credit crunch.

The last two limitations mentioned apply not only to the regulatory framework being in place during the crisis in 1997, but are in fact beyond the scope of market risk recognized in the present regulatory framework.

3 Prudential Regulation Calculation for Commercial Banks in Thailand

As a basis for outlining any scenarios which might have happened under different regulatory standards, the first task is to reproduce how prudential regulation affected commercial banks in 1996. Unfortunately, the necessary figures are not provided publicly but have to be estimated from available information. On the other hand, there are some data published which frame and thus also limit the conceivable possibilities. The considerations leading to the calculations done are made explicit in the next sections which cover credit risk (Section 3.1) as well as market risk (Section 3.2).

3.1 Prudential Regulation Calculation of Credit Risk

To take account of credit risk, commercial banks in Thailand have had to hold equity capital according to the BIS rules (see Section 2). The capital adequacy norms were more than fulfilled in December 1996 as the actual ratios stood at 10.79% for equity capital and 7.59% for core capital respectively up from 9.59%, and 7.49% one year earlier (Bank of Thailand Monthly Bulletin, Table 9; Bank of Thailand 1999, Table 6). We therefore modify equation (1) by substracting possible excess capital (E^x) from total equity capital (see Dewatripont and Tirole 1994, p.52):

$$E - E^x = s \cdot r \cdot A \qquad (2)$$

The great advantage of the actual ratios being provided is that they set the framework within which further calculations can be made: the determined volume of risky assets and the capital account leading to the ratio as proposed by the BIS. As an implication, one then has to attend "only" to the distribution of risky assets. Here again, choices are limited by the structure and the respective risk weight of assets. The basic structure of assets can be seen from the Bank of Thailand Monthly Bulletin (Table 7). In applying some plausible assumptions, one can multiply the separate categories of assets with their respective risk weight and thereby receive a volume of risky assets. The result of this approach is presented in Table 4, where total assets are split up into interesting categories according to the regulatory framework (see Bank of Thailand 1996, pp.53ff.).

Table 4: Calculating the commercial banks' on-balance credit risk at the end of 1996

Asset category (claims on)	Asset Volume in bn. Baht	Risk Weight in %	Risk-Weighted Assets in bn. Baht
Bank of Thailand	165.8	0	0
government	8.5	0	0
(subtotal)			0
nonfinancial public enterprises			
securities	98.2	(20+0):2	9.8
public utilities loans	142.8	(20+0):2	14.3
(subtotal)			24.1
commercial banks	40.7	20	8.15
other financial institutions	213.9	20	42.8
foreign assets (banks)	102.2	20	20.5
(subtotal)			71.4
home buyers loans	420.7	50	210.4
(subtotal)			210.4
foreign assets (non banks)	77.8	100	77.8
business and household loans	4139.4	100	4139.4
other assets	278.0	100	278.0
(subtotal)			4495.2
total	5688.0		4801.0
minus credits equal to provisions for loan losses			74.0
on-balance credit risk			4727.0

Notes: The basic source is the Bank of Thailand Monthly Bulletin, Table 7; the public utilities loans figure is from Table 13; the home buyers figure is based on Bank of Thailand (1997), Figure 4 by inflating the 1995 figure with the average assets growth rate; business and household loans are from Monthly Bulletin Table 7, line 30 minus (public utilities loans, home buyers loans) plus public enterprise loans (line 28); provisions for loan losses are estimated from the respective share to capital account from finance companies (Monthly Bulletin, Table 22, lines 56 and 57)

The calculated amount of risky assets from this approach sums up to 4,727.0 bn. Baht and thus almost matches the figure provided by the Bank of Thailand (Monthy Bulletin, Table 9, line 12) to be in December 1996 4,726.6 bn. Baht. This implies that weighted risk due to off-balance sheet items is negligible.

As any such calculation must necessarily be arbitrary to some degree, the considerations behind it should be made transparent (for details see Annex). First of all, the basic volume figures used are from a single table of the central bank, as mentioned above, and are basically modified only to consider specific risk weights. Second, these modifications are based on figures by the Bank of Thailand again, i.e. for public enterprises and for home buyers' loans (see notes in Table 4). Third, the risk weights associated with other assets seem to be quite reliable as the categories are already used by the Bank of Thailand itself.

In summary, we feel quite confident that we have largely reproduced the true calculation of risk weighted assets leading to the figure published by the Bank of Thailand.

3.2   Prudential Regulation Calculation of Market Risk

The preceding section already introduced the idea that market risks, as they are mirrored by the German regulation, were rather low for commercial banks in Thailand. The main elements of market risk are risks from changing exchange rates and from changing interest rates, in short: currency and interest rate risk.

Regarding currency risk, the Bank of Thailand limits the net foreign exchange position of commercial banks by not allowing a certain ratio to the tier one capital to be exceeded (Bank of Thailand 1997, p.33). Since October 1994 this ratio has been lowered by 5 percentage points to 20% and 15% in the long and short end markets respectively. In reality, only the short position was important, as banks were eager to lend primarily in US dollars (or yen) and then extend these funds as Baht loans because the interest rate differential during the 1990s was roughly 4 percentage points (or often even 10 percentage points in the case of the yen). In October 1995, the central bank tightened the rules further by excluding "loans granted to high risk activities and non-productive sectors" (Bank of Thailand 1997, p.33) from the netting of open positions. In any case, the direct currency risk of the banks was obviously restricted even under the extreme assumption that all banks would have exploited their limit fully to 1.1% of risky assets (0.15 times 7.59% tier I capital in December 1996).

Regarding interest rate risk, the rules have been more complaisant. In effect the regulation here relies heavily on the risk management systems of the individual banks. The Bank of Thailand (1997, p.30) puts "emphasis on the ability of internal control systems of commercial banks to properly assess these risks". Compared with international standards, this may be regarded as being rather lax; however, financial contracts in Thailand are typically of a short-term nature. Only about 2% of time deposits stretch further into the future than 12 months but more than 80% are in accounts below 3 months (see Bank of Thailand 1999, Table 4.2), implying that the duration of these outstanding contracts is below three months. Other local deposits, such as demand and savings deposits, are of an even shorter-term nature. Finally, borrowings from banks abroad, which accounted for 20.3% of total liabilities at the end of 1996 (Bank of Thailand Monthly Bulletin, Table 7), are typically lent on to local customers on a margin basis as regards the interest rate agreement.

The situation is similar for the remaining assets of the balance sheet. Even if the loan may be negotiated for several years there will practically always be a clause that interest rates adjust on a much more frequent basis. Consequently, it is also common to negotiate a de facto spread on top of a deposit rate. The only fixed interest contracts of a longer-term nature, i.e. bonds, are of insignificant importance as the bond market in Thailand is underdeveloped and was not of

great interest to commercial banks during the 1990s. So, even adding up all positions classified as bonds and securities on the asset side, this adds up to not more than 301.7 bn. Baht, i.e. 5.3% of total assets at the end of 1996 (see Bank of Thailand Monthly Bulletin Table 7A).

These considerations do not cover the aspect of possible liquidity risk. As practically all relevant funding sources are of a short-term nature but about 53.7% of all loans in the year 1996 had an original maturity of longer than one year (see Kamin et al. 1997, Table 10), some maturity mismatch is recognizable. In a macroeconomic sense this may be not too important as long as we regard a closed economy. If we allow, however, for net foreign funding of the domestic banking system, then the withdrawal of these funds forces the banks to liquidate assets and may thus lead into a credit crunch.

In summary, it seems fair to say that neither currency nor interest rate risk – as far as being covered by regulation - is of major importance to commercial banks in Thailand. This does not mean that they are absolutely negligible for the management, and in particular this does not say anything about any individual bank. Compared, however, with German banks, where the proper management of interest rate risk has enormous importance for the profitability of the bank, the market risk discussed in Thailand is low and less relevant than the credit risk.

4 The Impact of Tighter Regulation on Thailand's Banks

After having introduced the institutional foundations of banking regulation in Germany and Thailand, this section examines empirically how important the difference between the two countries may be. The question is whether tighter regulation, such as in the German case, would have provided a dramatically better ability of banks to withstand increasing risks and a less overheated macroeconomic environment producing less risk for banks. These more favorable circumstances might have saved Thailand's banks during the recent crisis. This is the proposition to be examined.

The approach followed is to break down the complex relationship between regulation and its consequences on the situation of the economy and banks into three steps. First, tighter regulation, such as in Germany, forces in a quite mechanical sense comparatively lower credit extensions, as the necessary capital base is restricted (Section 4.1). Second, lower credit growth limits the financing of investments and thus limits the growth of the real economy (Section 4.2). In Thailand's case this may have been helpful in reducing the asset bubble. Third, the possibly reduced boom may have lowered the burden that a downswing of the economy has on the health of banks (Section 4.3).

4.1 The Impact of Tighter Regulations on Credit Volume

In Section 2 it was established that the German framework has tighter and looser aspects in comparison with Thailand. Although most observers might assume ex ante that the Thai regulations were more generous to banks in the end, the existence and in particular the amount of this difference is an empirical question. This section tries to answer this question by using available data.

The effect from the German accounting rules which lead to a de facto tighter regulation can only be assessed with caution. Some of the details have been mentioned in Section 2. It is obvious that there is no information available to reliably estimate the empirical importance of the single accounting differences for the necessary capital base of banks. Fortunately, however, the Bank of Thailand has published a figure on one of the most important implications of the generous accounting rules, that is the treatment of loans that are not performing well. Whereas the share of non-performing loans (NPLs) to total loans according to the official rules was negligible, the central bank provided very different figures of about 8% at the mid 1990s for international comparisons as can be seen from Figure 1.

Figure 1: The share of non-performing loans at Thailand's commercial banks measured by international standards
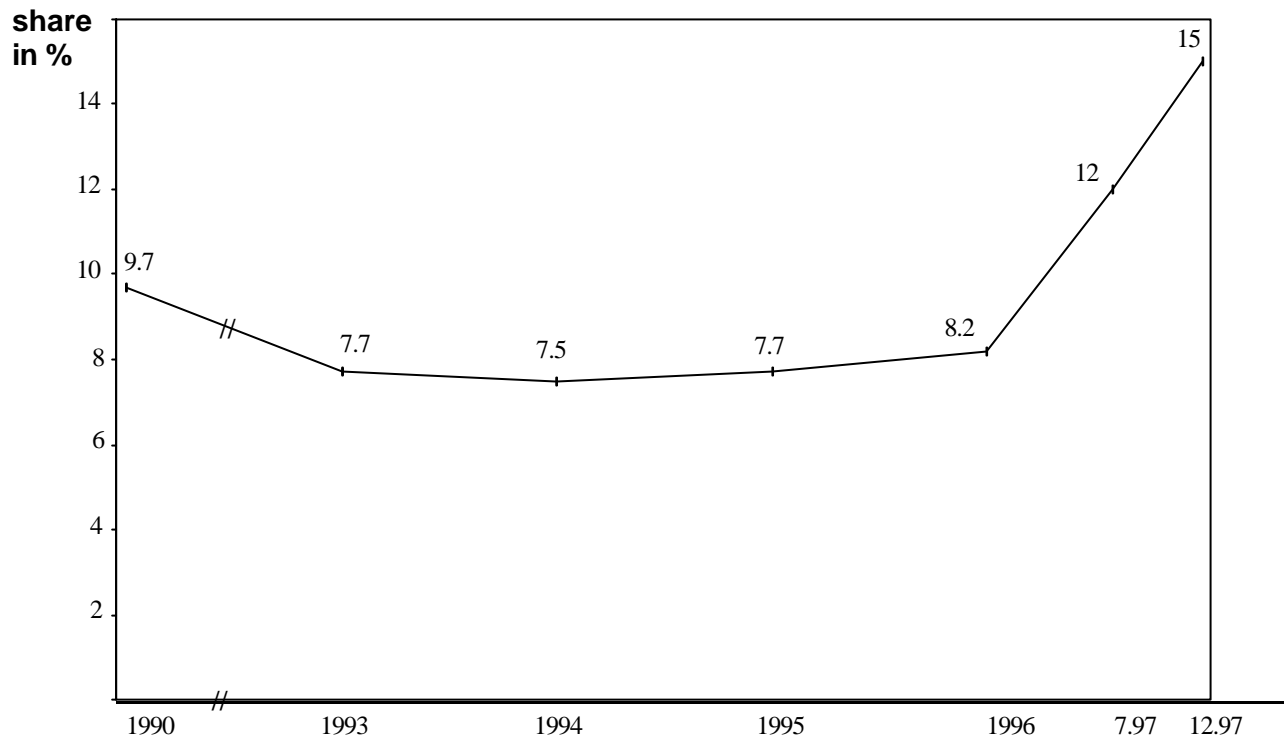
Source: Radelet and Sachs (1998) for 1990, 1994, 1995; Kamin et al. (1997) for 1993, 1996; Sirivedhin (1998) for 1997

Although there is no explanation available as to how this figure has been generated, it should be taken seriously as it was officially released to the Bank for International Settlements (see e.g. the BIS document of Kamin et al. 1997). The Bank of Thailand further provided the figure of about 12% for the middle of 1997 (see Sirivedhin 1998). These figures taken together suggest that a 8.2% share of NPLs to total loans at the end of 1996 is rather a conservative estimate.

Translating this share into absolute volume needs information about total loans. An estimate is provided in Table 5 (column 1) indicating a volume of 4,743.6 bn. Baht at the end of 1996. The range for this estimate is at its lower limit the total of the three loan categories mentioned in Table 4, i.e. 4,702.9 bn. Baht and at its upper limit the volume of bills, loans and overdrafts of 4,825.1 bn. Baht (Monthly Bulletin Table 9). Thus, the amount of non-performing loans would be calculated as about 389 bn. Baht.

Table 5: Credit risk and loan volume under different prudential regulations (in bn. Baht)

	Asset Categories	Status Quo 12.1996	Tight Standard de Facto
	(1)	**(2)**	**(3)**
business and household loans	4,139.4		
home buyer loans	420.7		
public utilities loans	142.8		
commercial bank loans	40.7		
(subtotal: loans)	(4,743.6)	4,572.8	
non-performing loans	47.4e	+341.5	
other assets	944.4		
total assets	5,688.0		
on-balance risk-weighted assets	4,727.0	4,556.2	3,853.4
capital accounts	509.9	339.1	339.1
capital / asset ratio	10.79%	7.44%	8.8%

Notes: For sources of the status quo figures see Table 4

If we assume that this figure reveals the "true" situation according to an international standard as it is used in Germany, it must be compared with the unreleased figure of NPLs under the former Thai standards which are said to be "close to zero". We assume these to be 1% of total loans and further assume that they are adequately dealt with in the balance sheet. From this comparative view, there emerges a gap of undisclosed non-performing loans of 7.2% of total loans or 341.5 bn. Bt. which is relevant for our considerations (see Table 5, column 2). These additional NPLs require a depreciation of assets and thus have effects on equity capital and possibly the volume of outstanding risky assets. To demonstrate the impact of depreciations, we extend equation (2) by assuming that regulatory equity capital (E) equals assets (A) minus deposits (D):

$$E = A - D \tag{3}$$

Further assuming that the risk weight (r) is always 1 and inserting (3) into (2) leads to

$$A - D - E^X = s \cdot A \tag{4}$$

Considering the impact of a certain average rate of necessary depreciation (d) on equation (4) gives the extended equation (5)

$$(1-d) \cdot A - D - E^x = (1-d) \cdot s \cdot A - (1-s) \cdot d \cdot A \qquad (5)$$

The left side of equation (5) shows the reduced equity capital but note that E^x is still a capital buffer. The right side of equation (5) consists of two terms. The first one provides the amount of capital necessary which is somewhat reduced due to the lowered asset volume. The second term states the item balancing both sides of the equation: the reduced capital requirement (first term right side) minus the reduced capital (left side) gives the induced additional capital requirement. This additional capital requirement minus possibly excessive capital yields the induced capital need:

$$(1-s) \cdot d \cdot A - E^x \qquad (6)$$

If Thai banks had aimed to cover 50% of the gap in undisclosed NPLs this would have introduced a capital need of 170.8 bn. Bt. Covering this need out of the existing capital accounts would leave Thai commercial banks at an equity capital ratio of 7.44% where the depreciated credit volume [(1-d) A] of 4,556.2 bn. Bt. is already considered (see Table 5, column 2). Compared with a fictive formal requirement of only 8%, there is an urgent need of 0.56% of extra capital to cover risky assets.

This first very rough attempt is, however, an underestimation of the problematic situation. Several other effects also point towards an under capitalization by German standards:

- Debt of classifications better than "non-performing loans" needs (as under the new Thai regulations) or can be provided (as under the German regulations) with some provisions. In the Thai case this amounts to 1 - 2%, in the German case these provisions were expected to exist but must not be higher than 4%. Assuming a value of 2% applied to a volume of 4,402 bn. Bt. (4,743.6 minus 7.2% undisclosed NPLs) would amount to necessary provisions of 88 bn. Bt., a figure being higher than the estimated existing provisions of 74 bn. Bt. These kinds of provisions are regarded as "tier II" equity capital;

- So far the calculation referred to fulfilling the minimum capital norm, i.e. 8% of risky assets. In practice, however, simple technical reasons of discretionary increases in capital but permanent increases in loans (in Thailand often 20% p.a.) and also some safety margin rather motivate banks to aim for a buffer cautiously assumed to be 10% above the minimum, i.e. a capital base of 8.8% in relation to risk-weighted assets;

- There is a further difference regarding the possibly higher valuation of real estate in the lending process in Thailand. A more cautious policy of real estate appraisal might affect the risk weight of home buyers' loans and would also lead to a downwards classification of loans, causing higher capital needs;

- Finally, the assumed capital base represents a rather favorable situation: first, there is the effect from a more generous treatment of revaluation reserves for inclusion in the capital base in Thailand. However, no information is available on its quantitative importance. Second, the equity capital ratio of 10.79% at the end of 1996 was comparatively high compared with the preceding five-years average of 8.9%. Third, the published ratio was possibly too high as the latest available figure has been given as only 10.26% for the end of 1996 (see Bank of Thailand 1999, Table 6).

Summing up our effort to assess the quantitative importance of tighter German accounting rules for Thai banks results in a completely different picture regarding capital endowment of Thai commercial banks. Whereas the former standards showed a high ratio of 10.79%, the figure adjusted according to international practices should lie below 7.44%. If the banks aim for a ratio of 8.8%, the resulting capital shortage is more than 1.36% of risky assets. This can be directly translated into a necessary reduction of risky assets, i.e. in the Thai case reduced lending, by supplementing equation (6) with the factor for asset increase (*1/s*):

$$\frac{(1-s) \cdot d \cdot A - E^x}{s} \tag{7}$$

For the Thai case this leads to a figure of 702.8 bn. Bt. (4,556.2 minus 3,863.4), i.e. the position of about 15.4% of risky assets had to be closed (see Table 5, column 3).

This kind of calculation is based on comparative static and banks might be able to generate additional funds. However, even then the structural differences between banks may translate into an aggregate effect of some remaining credit restriction (see in this vein Brinkmann and Horvitz 1995). Moreover, the higher capital needs would mean that the shorter-term return on equity is lower and thus less attractive than it had been until 1996. So, this simple baseline scenario may be understood as indicating a range of possibilities: in the optimistic case that the banks can attract further funds, the path of credit extensions may have been only 5% lower than experienced. In the pessimistic case that the capital needs calculated above may be too low, the credit volume may have been even 25% lower than it happened to be. This band of 5 – 25% lower credit volume seems to be a reasonably estimated consequence of a tighter prudential regulation.

4.2   The Impact of Credit Volume on the Real Economy

The next question is how this lower credit volume might have affected the growth path of the economy. This seems to be a particularly relevant part of the Asian crisis, as a credit boom is often mentioned as having caused over-investment, and thus an asset bubble (for an empirical study see Sarno and Taylor 1999). Although the empirical evidence for overly high credit growth

is not unambiguous (see e.g. Moreno 1999) it can still be regarded as a kind of stylized fact in many emerging economies' financial crises (see also Edwards and Vegh 1997).

This also applies to the Thai case, where several studies seem to agree that investment was higher than justified from a longer-term oriented perspective. Reasons may have been that the price of capital was too low due to mispriced capital imports, that the expected return on investment was too optimistic or that sometimes risks were wrongly underestimated (possibly due to moral hazard). In any case, the assumption of over-investment being at the heart of Thailand's bubble is shared by most observers (see e.g. Bank of Thailand 1998, Lauridsen 1998, Warr 1999). It may explain why appropriate credit growth is important for a sound macroeconomic development.

A look at the post-1955 relationship between changes in credit volume and GDP demonstrates the expected positive relation (see Figure 2). It becomes obvious that credit volume increases faster than GDP and that its change is more volatile.

Figure 2: Change in credit volume and GDP in Thailand 1955 – 1996
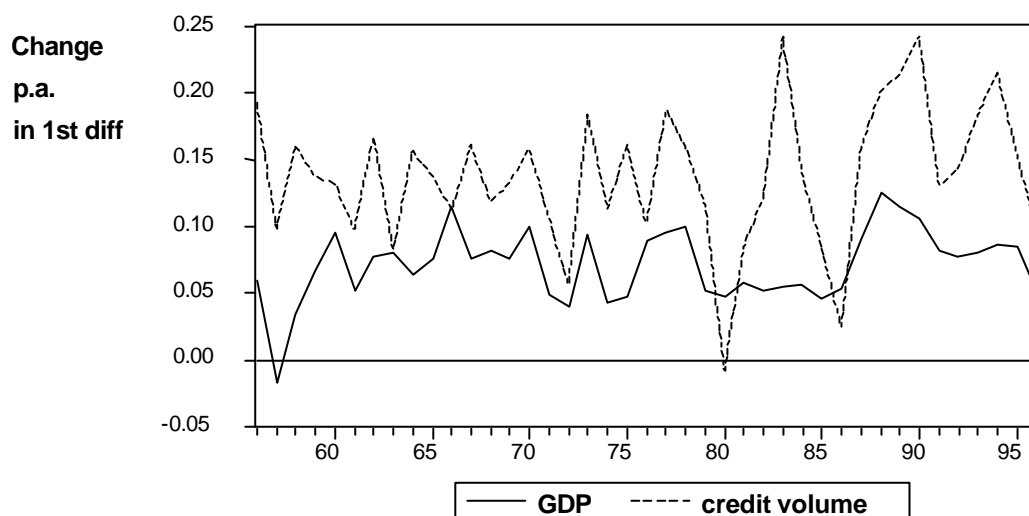
Notes: GDP = log of GDP at 1990 prices in 1st differences, IFS line 99b.p
Credit volume = domestic credit/claims on private sector, in logs and
1st differences, IFS line 32d.

In a next step we examine the shorter-term statistical relationship between both economic variables by using typical determinants of business cycle regressions. Credit growth is expected to be a major determinant of GDP growth, mainly capturing the domestic component. This was particularly relevant until the early 1990s when the monetary regime was largely one of credit rationing. Nevertheless, due to the outward orientation of Thailand's economy, external factors should also be important. This concerns in particular the exchange rate. To identify a satisfactory regression, three steps have been considered: first, data availability was often a restriction. Some

additional determinants, such as foreign direct investment is available on a higher frequency but only for a shorter time period, whereas e.g. GDP growth is reported only on a yearly basis and the correlation between GDP and industrial production – as a potential substitute – is too weak for our purpose. Second, data had to be transformed to achieve stationary time series. Third, the influence from lagged values has been checked. Meaningful specifications and statistical details are indicated in Table 6.

Table 6: Determinants of GDP growth in Thailand 1957 - 1996

	(1)	(2)	(3)
constant	0.016	0.024	0.009
	(0.201)	(0.031)	(0.501)
$DGDP_{t-1}$	0.332	0.295	0.330
	(0.020)	(0.017)	(0.020)
$DCRE_t$	0.215	0.188	0.221
	(0.004)	(0.003)	(0.003)
DEX_t	0.069	0.057	0.073
	(0.087)	(0.103)	(0.068)
DEX_{t-1}		0.020	
		(0.584)	
DWY_t			0.113
			(0.241)
No. of obs.	40	40	40
DW	1.709	2.099	1.700
R^2	0.385	0.427	0.409

GDP_t = GDP at 1990 prices, IFS line 99b.p
$DGDP_t = logGDP_t - logGDP_{t-1}$
CRE_t = domestic credit/claims on private sector, at 1990 prices, IFS line 32.d
$DCRE_t = logCRE_t - logCRE_{t-1}$
$WY_t = GDP(USA)_t + GDP(Japan)_t + GDP(Malaysia)_t + GDP(Hong Kong)_t + GDP (United Kingdom)_t + GDP(Germany)_t$, at 1990 prices, IFS lines 99b.r or 99b.p
$DWY_t = logWY_t - logWY_{t-1}$
EX_t = Exchange rate \$/Yen, year average of market rate, IFS line rh
$DEX_t = logEX_t - logEX_{t-1}$
Augmented Dickey-Fuller tests and Phillips-Perron tests indicate that all variables contain a unit root with trend in levels, but are stationary in first differences. See Dickey and Fuller (1979) and Phillips and Perron (1988).

Note: p-values are given in parenthesis.

Estimation (1) shows that GDP growth (DGDP) is strongly related to credit growth (DCRE) and positively affected by a US dollar depreciation versus the yen (DEX), which can be interpreted as a causal relationship due to the exogenous monetary policy. The relevant coefficients have the expected sign, are statistically significant and the credit growth coefficient seems to be quite robust regarding the specification (see estimations 2 and 3).

As a last exercise we use the established relationship – column (1) in Table 6 - between credit and GDP to determine the impact that tighter regulation might have had on real growth via lower credit extensions. For this purpose it is assumed that the tightening impact estimated for commercial banks with a market share of more than 60% only can be linearly extended to the total financial sector. Figure 3 shows graphically how the three differentiated scenarios, mentioned at the end of Section 4.2, translate into lower growth rates. The baseline scenario of a 15% lower credit volume, here distributed on 5 years of the bubble, means roughly that the yearly growth rate would have been about 1%-point lower than the realized values. In the scenario of successfully increased equity capital, i.e. only 5% lower credit volume, the impact on GDP – below 0.5% p.a. - is rather negligible. Finally, the severe scenario of 25% lower credit volume generates roughly 1.5%-point lower growth and would thus be perceptible for the economy.

Figure 3: The impact from reduced credit volume on five years of GDP growth
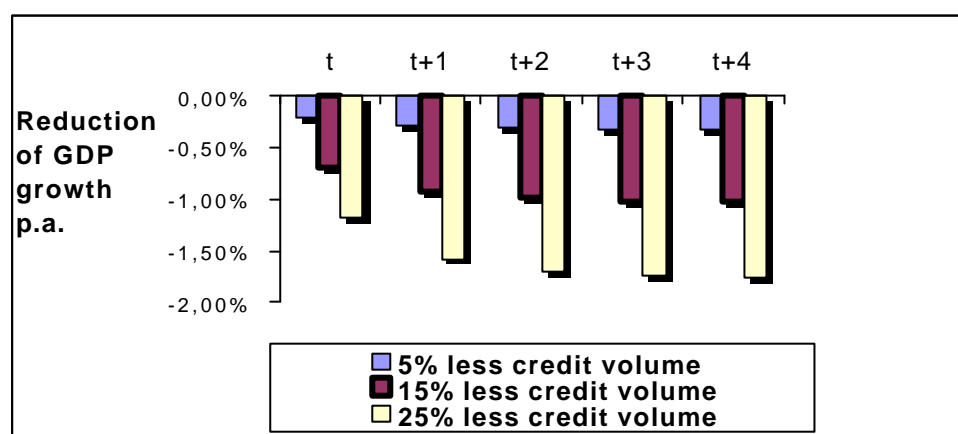
Note: Using Equation 1 in Table 6, this figure plots the effect of a 5/15/25 % lower credit volume, originating in less (average) growth of the credit volume over 5 years, on GDP growth.

The last scenario does not seem to be a very probable case, however, as the open capital account in Thailand effectively made the money supply and thus also the credit supply in the late 1990s largely an endogenous variable. The economy was able to borrow from abroad with few restrictions. Even from the viewpoint of a qualitative improvement of investments, warranted by many observers, tighter regulation can not offer much hope. Regulators do not interfere with the credit allocation decisions of banks, but enforcing prudential regulation basically affects the amount of lending. There is, unfortunately, the possibility that banks try to compensate for the increased equity capital costs from tightened prudential regulation by choosing more risky projects.

In summary, applying tighter regulation on commercial banks in Thailand may not have contributed too much to a sounder economic development. The responsibility is rather with macroeconomic policy-making or, if one aims at improving the quality of investment decisions, with enhanced corporate governance (see e.g. Pomerleano 1998).

4.3   The Impact of the Real Economy on Banks

When over-lending creates an artificial boom, this might increase risk in the sense of volatile cycles but does not necessarily threaten banks in their existence. The aggravating problem derives from the fact that real cycles are accompanied by price cycles reflecting - from a flow-perspective - the supply-demand-situation and - from a stock-perspective - changing expected profitability. As loans are extended in nominal terms, a downswing in prices endangers the value of the underlying collateral. This is of particular importance in a banking system such as in Thailand, where loan decisions are heavily based on available collateral. Therefore, one would like to know to which degree price movements in collateral, i.e. basically real estate and stocks, appear to be influenced by changes in demand.

A second important price-related channel runs from asset inflation and then asset deflation on the revaluation reserves of banks which are part of the regulatory capital. Depending on the use of revaluation reserves one can imagine that this may be important in Thailand, where the stock market experienced a boom and bust cycle. Thus, banks really get into a double lock from declining asset prices.

These arguments show that a somewhat lower asset bubble can be more than proportionately relevant for the survival of banks. However, the basic effect is the one from change in credit on growth and this effect is not too large.

5 Assuming Thailand's Macroeconomic Shock for Banks in Germany

As possible proof of our considerations and calculations made above. it would be interesting to know whether German banks would have easily survived the macroeconomic shock that happened to the Thai economy. It is obviously not trivial to find a true equivalent of the Thai experience for the German case, because some structural characteristics are different. The most important difference in this respect is probably that Germany has no net foreign debt and further, that company debts are usually invoiced in local currency. Other elements, such as diversification of the economy and trade, the dependence of the economy on trade, the share of shock-insensitive public debt at bank assets, the financial leverage of enterprises and thus their vulnerability to interest rate changes etc. tend to be more favorable in the German case. There is, however, the relative disadvantage for German banks that they would have been much more heavily hit by a dramatic interest rate increase from 12% to 20%, such as happened in Thailand within weeks in 1997/98 (see IFS, line 60b). Therefore, it appears to be reasonable to neglect these counterbalancing structural differences and to summarize all effects in a single shock, i.e. the major swing in growth rates from about +8% p.a. during the years 1993-1995 to +5.5% in 1996, -0.4% in 1997 and –10.2% in 1998 (see IFS, line 99b.p). How would German banks have fared in this unfavorable environment?

There is no clear-cut answer to this question, first, because it is highly hypothetical in nature and, second, because no data are available which allow us to estimate the losses incurred from non-performing loans and other sources due to a macroeconomic shock. The main difficulty arises from the German accounting rules which allow banks to hide their anticipated and realized losses. Because of the data we will use, the following remarks refer to the German accounting rules for banks (slight modifications introduced in 1993 are negligible for our conclusions):

- anticipated and realized losses from loans and losses from investments in securities are combined in the same item in the profit and loss account;

- no distinction is made in the profit and loss account between general provisions and those provisions which are earmarked against assets already identified as impaired;

- to make things even less transparent, banks were allowed to compensate losses and profits from provisioning measures. The profit and loss account, therefore, usually only shows the net loss or net figure.

Due to these peculiarities of the accounting rules, banks are able to build up or to reduce hidden reserves secretly, making it impossible to exactly infer the "true" amount of provisioning from the profit and loss account. The idea behind these rules is that banks should be allowed to smooth their income by building up hidden reserves in good years and reducing them in bad years, thus showing a more constant performance during different states of the business cycle. This may strengthen confidence in the financial sector, producing a positive externality at the cost of reduced quality of information. It comes, therefore, at no surprise that the net provisioning figure shown in the published profit and loss account is only loosely related to macroeconomic conditions.

The Deutsche Bundesbank publishes the uncompensated loss provisions stemming from loans and securities for the time period 1978 up to 1998 on an aggregated level. While these data are still subject to the first and second disadvantage mentioned above they do not suffer from netting profits and losses and are thus the best time-series data available about anticipated loan and securities losses of German banks. Figure 4 shows the changes of the two variables of interest, i.e. gross provisioning and GDP (multiplied by a factor of ten), over the period of data availability. One can see immediately that the change in provisioning is often quite rapid.

Figure 4: Changes in GDP and gross provisions in Germany 1979-1998
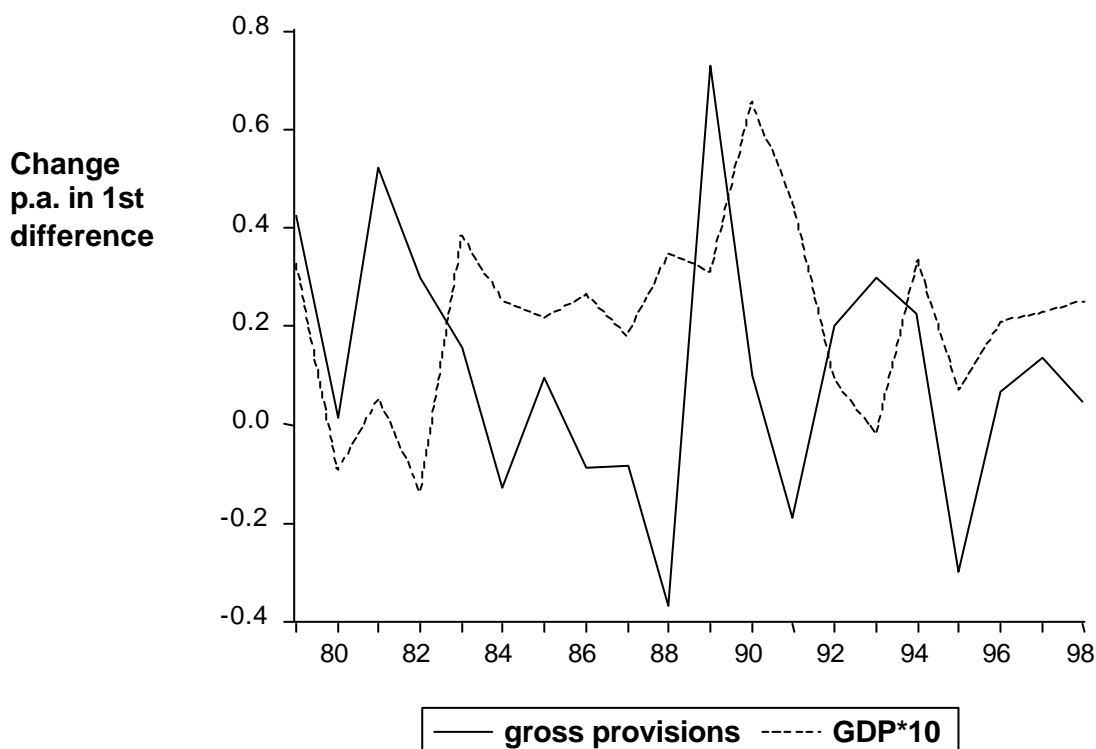
Notes: GDP= log of real GDP in 1st differences, 1979-1991: data for West Germany, 1992-1998: data for Germany
gross provisions = log of gross provisions in 1st differences

To establish a relationship between changes in provisions and GDP growth as a possible determinant, it seems worthwhile to consider influences other than changes in GDP. In particular, the provisioning data include provisions on interest rate-sensitive investments. This influence can be grasped by integrating the difference between long-term and short-term interest rates in the regression. The most satisfactory specification is shown as column (1) in Table 7.

Table 7: Determinants of provisions in the banking sector

	(1) Germany 1979-1998	(2) USA I/1985 - I/1999	(3) USA I/1985 - I/1999
constant	0.742 (0.000)	0.048 (0.006)	0.056 (0.002)
$DProv_{t-1}$	-0.443 (0.036)	0.347 (0.005)	0.364 (0.003)
$DProv_{t-2}$		0.323 (0.008)	0.371 (0.003)
$DGDP_t$		-6.432 (0.001)	-7.486 (0.000)
$DGDP_{t-1}$	-7.382 (0.007)	--	--
$DGDP_{t-2}$	-4.605 (0.136)	--	--
$IN6160C_t$	-0.253 (0.001)	--	--
$DIN60B_t$	--	--	0.042 (0.081)
No. of obs.	20	57	57
DW	2.258	1.908	2.023
R^2	0.691	0.513	0.543

$Prov_t$ = provisions, source: for Germany: see text; for the US: charge-offs, seasonally adjusted, measured as a percentage of average loans and annualized, source: Federal Financial Institutions Examination Council (FFIEC).
$DProv_t$ = log $Prov_t$ - log $Prov_{t-1}$, for Germany
$DProv_t$ = $Prov_t$ - $Prov_{t-1}$, for the US (as the US measure for the provisions is a
          ratio, we do not take logs)
GDP_t = GDP at 1990 prices(Germany), resp. at 1992 prices (USA), IFS line 99b.p
$DGDP_t$ = $logGDP_t$ - $logGDP_{t-1}$
$IN60C_t$ = treasury bill rate, year average, IFS line 134 60c
$IN60B_t$ = federal funds rate, year average, IFS line 111 60b
$DIN60b_t$ = $IN60B_t$ - $IN60B_{t-1}$
$IN61_t$ = government bond yield, year average, IFS line 134 61
$IN6160C_t$ = $IN61_t$ - $IN60C_t$
Augmented Dickey-Fuller tests and Phillips-Perron tests indicate that, while GDP contains a unit root with trend, GDP growth is stationary for both countries. In the case of Germany, the provisions are I(1), so that the growth rates are stationary, while the interest rate and the interest rate differential are both stationary. The index measure of provisions for the United States is stationary, whereas the interest rate is I(1), so that we take first differences. See Dickey and Fuller (1979) and Phillips and Perron (1988).

Note: p-values are given in parenthesis.
In order to account for the structural break occuring with German unification in 1990, we take
GDP growth in West Germany up to 1991 and GDP growth in Germany from 1992 onwards

The coefficients have the theoretically expected signs and are mostly statistically significant: GDP (DGDP) has a lagged and negative influence on provisions (DProv), that means a recession leads to repayment problems of creditors and thus increased provisions one year later. As a second effect, increasing interest rates - leading to a declining value for our interest rate term (IN6160C) - cause a depreciation of investments and thus higher provisions. In addition to these main channels there are two more effects tending to compensate each other: the lagged negative influence from provisions ($DProv_{t-1}$) has very roughly the same dimension as the 2 period-lagged influence from GDP growth ($DGDP_{t-2}$).

To check the robustness of this finding, similarly defined data for the United States have been examined in an analogous way. The documentation in columns (2) and (3) in Table 7 shows that the coefficient on GDP growth which has, indeed, the same order of magnitude as in Germany. The contemporaneous effect, different from the lagged impact in Germany, indicates possibly the more restricted accounting rules. These are expected to show up in a lower constant term and in stronger re-enforcing provisioning as it is, indeed, the case. It is therefore no surprise that the overall effect from changes in GDP on provisioning is markedly higher than for Germany, here about 60-70% due to the lagged impact from provisioning.

The coefficient of lagged GDP growth in the German case provides an elasticity that can be used to roughly estimate how a decline in economic growth affects provisioning during crisis situations, such as the macroeconomic shock happening in Thailand. To demonstrate the estimation in an intuitively accessible way, the coefficient of lagged GDP growth in column (1) is presented as a graph for an interesting range of GDP changes (see the bold line in Figure 5). It can be inferred that a decline in the GDP growth of about 5.9%, which equals the difference between Thailand's growth in 1996 (+5.5%) and 1997 (-0.4%), will lead in the following year to an increase in the provisions by about 44%. This is unfortunately an unrealistically optimistic estimate.

Figure 5: The relation between changes of GDP and changes of provisioning
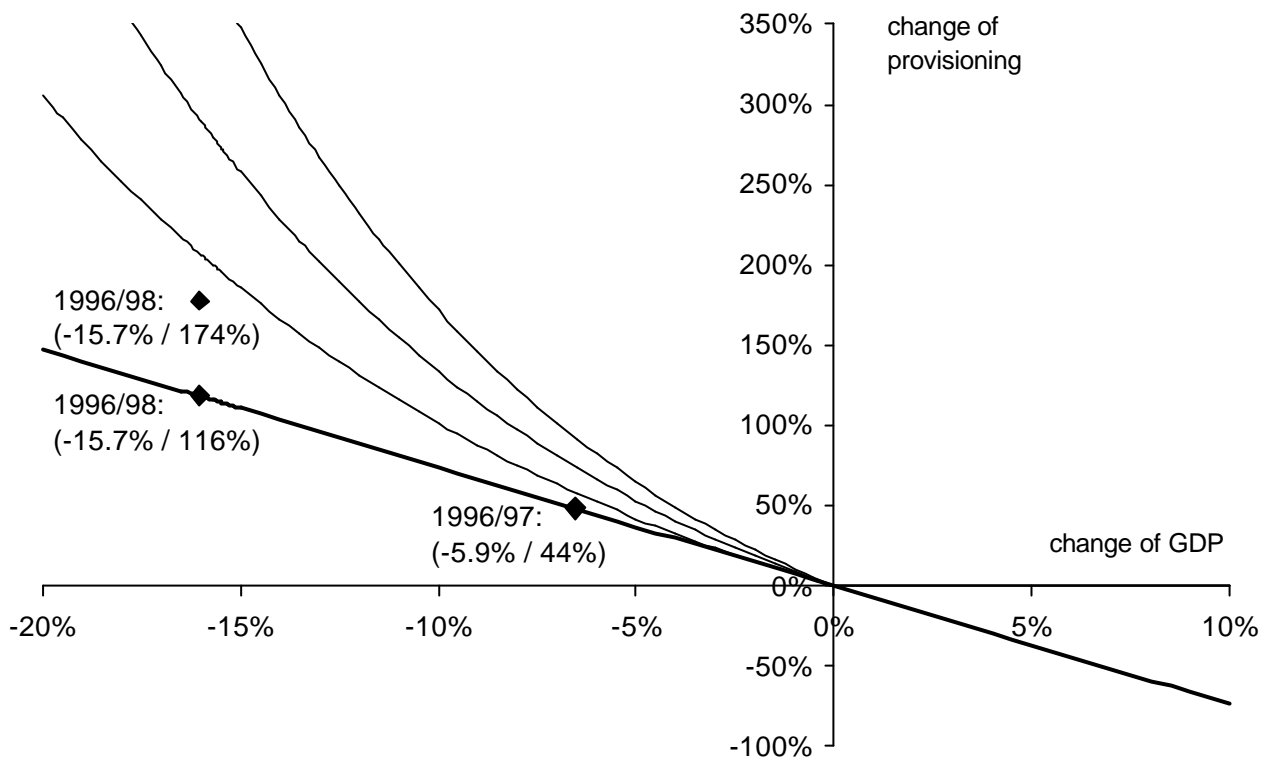
It is more realistic to assume that market participants build rational expectations in the sense that they forecast further influences: if they would have correctly foreseen the depression in 1998 (-10.2%), the aggregated swing in GDP growth by 15.7% results into expected increased provisions of about 116%. Even this is most probably a clear underestimation of the actual needs that may occur in such a catastrophic economic situation:

- the data generated refer to provisions during normal business cycles but not to disastrous events like a shrinking of the GDP by 10% in the year 1998;

- the gross provisions include general reserves which are used for income smoothing, thus underestimating the impact of GDP changes on losses in loans and securities as measured by the empirically derived elasticity.

Taking this into account, it seems quite reasonable to assume that declines of the GDP that go beyond the normal experience force provisions that are considerably higher than our statistical analysis suggests. If one imagines some more than proportionate impact from severe recessions on provisioning, the linear regression coefficient assumed would become much higher. This is indicated in Figure 5 by adding graphically some non-linear relations between changes in GDP and in provisioning to the bold linear regression line. We feel assured by this intuitive reasoning as well as by the 60-70% stronger impact in the US-data to assume in our

following analyses that a surcharge of 50% can be applied to catch in a most conservative way the true impact from a very deep recession, such as in Thailand.

This analysis still has two major shortcomings that can be overcome; however, only for a much smaller statistical basis: first, the general loan loss provisions may still blur the picture and, second, the resulting figures are bank averages which implicitly assume that the unsystematic risk would be perfectly diversified. It is thus useful to take the analysis to the level of single banks.

In this respect the internationalization of financial markets has provided the incentive for some big German banks to publish their profit and loss accounts for the last years in the 1990s in accordance with the International Accounting Standards (IASs). The amount of provisions earmarked for loans can be seen from these profit and loss accounts. Thus, the reported losses do not contain general loan loss provisions and are available on a gross basis regarding netting with profits from resolved provisions made in earlier years.

This provisioning information can be related to the earlier discussed provisioning information as shown in Figure 6. The information from German accounting is the most highly aggregated information and covers the eight fields of the Figure. The data from the Deutsche Bundesbank giving the gross loss figures and used here for the elasticity estimates is shown in the top row (four fields). Finally, the IAS information introduced last is the most precise, covering one field for gross data in Figure 6.

**Figure 6: The coverage of different provisioning accounts in Germany**
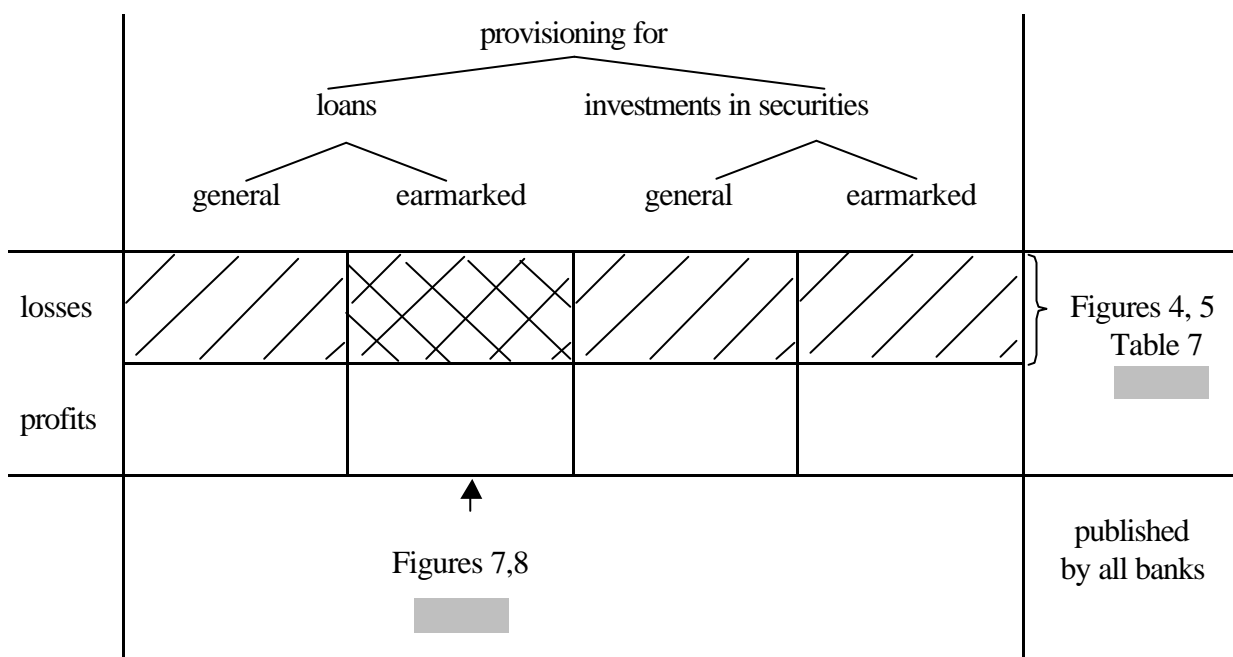
Regarding IAS information, we rely on gross provisions to calculate the effect from provisioning requirements for single banks in case of a strong economic crisis and assume that resolved provisions in the case of a severe economic crisis stay at the former absolute level. As a second adjustment we multiply the gross provisions by 2.74 (i.e. a change in provisioning by +174%), to take account cautiously of the elasticity as identified through the regression in Table 7 (1996/98: +116%) plus the indicated surcharge of 50%. Note that this amount of provisioning is a conservative estimate as it does not take account of the two shortcomings identified just above: compensation via general reserves and bank-specific sensitivity towards shocks. Obviously, the resulting multiplication of gross earmarked loan loss provisions by a factor of 2.74 is an imprecise but most probably still conservative measure of additional provisioning being necessary in an economic crisis. We use this as a basis for two calculations that give a rough idea what could happen to German banks under such circumstances.

For this purpose, we place these banks into a severe economic crisis like Thailand's situation of 1997/98. This is defined by increasing the banks' gross earmarked provisions – which relate to a quite balanced business cycle situation during the years 1995 to 1999 (see Figure 4) - by a factor of 2.74 and leaving everything else equal. As can be seen from Figure 7, an economic crisis like the one Thailand had experienced will probably turn profitability at many German banks into severe losses.

**Figure 7: Profits of German banks before and after a severe shock**
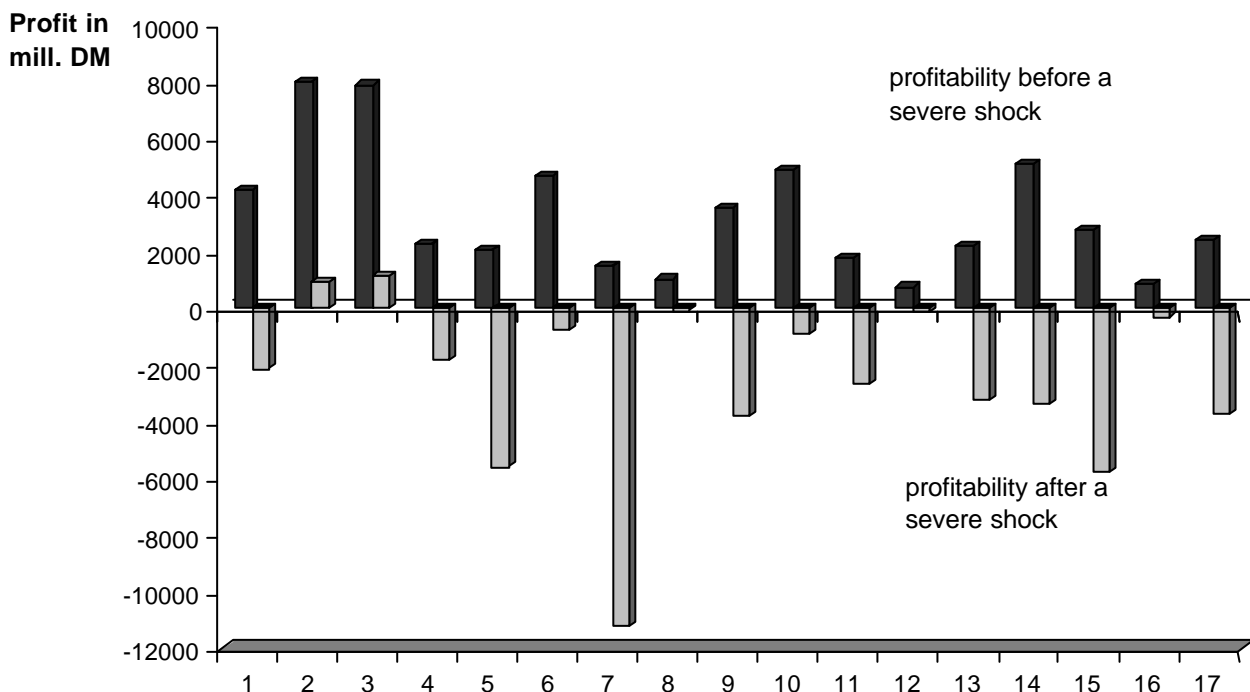
Notes: Data are for five big German banks during the time period 1995-1999 and 1997-1999 respectively. The shock is designed to simulate the impact from Thailand's macroeconomic recession in 1997/98.

Hidden reserves may be able to compensate losses which occur in one year, but general loan loss reserves will be exhausted if losses of the indicated dimension accrue over several years. What may be even worse is the fact that in several cases these losses can be high enough to pull the regulatory capital below the adequacy norm as shown in Figure 8. Note that the existence of general loan loss provisions does not cushion the decline in the equity ratio because they are already included in the regulatory equity capital.

Figure 8: Equity capital ratio of German banks before and after a severe shock
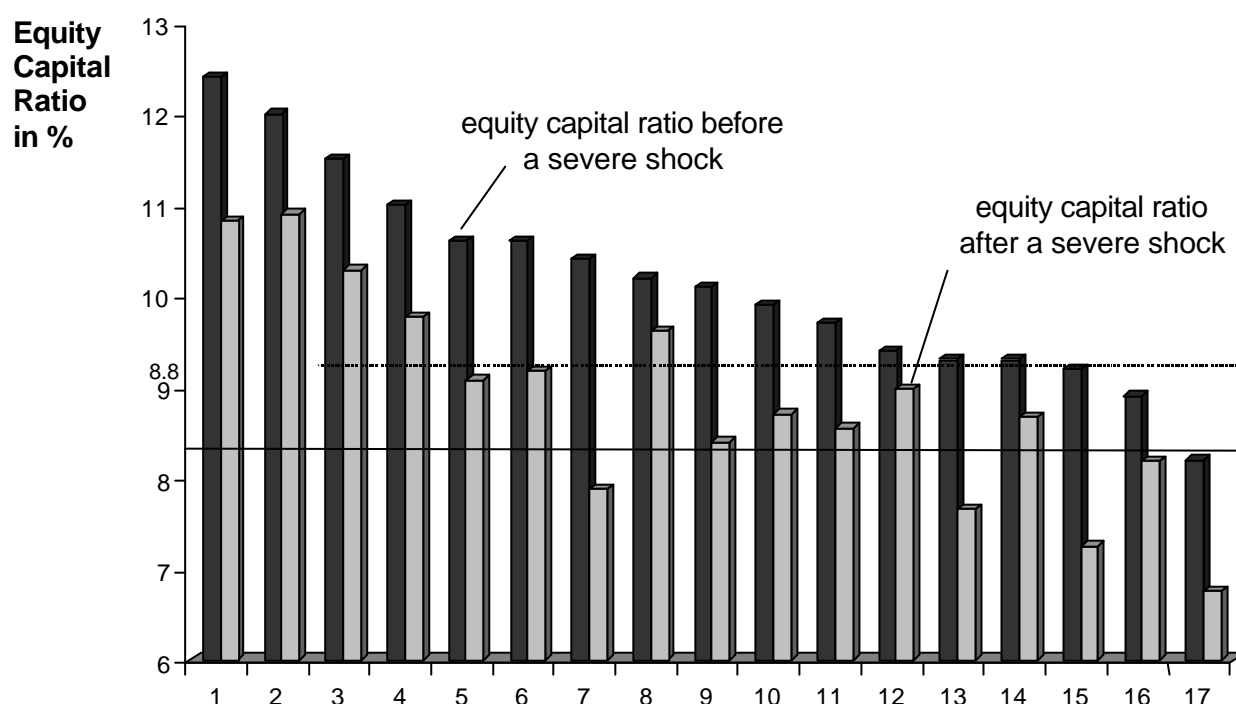
Note: For data description see Figure 7. The equity capital ratio is published either according to the international Bank for International Settlements-standard or according to the slightly tighter German standard.

In addition to this rough calculation there are three further effects which will influence the final outcome of such an economic crisis: on the positive side, banks can possibly counteract these developments by increasing their interest rate spreads and their capital base. However, a crisis is probably not the best time for such measures. There are, moreover, two sources of negative influences to be taken into account, i.e. problems being positive correlated to; first, the loan losses and second, feedback effects. Regarding loan losses, there are three aspects to be considered:

- a massive decline in the GDP will also lower the market values of other financial assets due to downgradings or defaults leading to additional provisioning;

- other elements of profitability are positively correlated with loan losses, such as provisions' income and trading profits (these other elements are sometimes more important than net interest income);

- taking into consideration that a decline in the GDP will not only cause an increase in the losses in the following year, but also in future years, one can imagine that the amount of hidden reserves will not suffice to cover the losses.

Apart from these additional strains on profitability, there are three feedback channels which may be responsible for a further decline of the financial sector's health:

- shortages in regulatory capital will force banks to sell assets, leading presumably to further losses;

- a substantial part of bank lending is inter-bank lending thus creating the danger of contagion;

- it is not clear how the depositors will react if huge losses become public. Although bank deposits are almost completely protected by the German deposit insurance system it is obvious that the reserves of the deposit insurance system will not suffice to cover the losses in the case of a crisis of the whole banking system.

To summarize the discussion, German banks are better armed to withstand a disastrous economic development than Thai banks, but nevertheless the stability of the German banking system would be severely challenged by an economic crisis like the one Thailand had to cope with.

6 Conclusions

It is the purpose of this paper to empirically estimate the impact that a tighter prudential regulation of Thailand's banks would have had on the crisis. Therefore, as a first step, the difference in regulation between Thailand's practice before the crisis of 1997 and a tighter international standard has to be identified. This is the basis for learning about the amount of missing equity capital or – as the flip side – the oversupply of credits. If regulation had been stricter, it seems plausible to assume that credit extensions would have been less dynamic, investments and growth lower, and in the end the asset bubble less severe. The question is: what is the quantitative importance of this argument? Our calculations indicate an effect which is rather modest and may be in the order of a cumulated decrease in growth over five years of about 5%. This slight flattening of the boom is then consequently not able to decisively moderate the bust and thus the breakdown of banks in a relevant manner.

If we change the perspective and ask what would have happened to the banks in an economy if the macroeconomic facts of Thailand's crisis had affected that country, the expectation is quite clear: there is a high probability that this economy would see a most severe financial crisis. Our calculations for the German case do indeed indicate that many banks might run into deep trouble. However, the safety net of tighter regulation appears to be working to some degree, as there is a good probability for many banks to survive such a shock in reasonable financial health.

Obviously, these results need some methodological qualifications. First, the available data are often proxies for the data one would actually like to have but which are not available. Second, we have applied structural relationships of a 20 or 40 year base period to an out of sample period which may be problematic in the light of structural breaks. Third, the elasticities being estimated have to be based on rather normal economic cycles and thus cannot really inform about economic behavior in a deep crisis. Therefore, on the one hand, the results have to be interpreted carefully. On the other hand, there is hardly any alternative to the approach chosen if we want to learn about the consequences of policy alternatives. In this respect, we feel that the analysis provides four messages which may be interesting also for other situations:

- Tighter prudential regulation would have been useful for Thailand's banks as it helps to cool the bubble, although unfortunately only a little bit, and as it makes financial institutions much more robust in the case of an economic crisis;

- The analysis shows that tightness of regulation can become relevant on a level below a superficial application of the Basel Accord, an aspect of particular relevance in developing economies. The formal application should be complemented by

appropriate standards, e.g. regarding NPLs, and by strict and transparent accounting practices;

- The present regulatory framework has two major limitations important for the Thai case: exchange rate risk passed on to customers can backfire in the form of later credit risk and maturity mismatch can be dangerous in connection with volatile capital flows and an open capital account.

Prudential regulation is not designed to save banks in case of a dramatic macroeconomic crisis. Thus, prudential macroeconomic policy is a necessary precondition for financial institutions to flourish in the long run, which should complement the microeconomic reforms highlighted in the present discussion.

Annex   Details on the Prudential Regulation Calculation of Thailand's Commercial Banks' Credit Risk

The calculation of Thailand's commercial banks credit risk based on external sources only necessarily involves some uncertainties. These have been dealt with in the following way:

- The total amount of claims on non-financial enterprises that receive only a 20% weight cannot be taken directly from the statistics available. In fact, the credit extended to public enterprises from the Monthly Bulletin (Table 7) is much lower than credit extended only to public utilities (Table 13). As a most conservative approach, the former credits are regarded as being part of the latter, thus probably underestimating the amount of claims on public enterprises in different forms. Furthermore, commercial banks also seem to hold larger amounts of bonds than assumed in our Table 4 (see the Monthly Bulletin Table 30 and the figures provided below). If the second qualification were fully appropriate, it would refer to 49.5 bn. Baht of securities which are weighted in our calculation with 100% instead of 20%, thus falsely overestimating risky assets by about 40 bn. Baht.

- Furthermore, many of the claims against public enterprises appear to be guaranteed by the Ministry of Finance, which makes them then equal to sovereign debt, receiving a risk weight of 0. According to the Monthly Bulletin, Table 30, commercial banks in December 1996 were holding state enterprise bonds, guaranteed by the government, of 126.7 bn. Baht and a non-guaranteed volume of 21.0 bn. Baht. Note that the volume of guaranteed bonds alone is higher than the total guaranteed volume assumed in our Table 4.

- Whereas both qualifications above seem to indicate an overestimation of risk weighted assets in our calculation, there is also the opposite possibility. In particular, claims on banks have been weighted with 20%, which would not apply to all claims from banks whose home base is in the region. However, credits to all commercial banks, whether they are incorporated in, or outside of the OECD, are eligible for the favorable 20% weight according to Thai standards. Moreover, all loans to home buyers are weighted with 50%, although this would apply only to first mortgages or in the case of sufficient collateral. However, the two critical cases, i.e. certain claims on certain foreign banks and risky home buying loans, are rather marginal with regards to the volumes involved.

- In addition to credit risk from business on the balance sheet there are also off-balance sheet transactions, such as position-taking in derivatives. However, the overall depth of these markets in Thailand is rather low, the risk weights are extremely low compared with loans and there was no urgent need for commercial banks to conduct much derivatives business, as currency and interest rate risk was low in any case (see next section). So we can neglect these kinds of off-balance credit risks.

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