

# **The Role of Financial Sector Dynamics in Thailand's 1997 Currency Crisis**

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## **Abstract**

In 1997, several East Asian countries have been hit by a currency crisis, despite the absence of the policy conflict between financing a government deficit and maintaining a pegged exchange rate that is assumed to be the cause of such a crisis by early theoretical models. As a result, new currency crisis models – so called “3<sup>rd</sup> generation models” – have been developed that see a currency crisis as the result of a financial crisis. Which subgroup or combination of subgroups of these 3<sup>rd</sup> generation models is most suitable to explain recent crises is subject to ongoing research.

This paper tries to contribute to the understanding of the causes of currency crises by examining financial sector dynamics. Thailand that was hit by a financial crisis followed by a currency crisis in 1996/97 is used as a case study. The study consists of two parts:

1. an analysis of Thailand's domestic financial sector and
2. an analysis of the behaviour of international investors in the context of Thailand's financial sector problems.

The findings suggest that Thailand's currency crisis was caused by its domestic financial crisis as assumed by one strand of 3<sup>rd</sup> generation models: The domestic financial sector problems seem to have triggered the withdrawal of international capital that led to the collapse of Thailand's exchange rate regime. The financial crisis in turn appears to have been the result of an economic deterioration, following a period of overlending by national financial institutions as well as international investors and overinvestment. Furthermore, the empirical evidence indicates that international investors were euphoric and irrational before the currency crisis as they only started to withdraw capital when Thailand's financial sector trouble was clearly reported by the international press.

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## **Introduction**

### **1.1. Theoretical Background**

Over the past two decades, several developed as well as developing countries have been hit by currency crises. Recent examples involving developing countries include Mexico 1994/95, East Asia 1997 and Russia 1998. Since these currency crises usually have huge negative effects not only on the economy where they occur but due to globalisation on other economies as well, it is important to understand the dynamics of such crises in order to find policy implications that help to prevent similar crises in the future. Several models are available to explain currency crises.

So called “first generation models” that are based on an explanation approach by Krugman (1979) and the extension of his model by Flood and Garber (1984)<sup>1</sup> view currency crises as the result of a speculative attack on a country’s pegged currency. The speculative attack is triggered by the knowledge that the pegged exchange rate cannot be maintained due to a lack of reserves following expansionary monetary policy to finance a public sector deficit. In modern versions of this framework, the assumption that market participants *know* that the peg cannot be maintained under the current policy framework is replaced by the assumption that market participants *expect* future policies to be inconsistent with the peg.<sup>2</sup>

However, both first and second generation models do not seem to be appropriate to explain the most recent crises because the policy conflict (i.e. between financing a government deficit while maintaining a pegged exchange rate) causing the crisis was not present in either East Asia or Russia.<sup>3</sup> Therefore, a new generation of models developed, seeing a currency crisis as the result of a financial crisis. Among these “third generation”<sup>4</sup> models, two general approaches can be distinguished. One approach is global and sees the origins of the financial crisis in international financial markets; the other approach blames the domestic financial sector for the crisis. Both approaches can be divided further into two subgroups: one based on moral hazard, the other one based on uninformed market participants.

#### ***Global Approach Based on Moral Hazard***

In this approach, that is, for example, described in a model by Dooley<sup>5</sup>, the crisis is caused by moral hazard among international investors. As long as deposits in a country are insured by the government and thus, offer attractive yields (as the downside of investment is limited), international investors invest heavily in that country, without paying attention to the riskiness of their investments. As soon as insurance liabilities become too high, however, and the

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<sup>1</sup> Agenor & Montiel (1996), Ch. 6.

<sup>2</sup> Dooley (2000).

<sup>3</sup> Dooley (2000).

<sup>4</sup> Eichengreen (1999).

<sup>5</sup> Dooley (2000).

government runs out of funds to sufficiently insure deposits, large capital inflows are reversed into large capital outflows. This results in a financial crisis and devaluation.<sup>6</sup>

### ***Global Approach Based on Uninformed Investors***

This view is taken, for example, by Radelet & Sachs.<sup>7</sup> According to this approach, an economy becomes vulnerable if financial reforms are biased towards liberalising inflows of short-term international capital without putting appropriate regulative measures into place. The crisis is the result of a collective action problem that emerges due to adverse information.<sup>8</sup> It starts as international creditors' expectations about the behaviour of fellow international creditors shift and they commence to withdraw liquidity. Consequently, illiquid but solvent borrowers are unable to obtain funds in international capital markets.

In both subgroups of the domestic approach, the following sequence of events leads to the currency crisis: overlending by national financial institutions as well as international investors causes an asset bubble and vulnerability among domestic financial institutions, the vulnerability being attributable to risky loan portfolios, substantial maturity mismatches and unhedged foreign exchange and interest rate positions. As economic conditions change<sup>9</sup> the asset bubble bursts and financial intermediaries' portfolios deteriorate, leading to a domestic financial crisis. Formerly irrational international investors pick up these negative signals<sup>10</sup> and withdraw capital, thus causing a currency crisis. As a result of the currency crisis and capital withdrawal, financial intermediaries' problems increase further due to unhedged currency exposure and maturity mismatches.

It should be emphasised that both subgroups of the domestic approach do not associate international investors with moral hazard.<sup>11</sup> The difference between the two subgroups lies in the motivation behind the overlending behaviour of domestic financial intermediaries:

### ***Domestic Approach Based on Moral Hazard***

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<sup>6</sup> Compare Nagel (2000).

<sup>7</sup> Nissanke (1999).

<sup>8</sup> Radelet & Sachs (1998).

<sup>9</sup> Examples for a change in economic conditions are an interest rates increase or a decrease in corporate returns on assets due to overcapacity. The interest rate example is provided by Minsky (1978) and Allen (2000). The causality chain following such an event may be explained as follows: A rise in interest rates increases cash flow commitments for borrowers. As a result, vulnerable borrowers may have trouble to service their debt (with floating rate contracts) or to refinance themselves and have to sell assets. This leads to the burst of the assets bubble.

<sup>10</sup> E.g., according to Palma (1998), international investors reversed their capital inflows following the collapse of Thai banks and Korean corporations (the failure of the corporations could be seen as a deterioration of bank portfolios).

<sup>11</sup> E.g., see McKinnon & Pill (1998), p. 1279 ('loss of confidence' among international investors) and Palma (1998), p. 790 (international agents did not have the capacity to 'evaluate risk properly' due to competitive pressures in a 'buyers market').

According to the moral hazard subgroup that can be based on, for example, Miller & Luangaram and McKinnon & Pill, domestic financial intermediaries are aware of projects' riskiness but have no incentive to either maintain a low risk portfolio or to hedge their exposure because bankruptcy is no real threat. There are two possible explanations for this: a) financial intermediaries have a low equity base so that their downside is limited and losses occur at the expense of creditors and depositors<sup>12</sup> and b) bailout promises are in place that lead domestic financial intermediaries to view investment projects in a distorted way and ease lending conditions. The propensity of domestic financial institutions to overlend is fuelled by the availability of international capital.

### ***Domestic Approach Based on Uninformed Investors***

This subgroup is based on Minsky and Kindleberger. In contrast to the domestic moral hazard approach, financial institutions do not have the necessary information or do not possess the ability to proceed available information to assess riskiness of loans/investments successfully. Instead, economic success causes euphoria not only on the international investor side but also among domestic financial intermediaries.<sup>13</sup> This leads to overlending, the endogenous development of an asset bubble and vulnerability among domestic financial institutions.

## **1.2. Objective and Structure**

As shown above, third generation models see currency crises as a result of financial crises, caused either primarily by the behaviour of international investors or primarily by failure of the domestic financial sector in connection with excess international liquidity. In both explanation approaches, moral hazard could play a role. Which approach is most suitable to explain recent crises and serve as a base for policy implications is subject to further research. It is possible that the causes for currency crises are far more complex than outlined by the models above. For example, recent crises might be best explained by a *combination* of different third generation models. Furthermore, it is possible that factors such as the institutional framework<sup>14</sup> or political events play a role in the development of currency crises.

The objective of this paper is to contribute to the understanding of the causes of currency crises by examining financial sector dynamics that possibly led to the withdrawal of international capital. Hereby, Thailand – one of the most affected countries in the East Asian crisis<sup>15</sup> - is used as a case study and empirical findings are analysed with respect to the third generation models presented above. The case study focuses on two aspects:

1. Thailand's domestic financial sector.

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<sup>12</sup> Miller & Luangaram (1998). Compare also Stiglitz & Weiss (1981) who state that the downside of debt financed projects is limited to the collateral which may give rise to moral hazard.

<sup>13</sup> Palma (1998), Minsky (1978).

<sup>14</sup> Minsky (1978), p. 138.

<sup>15</sup> Chinn (1999).

2. the behaviour of international investors in Thailand.

Political events and institutional issues will not be specifically investigated as this would go beyond the scope of this paper.

The remainder of the paper is organised as follows: part 2 presents the analysis of the domestic financial sector, preceded by a brief presentation of the macroeconomic context in which financial intermediaries operated at the eve of the crisis in order to evaluate whether there were signs of a change in market conditions<sup>16</sup> and a bubble burst. In part 3, an event study is used to examine the reaction of international investors to bad news about the Thai financial sector and some real sector news that may be a sign of deterioration of financial intermediaries' portfolios. In part 4, the conclusion of this paper based on the empirical findings of the case study is presented and areas for further research are highlighted.

## **2. Thailand's Financial Sector in the 1990s**

### **2.1. Macroeconomic Context**

Thailand's economic performance in the 1990s before the crisis was "impressive"<sup>17</sup>: its economy was characterised by investment and export led growth with GDP growth rates of 8-9% between 1991 and 1995, and 5.5% in 1996. At the same time, the government ran a budget surplus, inflation was relatively low between 3.4% and 5.9%, and the savings rate was high at just over 30% of GDP.

Despite this strong performance, Thailand experienced domestic financial sector problems that became evident through "irregularities"<sup>18</sup> at the Bangkok Bank of Commerce in May 1996 and climaxed<sup>19</sup> in the suspension of operations of 16 Finance Companies in June 1997.<sup>20</sup> Additionally, Thailand was hit by a currency crisis in the second half of 1997: as the baht came under severe pressure in the second quarter of 1997, central bank reserves declined by 15.6% from 985.5 billion baht at the end of March to 831.4 billion baht<sup>21</sup> at the end of June.

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<sup>16</sup> Not much attention is paid, however, to interest rate changes as in Thailand, interest rates were used as a policy instrument (Baig & Goldfajn, 1998). They did not change automatically subject to market conditions as in Minsky's model. Thus, rather than causing the crisis, they may be seen as the response to disturbances.

<sup>17</sup> Miller & Luangaram (1998).

<sup>18</sup> Financial Times, 11.05.96

<sup>19</sup> The crisis was not over in June 1997 and may have been even worse afterwards. However, until the suspension of operations, the crisis was independent of any currency depreciation. Since the focus of this paper is the *cause* of the currency crisis, only the financial sector problems before the currency crisis are of interest.

<sup>20</sup> Financial Times, various issues.

<sup>21</sup> Source: IFS (net foreign assets of central bank = line 11 – line 16c).

Consequently, the government abandoned the baht's effective peg<sup>22</sup> against the US dollar on July 2<sup>nd</sup> and adopted a managed float as a currency regime. This resulted in a strong depreciation of the baht and economic depression: the baht lost 23% against the US dollar in July 1997 alone and 115% between July 1997 and January 1998 when the currency reached its lowest value against the dollar (see graph 2). GDP growth became negative (see table 1).

This twin crisis may seem surprising in the context of Thailand's strong economic growth. Additionally, the absence of a government deficit and the relatively stable level of central bank reserves until the second quarter of 1997 (see graph 1) is at odds with first and second generation models of currency crises.

However, Thailand's economy was not as sound as its strong growth performance suggested. Following a real appreciation of the dollar in 1996 against the yen and several European currencies (and thus, a real appreciation of the baht against these currencies), Thailand encountered a loss in external competitiveness. As a result, export growth – one of the drivers behind Thailand's economic success – fell from 25.1% in 1995 to –1.3% in 1996.<sup>23</sup> Furthermore, the building up of overcapacity indicated that overinvestment took place, meaning that the second driver of Thailand's growth – investment – was not sustainable, either. Even in 1995, only 80% of the economy's overall capacity was utilised. This ratio declined further in the following years until it reached 65% in July 1997. The overinvestment did not only result in overcapacity but in diminishing returns on investment as well: the average return on assets dropped from 3.69% in 1996 to 2.54% in 1996 and 1.51% in 1997.<sup>24</sup>

These problems were particularly pronounced in the real estate sector where vacancy ratios were very high (15% in business property in 1997<sup>25</sup>) and prices dropped sharply in early 1997.<sup>26</sup> The drop in real estate sector prices could be interpreted as an asset bubble burst. The finding that overinvestment and the following price decline were problems especially of the real estate sector was reflected in the development of the sector's share prices that at first rose much stronger than the general share price index (395% rise in real estate sector share price index vs 175% rise in general share price index between 1990 and 1993) and then lost much more value than other sectors (73% vs 51% between 1993 and 1996).<sup>27</sup>

The deterioration of economic conditions described above, especially the bubble burst of real estate sector prices, could have caused the financial sector crisis if financial intermediaries were vulnerable (which will be examined in section 2.3.) because investments were largely

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<sup>22</sup> See IIE (?): After being pegged solely to the US dollar, the baht was fixed to a basket of currencies of Thailand's major trading partners from 1978 on. However, despite the basket, close links to the US dollar were maintained => 'virtual' peg.

<sup>23</sup> Radelet&Sachs (1998).

<sup>24</sup> Numbers on return and utilisation: Corsetti et al. (1998) and IMF (2000).

<sup>25</sup> Corsetti et al. (1998).

<sup>26</sup> Miller&Luangaram (1998).

<sup>27</sup> Corsetti et al. (1998).

debt financed by domestic financial institutions. The average debt/equity ratio for Thai corporations increased from 1.54% in 1994 to 2.18% in the first half of 1997 which can be considered as high: the ratio in the US, for example, is just below 1.<sup>28</sup> This overlending was encouraged by the liberalisation of Thailand's financial system that had started in 1990. The liberalisation facilitated foreign capital inflows to financial institutions that could then be channelled through to corporations.

That Thailand's investment was at least partly financed by foreign capital inflows is confirmed by the fact that Thailand ran a large current account deficit - averaging 7% of GDP between 1990 and 1996<sup>29</sup> - but central bank's foreign reserves remained relatively stable during this period (see graph 1). Apparently, the largest part of Thailand's capital inflows was foreign debt (the average proportion being roughly 70.9% in the period from Q2 1996 to Q1 1997) and a large part of this debt was short term (40% - 50% in 1996 and 1997 before the crisis, see graphs 3 & 4).

A current account largely financed by debt is sustainable as long as international investors are convinced that the country can repay its debt in the future<sup>30</sup> and thus, maintain capital inflow levels. However, as soon as this conviction changes (for one of the reasons outlined in the third generation models, e.g. insufficient deposit insurance, expected withdrawal of funds by fellow international creditors or deterioration of the financial sector), international investors will start to decrease inflows or even withdraw capital which - in the case of a maintained large current account deficit - can lead to a currency crisis. This is what appears to have happened in Thailand: net capital inflows peaked in Q4 1996 and then started to decline.<sup>31</sup> In the second quarter of 1997 - coinciding with the pressure on the baht and the decline of central bank reserves that resulted in the collapse of the currency regime- net capital flows became negative (see graph 5). The capital outflows could have been the result of capital flight by domestic agents as well as international investors. However, since Thailand received substantial inflows of foreign capital before the crisis that financed its current account deficit, and since a large proportion of these inflows was short term and thus, easily reversible, it is likely that the largest part of outflows was due to capital withdrawal by international investors.

## **2.2. Objective and Methodology of Examining the Financial Sector**

In section 2.1., it was illustrated that several of the conditions which - according to the domestic approach of 3rd generation crisis models - lead to the withdrawal of foreign capital

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<sup>28</sup> IMF (2000).

<sup>29</sup> Corsetti et al (1998). The article states that a CA deficit above 5% of GDP should be subject of 'close attention'.

<sup>30</sup> Sachs & Larrain.

<sup>31</sup> Not only net capital outflows can put pressure on the exchange rate of a country running a current account deficit but declining net capital inflows as well if the current account deficit does not decline at the same time.



and consequently, a currency crisis, were present in Thailand's economy: overlending by national and international investors, overinvestment, a deterioration in economic conditions and a crisis in the domestic financial sector.

Keeping in mind that the focus of this paper is the cause of Thailand's currency crisis, the objective of the remainder of part 2 is to examine:

1. whether financial institutions were vulnerable to a deterioration in economic conditions because the *presence* of diminishing returns (affecting loan service ability of corporations) and a bubble burst (affecting collateral) does not necessarily mean that they were the *cause* of the financial sector problems in 1996/97 as theory suggests. The finding of vulnerability among financial institutions would also indicate the *possibility* of moral hazard among international investors: In case they knew about the weakness of the financial system but lent to Thai financial institutions anyway, this could be interpreted as moral hazard.
2. whether there could have been moral hazard among domestic financial institutions.
3. whether Thailand's financial sector problems could have caused its currency crisis. Section 2.1. stated that foreign capital inflows to financial institutions took place. It has to be analysed, however, whether these were significant enough to affect the value of the baht and whether they were reversed at the eve of the crisis.

Points 1 and 2 will be analysed by looking at publicly available consolidated data for commercial banks and finance companies. These two groups were the most dominant among Thai financial intermediaries, accounting for roughly 70% and 20% of total assets in the sector, respectively.<sup>32</sup> They were also the two groups where the financial sector problems in 1996/97 occurred.<sup>33</sup>

The main data source for banks is the "Banking Statistical Supplement" for Thailand by Moody's Investor Service (various issues). From income statement and balance sheet data for individual banks provided, average data will be calculated by weighing banks according to the ratio of their assets to total assets. Although not all commercial banks are included in the supplement, the numbers obtained are considered to be representative as 12 out of Thailand's 15<sup>34</sup> domestic commercial banks are covered. The analysis will look at ratios providing information on profit, non-performing loans (NPL), capitalisation and banks' main business to find out how vulnerable banks were. Furthermore, a ratio for new loan loss provisions will be examined. Together with the capital ratios, it can indicate whether there may have been moral hazard among domestic banks. Last, it will be analysed whether banks were illiquid.

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<sup>32</sup> IIE (?). The numbers are for 1992. However, lacking more up-to date numbers, the author assumes that the weight in the financial sector has not shifted significantly between 1992 and 1997.

<sup>33</sup> Financial Times, various issues.

<sup>34</sup> IIE (?). 'Total assets' in the ratio used for bank weights does not refer to the assets of all 15 banks but to the assets of the 12 banks covered by Moody's.

Illiquidity does not necessarily signify that banks were vulnerable to a deterioration in economic conditions. However, it does mean that initial problems in the banking sector can lead to even greater desire among investors to withdraw funds if they expect that fellow creditors will not roll-over short term bank debt due to the initial problems.<sup>35</sup> A detailed description of the ratios used in the analysis can be found in APPENDIX I.

Moody's supplement provides annual data only. This is useful in order to reach the objectives of this section. However, monthly data would illustrate the role of banks in Thailand's currency crisis even further because it could show whether the start of the bank problems (reflected by a deterioration in banks' financial statements) coincided with the bubble burst and because it would allow to separate the effects of Thailand's economic downturn and the currency crisis. Unfortunately, detailed monthly bank data could not be obtained within the time frame of this thesis (it may not be publicly available at all).

Analysing data for finance companies is problematic because only limited information is published. The best source found for finance company data is the Bank of Thailand's "Quarterly Bulletin" (various issues). It provides some consolidated monthly information on capitalisation and finance companies' main business which can indicate the companies' vulnerability to the deterioration of economic conditions to some extent. An advantage is the monthly availability of the data.

Very little loan portfolio information is publicly available for either group of financial intermediaries. The only data on loan portfolio composition by sector found by the author for each group was their exposure to the real estate sector, published in the IMF February 2000 country report on Thailand. This information can be used to specifically examine the financial sector's vulnerability to the burst of the asset bubble in real estate/land prices.

Point 3 in the objective will be addressed by looking at Thailand's external debt. Data source is the Bank of Thailand's "Quarterly Bulletin" (various issues). A high ratio of financial sector debt to total external debt and a declining level of external financial sector debt in 1997 may indicate that the financial sector was indeed responsible for the currency crisis, as suggested by the domestic approach of 3<sup>rd</sup> generation models.

## **2.3. Evaluation of Financial Sector Data**

Table 2 presents the consolidated ratios for Thailand's commercial banks (ratios for individual banks can be found in APPENDIX II).

The analysis focuses on the period 1993 – 96, i.e. the time before the financial crisis became full blown and the currency crisis occurred. Data for 1997 and 1998 is provided mainly for general information.

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<sup>35</sup> Collective action problem, see Radelet & Sachs (1998).

### ***Profit Ratios***

The profit ratios in table 2 indicate that Thailand's banking sector was generating relatively strong profits. For example, a pre-provision return on average assets above 2% can be considered as high<sup>36</sup> and compared to the same ratios of two commercial banks in industrialised countries, Abbey National (Great Britain) and Commerzbank (Germany)<sup>37</sup>, the ratios for Thailand's banks are more favourable (compare tables 2 & 3).

One reason for Thai banks' relatively strong profit could be that they faced little competition: Between 1978 and 1998, no new banks were allowed to enter the market in Thailand so that existing banks could earn "oligopoly profits".<sup>38</sup>

The analysis of this group of ratios suggests that Thai banks had some flexibility to withstand a decline in earnings and/or the need to increase provisions.

### ***NPL Ratios***

According to the ratio NPL/gross loans in table 2, the banking sector's proportion of non-performing loans seems to be reasonably low. The ratio NPL/(provisions + equity) confirms this impression as it indicates that before 1997, all non-performing loans in the sector could have been written off without running down the capital base completely, i.e. causing insolvency. As expected, a slight deterioration of these ratios is visible in 1996, the start of the financial crisis. The ratio of NPL/provisions, however, is less favourable: the fact that NPL are roughly three times the amount of provisions signifies that in case that all NPL have to be written off, the capital base will decrease substantially.

Conclusions based on the NPL ratios have to be drawn with extreme caution: due to a lax regulation in Thailand regarding NPL classification before July 1998<sup>39</sup>, the true ratios could be much worse. Additionally, only few banks (3-4) are included in the average before 1996, so the numbers before 1996 may not be representative for the sector.

Keeping these limitations in mind, the NPL ratios indicate that the banking sector was in no immediate danger before the bubble burst but vulnerable to an economic deterioration which would increase NPL levels, lead to a write-off of existing NPL and thus – as the ratio of NPL/provisions was high – cause a decrease in equity.

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<sup>36</sup> Interview Ms Richter, Deutsche Bank.

<sup>37</sup> Abbey National and Commerzbank were chosen for comparison because they are commercial banks with a relatively high percentage of loans in total assets, similar to the Thai banks. However, the comparison is still only indicative and can merely provide a rough idea because conditions under which Thai banks operated were very different from Great Britain and Germany. Additionally, Abbey National's and Commerzbank's numbers for 1997 and 1998 might be influenced by the crisis in Asia and Russia and thus, slightly negatively biased.

<sup>38</sup> IIE (?).

<sup>39</sup> IMF (2000). See APPENDIX III for loan classification regulation and provision requirements before and after July 1998.

### ***Capital Ratios***

According to the average risk weighted capital (RWC) ratios, Thailand's banking sector does not seem to have been undercapitalised, neither before the crisis years nor during the crisis years. From 1994 on, the ratios were always well above the 8% minimum required by the Basle Capital Accord that applied to Thailand from 1995 onwards<sup>40</sup>. However, some criticism has to be made: first, although compliant with requirements, the ratios still appeared to be below the ratios of banks in industrialised countries. The average ratio for major banks in G-10 countries, for example, was 11.2% in 1996.<sup>41</sup> This should be alarming because sufficient capitalisation is much more important for banks in developing countries than for banks in industrialised countries as developing countries are more prone to a deterioration in economic conditions like the one effecting Thailand in 1996/97.<sup>42</sup> Second, Thai ratios could be biased upwards due to the lax classification of NPL which artificially increases the capital base.<sup>43</sup> Third, the numbers before 1996 may not be representative for the sector because only 2-4 banks are included in the average. Last, critic can be raised about the usefulness of RWC ratios because risk weight requirements may be too general. For example, "loans fully secured by mortgage on residential property that is or will be occupied by the borrower or that is rented"<sup>44</sup> are risk weighted with 50% across countries without taking specific country conditions – such as the existence of an asset bubble in the property market – into account.

Considering this last criticism, equity/total assets seems to be better suitable to provide information on the capitalisation of Thai banks. It could even be considered as their "true" RWC ratio. Since all 12 covered by Moody's banks are included in the average and there are no outliers<sup>45</sup>, equity/total assets is also more representative for the sector than RWC. Average equity/total asset ratios are below the 8% minimum for RWC throughout the 1990s, indicating that capitalisation of the Thai banking sector was low. From this information, it can be concluded that a) Thai banks were vulnerable to a deterioration in economic conditions as they were in danger of insolvency in case many loans had to be written off and b) the overlending by Thai banks could have been a result of moral hazard as the downside of investment pay-offs was limited.

### ***Provision Ratio***

A provisions (= new provisions)/pre-provision income ratio of well below 20% throughout the period 1993-96 seems low, especially considering the high NPL/provisions ratio of Thai

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<sup>40</sup> IIE (?). BIS guidelines were introduced in Thailand as early as 1993 but there was a transition phase until 1995 during which ratios below 8% were still tolerated.

<sup>41</sup> BIS (1999).

<sup>42</sup> Moody's (1999b).

<sup>43</sup> See APPENDIX III: Banks might have still had loans on their books that should have been written off against equity.

<sup>44</sup> BIS (1988).

<sup>45</sup> Outlier for the purpose of this analysis is defined as: Any bank whose ratio deviates from the average by more than 100% (50% for capitalisation ratios) over at least 2 periods.

banks. The ratios for Commerzbank, in comparison, were above 40% in 1997 and 1998.<sup>46</sup> However, provisions may have been within the requirements set by Thai authorities: required provisions for NPL were 15% - 100% of the principal value (see APPENDIX III) and banks' existing provisions for NPL were around 30% (=> derived from NPL/provisions) between 1993 and 1997. Thus, it is inconclusive from the provision ratios whether or not there was moral hazard among Thai banks before the crisis. However, after the bailout of Thai banks during a banking crisis in the early 1980s, an implicit deposit insurance for Thai financial intermediaries existed,<sup>47</sup> possibly causing management to take on additional risk, i.e. causing moral hazard<sup>48</sup>.

### ***Main Business***

An average ratio net loans/total assets of over 80% for the period 1993-96 suggests that the main business of Thai banks was the provision of loans. Banks were, therefore, vulnerable to a deterioration in their loan portfolios, i.e. an economic downturn/bubble burst affecting debtors' earnings and the value of loan collateral.

### ***Liquidity Ratio***

The liquidity ratios for the banking sector were low at around 30% in 1993-96. However, the numbers in table 2 are not representative because out of 11 banks included in the average, 4 banks were well below the average (around 15% in 1993-96) and 3 banks well above (above 80% in 1993-96). Thus, the information provided by these ratios is inconclusive: some banks might have been prone to a collective action problem, others not.

As stated in the IMF country report, the exposure of the banking sector to the real estate sector was relatively stable around 23% from 1993-1997. This relatively high exposure indicates that the banking sector was vulnerable to Thailand's bubble burst in real estate prices.

Table 4 presents consolidated data for Thai finance companies for the period 1995-1997. The ratio equity/total assets for finance companies was relatively high at around 12-13% for the period 1995-97, especially compared to the same ratio for banks which was below 8% for the same period. This is surprising because finance companies were hit much worse by crisis than banks and were even at the brink of collapse in 1997.<sup>49</sup> It is possible that the data is not viable.<sup>50</sup> Additionally, it cannot be seen from the data provided by the Bank of Thailand whether the consolidated numbers are representative for the whole sector or whether they are upward biased because a few finance companies had very high equity levels.

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<sup>46</sup> Annual report available on the internet in August 2000 (i.e. 1998). One has to keep in mind, though, that the 1997 and 1998 numbers for Commerzbank could be biased slightly upwards due to the Asian and Russian crises.

<sup>47</sup> IIE (?).

<sup>48</sup> Eichengreen (1999).

<sup>49</sup> Financial Times, various issues.

<sup>50</sup> Moody's (1999b).

The consolidated loans/total assets ratios show that the main business for finance companies – as for banks – was loan provision. More than 30% of finance companies' loan portfolio consisted of loans to the real estate sector in the period 1995-97.<sup>51</sup> This suggests that finance companies – like banks – were vulnerable to a deterioration in economic conditions, especially an asset bubble burst in the real estate sector.

The composition of Thailand's foreign debt (see graph 6) shows that capital inflows to the financial sector were substantial. From Q4 1995 to Q2 1997, Thailand's foreign debt comprised to around 50% of Bank debt and BIBF<sup>52</sup> debt alone. Adding non-bank foreign debt (assuming it to be mostly debt to non-bank financial institutions) raises the proportion of financial sector debt to around 80%.

Graph 7 demonstrates that capital was withdrawn from Thailand's financial sector from Q2 1997 onwards. If non-bank debt is included, financial sector debt declined by 9,028 million US\$ between March and December 1997. Without non-bank debt, the decrease was still 6,150 million US\$. Both numbers appear to be large considering that Thailand's total net capital outflow was 7,942 million US\$ in the same period.<sup>53</sup> Given that Thailand experienced inflows in the form of rescue packages to Thai monetary authorities totalling 7,292<sup>54</sup> million US\$ between March and December 1997, one can assume that gross outflows during this time period were around 15 million US\$, provided that no other major inflows occurred simultaneously. Thus, the financial sector debt decline of 9,028 million US\$ accounted for nearly 60% of Thailand's capital outflows.

The analysis above suggests that Thailand's domestic financial sector crisis *could have* caused or at least played an important role in the origin of the currency crisis, because a significant proportion of the capital outflows leading to the collapse of the exchange rate regime came from the financial sector. However, these findings are no proof of causality.

It has to be kept in mind that all conclusions derived from financial sector data have to be viewed with caution as the numbers could be incorrect or incomplete.<sup>55</sup>

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<sup>51</sup> IMF (2000).

<sup>52</sup> BIBF = Bangkok International Banking Facility. The BIBF was set up in 1993 to facilitate inflows of foreign capital to the domestic financial sector. Under the BIBF, domestic banks were awarded licences to raise funds off-shore [IIE (?)].

<sup>53</sup> (263,245 million baht, converted at the average exchange rate for Q2, Q3 and Q4 1997 of 33.14 baht/US\$)

<sup>54</sup> BoT Quarterly Bulletin (1997).

<sup>55</sup> Moody's (1999b). Applies to data from developing countries in general.

### **3. Reaction in the FX Market to “Bad” Financial Sector News**

#### **3.1. Objective of Testing the Reaction to Financial Sector News**

Section 2.3. showed that both, Thailand's commercial banks and finance companies, were vulnerable to a deterioration in economic conditions to some extent before the twin crisis, indicated by a large proportion of loans among their assets, their exposure to the real estate sector and banks' relatively low capital base. Therefore, it is likely that the financial sector crisis hitting Thailand in 1996/97 was due to the country's economic downturn, especially the bubble burst in the real estate sector, as domestic approach of 3<sup>rd</sup> generation models suggests. Additionally, these findings give rise to the *possibility* of moral hazard among international investors. Evidence for moral hazard among Thailand's domestic banks, on the other hand, is inconclusive. Section 2.3. also showed that Thailand's 1997 currency crisis was – in accordance with the domestic approach – at least partly driven by capital outflows from the domestic financial sector.

The data presented in section 2.3. does not indicate, though, whether capital outflows (and eventually, the collapse of the exchange rate regime) were caused by the financial crisis as it is assumed in the domestic approach or whether they were initiated by another trigger. Furthermore, it does not provide any information on whether or not moral hazard among international investors, an element of the *global* approach of 3<sup>rd</sup> generation models, was actually present.

Thus, the objective of section 3 is to shed more light on the causal relationship between Thailand's financial crisis and its capital outflows/currency crisis in 1997 and to examine whether there were signs of moral hazard among international investors. This will be done by testing the reaction of international investors to negative financial sector news as well as some negative real sector news that could be a sign of financial sector trouble if financial institutions are vulnerable (e.g., problems among property companies). A reaction among international investors to this type of news in form of a decline or even withdrawal of capital flows could provide some evidence in favour of the assumption that a financial crisis caused the currency crisis. Additionally, a reaction to news about problems among corporations could be seen as a sign of moral hazard among international investors as it indicates that they might have known about the vulnerability of the financial sector but provided funds nevertheless.

#### **3.2. Methodology of Examining FX Market Behaviour**

It is important to not only examine in general whether international investors reacted to financial sector news in order to find out whether financial sector problems could have caused the currency crisis but to examine specifically what news international investors reacted to as

well in order to address the question of moral hazard among them.<sup>56</sup> Thus, an event study is conducted rather than a regression analysis.

One could examine the behaviour of international investors by looking at international capital inflows/outflows. However, an event study requires high frequency, preferably daily, data to test the impact of news - especially if news occur frequently as it is the case in this analysis (see table 5) - but only quarterly capital flow data is available. Therefore, exchange rate data for which daily quotes exist is used instead. The rationale behind using the foreign exchange (= FX) market to reflect international investors' behaviour is that - assuming the current account does not change accordingly - a change in capital inflows affects the demand and supply constellation in the FX market and thus, the exchange rate if the exchange rate is allowed to adjust to market conditions.

The problem with Thailand is, though, that before the currency crisis, the exchange rate was not largely determined by market forces but the baht was pegged against a basket of currencies (see footnote 23 in section 2.1.). Therefore, the behaviour of Thailand's international investors is not necessarily reflected in the baht spot rate. To circumvent this problem, the event analysis of this paper will look at the forward market. The forward rate is considered to indicate what the movements in the spot market resulting from international investors' behaviour would have been if market forces could have worked freely before the collapse of the exchange rate regime, based on the following assumptions:

- 1 The baht spot rate would follow a random walk if it was not pegged (equation 1), and the forward rate is the best predictor for the future spot rate (equation 2)<sup>57</sup>:

$$e_{t+1} = e_t + \varepsilon_{t+1} \quad (1)$$

$$\text{and} \quad f_{t(t+1)} = E_t(e_{t+1}) + u_t \quad (2)$$

$$\Rightarrow \quad f_{t(t+1)} \approx e_t \quad (3)$$

where  $e_{t+1}$  = the spot rate in period t+1

$e_t$  = the spot rate in period t

$f_{t(t+1)}$  = the forward rate in period t for period t+1

$E_t(e_{t+1})$  = the in period t expected spot rate for period t+1

$\varepsilon_t, u_t$  = random disturbances.

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<sup>56</sup> Did they react to real sector news possible affecting financial institutions? When did they start to react to negative financial sector news? Etc.

<sup>57</sup> Frenkel (1995).



2. Forward market participants expect that the peg cannot be maintained in the long run if the supply/demand constellation in the FX market changes significantly. This assumption is important because under a pegged exchange rate regime, the forward rate is not only determined by supply and demand in the FX market but additionally, by expectations about the sustainability of the peg.
3. Forward market participants use the market actively whenever the supply/demand constellation in the FX market changes significantly. This assumption is important because the forward market – unlike the spot market – does not *have* to be used for foreign currency transactions. It is especially relevant for Thailand as forward rate data for the baht does not exist on a continuous basis, implying that the market was not active daily.
4. The forward market is mainly used by international investors and thus, suitable to mirror their behaviour. This assumption is reasonable considering that Thai banks and corporations hardly hedged their foreign currency exposure.<sup>58</sup>

The analysis will concentrate on the 1-year baht/US\$ forward rate rather than examining the forward rate of the baht against all possible currencies because an additional assumption in this paper is that transactions of international investors involved mainly the exchange of US\$ against baht and vice versa.

Graphs 8 & 9 demonstrate that the choice of the forward market instead of the spot market is justified because they show that although spot and 1-year forward baht/US\$ exchange rates moved closely together 1996/97, changes in the latter were much larger than in the former before the collapse of the exchange rate regime.

In the existing literature, event studies have only been applied to measure the impact of events on capital markets. This application is described, for example, by MacKinlay and Campbell, Lo & MacKinlay. In this paper, MacKinlay's description will be used as a framework for the event study of the forward market. However, it has to be slightly adjusted because a) a different type of asset is subject of the examination and b) in this paper, the impact of different events on one asset is analysed whereas MacKinlay considers the impact of one type of event (e.g., M&A announcement) on different assets (e.g. stocks).

The six steps generally involved in an event studies, i.e.:<sup>59</sup>

- a. specification of events of interest
- b. specification of an event window
- c. specification of a benchmark for normal behaviour in the market
- d. specification of a measure for abnormal behaviour in the market

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<sup>58</sup> Miller & Luangaram (1998).

<sup>59</sup> MacKinlay (1997).

- e. specification of a test to test statistically whether there is a reaction to the event of interest in general
- f. calculation of the benchmark for normal and the measure for abnormal behaviour, conduction of the test, interpretation of the results

are as follows for the analysis of the baht/US\$ forward market:

a: The events of interest are: The release of negative financial sector news as well as negative news about the real sector that could negatively affect financial intermediaries by Thai authorities, Thai banks/corporations, international rating agencies, etc. Since the focus of this paper is the cause of the Thai currency crisis, the analysis will concentrate on this type of news before July 97. "News source" are all Financial Times (FT) issues between January 1<sup>st</sup>, 1996 and June 30<sup>th</sup>, 1997. 15 events of interest have been found (see section 3.3.) within this period, starting in May 1996.

b: An event window includes:

- the day of the event (*day 0*). It is assumed that the actual event day is one day prior to publication in the FT because the news of interest might have been released *after* the FT of the same day had been published. Nevertheless, it seems reasonable to include this day in the analysis because some investors might have received the news immediately after their release via information services such as Bloomberg or Reuters.
- the day after the event (*day 1*), i.e., the day of publication in the FT. This day is included because some international investors may have only found out about the event through the announcement in the FT rather than via information services.
- the first business day after FT publication (*day 2*). This day is included because some investors may have not had the chance to react on the same day they learned about the events of interest through the FT.<sup>60</sup>

c: The benchmark for normal behaviour in the forward market is the average daily change of the 1-year baht/US\$ forward rate in the 7-month period<sup>61</sup> *before* negative financial/real sector news started to be released in May 1996 (= estimation window). The *change* of the exchange rate is used as a variable rather than its level because it is better suited to demonstrate the impact of news when testing for abnormal behaviour: The level after an event, for example, could be high compared to the normal level but this could be the result of an earlier event. Using the *average* as a benchmark for normality follows from the statistical assumption that the normal change in the forward rate is stationary around a constant mean:

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<sup>60</sup> E.g., the relevant market may have been closed already or it may have taken time to prepare a reaction.

<sup>61</sup> The 7-month period is chosen because forward rate data is available from September 1995 onwards.

$$\Delta f_d = \mu + \phi_d \quad (4)$$

where  $\Delta f_d$  = the change of the 1-year baht/US\$ forward rate on day d

$\mu$  = the average daily change of the forward rate

$\phi_d$  = a stochastic, normally distributed disturbance with zero mean and constant variance.

d: The measure for abnormal behaviour is the daily abnormal change of the forward rate, defined as follows:

$$AN\Delta f_d = \Delta f_d - \mu \quad (5)$$

where  $AN\Delta f_d$  = the abnormal change of the forward rate on day d

$\Delta f_d$  = the actual change of the forward rate on day d

$\mu$  = the benchmark for normal behaviour.

Based on 3<sup>rd</sup> generation currency crisis models, abnormal changes within event windows of this analysis are expected to be significant and positive, signalling devaluation pressure on the baht as a result of negative financial sector news.

e: Statistical testing is used to examine whether forward market participants reacted in general to negative financial sector/real sector news between the start of the financial sector problems in May 1996 and the collapse of Thailand's exchange rate regime (i.e., the currency crisis) on July 2<sup>nd</sup> 1997.<sup>62</sup> Under the null hypothesis, the events of interest *do not* have an impact on the forward market, meaning that the  $AN\Delta f_d$  within the event windows are equal to the stochastic disturbances in equation (4), i.e., normally distributed with zero mean and a constant variance. The test statistic  $T$ <sup>63</sup> is:

$$T = \left( \overline{AN\Delta f_d} - 0 \right) / \sqrt{\text{estim.Var}} \quad (6)$$

where  $\overline{AN\Delta f_d}$  = the average daily abnormal forward rate change of the sample

0 = the "true" average daily abnormal forward rate change under the null hypothesis

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<sup>62</sup> Statistical tests allow for inference from a sample to the population. As it is not certain whether all negative financial sector news in the period of consideration are captured in the analysis, such tests are applicable here.

<sup>63</sup> Under the null hypothesis, T follows a t-distribution with n-2 degrees of freedom.

estim. Var = the estimated variance of  $\overline{AN\Delta f_d}$ <sup>64</sup>.

The results and an interpretation of the event analysis of the baht forward market (step f) are presented in section 3.3.

### **3.3. Evaluation of Event Study Results**

For the estimation window, i.e., the 7-month period before the events of interest started in May 1996, 62 observations of daily changes in the 1-year baht/US\$ forward rate are available (see APPENDIX IV); for the other dates, no changes can be obtained because no forward rate quotes exist<sup>65</sup>. The calculated daily average change for this period is  $-0.0098\%$ . Plotting these forward rate changes against time indicates that they are stationary around a constant mean of zero (see graph 10).

This observation is verified by statistical tests (see APPENDIX V), thus confirming the statistical assumption that the change in the forward rate without conditioning on an event of interest taking place is stationary, and suggesting that the benchmark for normal behaviour in the forward market is  $0\%$ . This implies that the abnormal change, defined by equation (5), equals the actual change of the forward rate.

Table 5 presents the events of interest as well as the abnormal changes of the forward rate in the event windows. The events of interest include 12 releases of negative financial sector news and 3 releases of negative real sector news (cursive font in table 5) that could be a sign of financial sector trouble if institutions are vulnerable. The total number of event window days is 43, i.e., 15 event windows @ three days minus two days due to overlaps of event windows around the events February 28<sup>th</sup> and March 3<sup>rd</sup>, 1997; and June 25<sup>th</sup> and June 27<sup>th</sup>, 1997 (in both cases, day 2 of the former equals day 0 of the latter). For these 43 days, 22 daily changes of the forward rate are available; for the remaining days, no changes could be calculated because either the announcement day in the FT was a Saturday or forward market data did not exist, indicating that the market has not been used.

Of the 22 daily changes observed in connection with the events of interest, 10 have the expected sign, i.e., they are positive, implying a loss in value of the baht in the forward market which is consistent with 3<sup>rd</sup> generation models, provided that the forward market does indeed reflect international investors' behaviour. Five of the 22 observed changes are significant (see shaded areas in table 5), i.e., they exceed  $\pm 0.35\%$ <sup>66</sup> and could be considered

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<sup>64</sup> Calculated as the variance of the forward rate changes in the estimation window divided by  $n-1$ , where  $n$  is the number of observations included in the sample. The true variance for  $\overline{AN\Delta f_d}$  is the variance of the disturbances in equation 4 divided by  $n$  (MacKinlay 1997). However, since this is unknown, an estimator is used. Hence, the t-distribution.

<sup>65</sup> This implies that the 1-year baht/US\$ forward market has not been used on these days.

<sup>66</sup> The threshold of  $\pm 0.35\%$  has been chosen because the largest change within the estimation window (i.e., normal times) is  $0.31$ .

as a “true” reaction to the news. Three out of these five changes are positive, i.e., in accordance with theory. These three significant positive changes in the 1-year baht/US\$ forward rate follow alarming news about Thailand’s financial sector that might be considered to be “more negative” than the other negative financial sector news. The forward rate did not change significantly after any of the real sector news.

The statistical test explained in 3.2. is conducted based on the 22 observed daily changes. Although it is assumed that no forward market data equals no reaction by international investors (see assumption 3, p. 26), the “n.a.” observations in table 5 are not entered as 0% changes into the formal analysis because this assumption may not hold. Including these days as a 0% change in the test could, therefore, decrease rather than improve the reliability of the test on international investor behaviour. The test result (see table 6) suggests that the null hypothesis of no impact of the events on the forward market has to be rejected. However, the sample average abnormal forward rate change is negative. These findings suggest that generally – *consistent* with theory – international *investors did react* to negative financial sector news but – *contradicting* 3<sup>rd</sup> generation models – supply of US dollars *increased* relative to demand.

For comparison, the same analysis has been conducted for the baht/US\$ spot rate. The results - presented in APPENDIX VI – again justify the use of the forward rate in this analysis: no significant changes in the forward rate occurred after any event of interest and the null hypothesis of no impact of the events on the exchange rate cannot be rejected.

The event analysis conducted in this thesis has several limitations. First, the assumptions implying that the 1-year baht/US\$ forward market reflects international investors’ behaviour (see section 3.2.) may not hold. For example, the forward market may be mainly used by speculators rather than international investors; or a strong reaction of investors to negative news may not be mirrored by changes in the forward rate because the forward market does not *have* to be used.

Second, not all events of interest may have been published in the FT, the event source used in this analysis. Consequently, the results of the analysis could be skewed. For example, more than three negative real sector news releases (internationally available) may have occurred during the time period considered, the inclusion of which may have led to different findings.

Third, the statistical test of whether or not international investors reacted to negative financial/real sector news in general is based on 22 observations only, implying that the test results could be questionable.

Fourth, an event analysis is no proof of a causal relationship: What appears to be a reaction in the forward market to the events of interest could in fact be the reaction to a completely different (e.g. political) event happening at the same time.

Keeping these limitations in mind, the event study results may be interpreted as follows: there was either insignificant (i.e., forward rate change  $< 0.35\%$ ) or no reaction (indicated by a forward rate change of 0% or even absent forward rate data) in the forward market on most of the days considered in the analysis, including the days around the real sector news. However, significant and positive forward rate changes were observed within the event windows of the three “most negative” financial sector events, i.e., Moody’s open concern about the soundness of the sector (February 14<sup>th</sup>, 1997), the near-collapse of a large finance company/the suspension of trading in financial sector stocks (overlap February 28<sup>th</sup> and March 3<sup>rd</sup>, 1997) and the suspension of operations of 16 finance companies (June 27<sup>th</sup>, 1997).<sup>67</sup> These findings suggest that although the average forward rate change for the days considered was negative (see table 6) and thus, contradicting theory, Thailand’s financial sector problems did play at least a partial role in the currency crisis because the “most negative” news to which investors apparently reacted in the way implied by theory were released in Q2 1997, coinciding with the decline in reserves and the start of net capital outflows.

Three possible explanations exist for the lack of significant reaction following most events of interest:

1. The events were expected by market participants/international investors and already priced into the forward rate before the news were released.
2. The news were unexpected but moral hazard existed among international investors, i.e., they did understand the implications of the negative news financial sector/real sector news but expected to be bailed out by the Thai government or international institutions in case that their Thai debtors defaulted.
3. Contrary to the rationality assumption underlying event studies, international investors were not rational, i.e., they did not possess the ability to assess the implications of the news for the riskiness of their investments.

Option 1. seems unlikely because the 1-year baht/US\$ forward rate was relatively stable for a long time before the sequence of events of interest for this analysis commenced (see graph 9). It is questionable that investors expected problems in Thailand’s financial sector such as declining profits and increasing short term foreign debt (see table 5) long before they occurred, especially since international rating agencies did not start to be concerned until May 1996.<sup>68</sup>

Option 2. could be applicable because after the IMF bail out during the 1994/95 Tequila Crisis in Latin America, it is possible that international investors expected to be bailed out of

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<sup>67</sup> There is an overlap here with day 2 after BoT’s announcement that it will no longer provide unlimited support to financial institutions. However, since the forward rate changes on day 0 and 1 following this announcement were *negative*, the large positive change on June 27<sup>th</sup> is assumed to be mostly attributable the the suspension of operations of finance companies.

<sup>68</sup> It is assumed that rating agencies were not concerned because according to the FT, they did not start to downgrade (or ‘put on credit watch’) Thai financial institutions’ deposits/debt until May 1996.

any crisis. However, the moral hazard explanation is still considered unsuitable in the context of this analysis because investors do seem to have withdrawn capital following the “most negative” news. With moral hazard, capital withdrawals start when agents know or expect that funds are not sufficient for a bail out any longer (see global moral hazard approach, section 1). It is unlikely that this coincided exactly with the “most negative” news.

Option 3. seems to be the best explanation. Forward market participants did not react significantly to either “less negative” financial sector news such as declining profits or to negative real sector news such as bankruptcies among property companies but they did react in the expected way to very alarming financial sector news. This indicates that international investors indeed did not know about the vulnerability of financial intermediaries and did not understand the implications of the negative news until the financial crisis was reported relatively obviously. International investors seem to have been irrational and euphoric until they picked up clearly negative signals.

In summary, it can be said that the results of the event study on the 1-year baht/US\$ forward rate are in favour of the domestic approach of 3<sup>rd</sup> generation models. However, they are no final proof of the theory due to the limitations of the analysis.

## **Conclusion**

Despite a strong economic performance in the first half of the 1990s, Thailand was hit by a currency crisis in 1997 when its exchange rate regime collapsed, following large capital outflows. The objective of this paper was to examine by looking at financial sector dynamics which group or combination of groups of so called 3<sup>rd</sup> generation models is best suitable to explain Thailand's experience in order to contribute to the understanding of the causes of currency crises.

It was shown that several of the conditions which according to the *domestic* approach of 3<sup>rd</sup> generation models lead to the withdrawal of capital and consequently, a currency crisis, were present in Thailand in the 1990s:

- overlending by international and domestic financial institutions and overinvestment by Thai corporations,
- a deterioration of economic conditions that was partly endogenous, i.e. the result of overinvestment (diminishing returns of investments, followed by a bubble burst in the real estate sector), partly exogenous (declining exports),
- and a domestic financial sector crisis.

An analysis of financial sector data indicated that Thailand's financial crisis was caused by the deterioration of economic conditions because both banks and finance companies appear to have been vulnerable to an economic downturn - especially an asset bubble burst in the real estate sector - that affects debtors earnings and the value of loan collateral. Both groups of financial intermediaries had a large proportion of loans among their assets and a high

exposure to the real estate sector. Additionally, the capital base of banks was low, indicating a risk of insolvency in case of large loan write-offs.

Furthermore, evidence was provided that the financial crisis was responsible for the currency crisis. The financial sector analysis showed that a large proportion of capital outflows at the eve of the crisis originated in Thailand's domestic financial sector and an event study indicated that these outflows from the financial sector reflected international investors reaction to negative financial sector news. Additionally, the results of the event study suggested that international investors were euphoric and irrational until clearly negative signals were given. They did not react to "less negative" or real sector news, implying that they did not understand the implications of these news.

In summary, it can be said that Thailand's currency crisis appears to have been caused by domestic financial sector problems that triggered the withdrawal of capital by formerly euphoric international investors. The domestic financial crisis in turn seems to have been the result of an economic deterioration, following a period of overlending by national as well as international agents and overinvestment. The findings of this paper, therefore, suggest that the strand of 3<sup>rd</sup> generation models named "domestic approach" in this paper (see section 1) is best suitable to explain Thailand's currency crisis. However, the findings do not indicate whether the subgroup of this strand based on moral hazard or the subgroup based on uninformed investors or a combination of both is best applicable to Thailand because evidence on moral hazard among domestic financial institutions is inconclusive. Apparently, the incentive for moral hazard existed because an implicit deposit insurance was in place after the bail out of Thai financial intermediaries during the banking crisis in the 1980s, and the capital base of banks was low. The examination of banks' provision/pre-provision income ratio, however, that could possibly indicate whether moral hazard behaviour actually took place, did not lead to clear results.

The conclusions presented above have to be viewed with caution, though, as the analyses conducted within the framework of this paper have several limitations:

1. As it is often the case with data for developing countries/emerging markets, the data may have been incorrect.
2. Due to the time constraint of this thesis, only limited data has been available for the financial sector analysis. For example, neither detailed portfolio information of financial institutions – especially finance companies -, nor monthly bank data nor qualitative information such as information about risk management has been included.
3. The assumptions underlying the event study and implying that the 1-year baht/US\$ forward rate reflects international investors' behaviour may not hold.
4. The FT, the news source used in the event study, may not have included all events of interest.



5. Both the financial sector analysis as well as the event study conducted within the framework of this paper may be seen as an *indicator* for a causal relationship between the economic downturn/the financial crisis and the financial crisis/the currency crisis but are no *formal proof* of causality.

Future research could eliminate some of the criticisms above and thus, improve the viability of the findings on Thailand by:

- including more detailed data in the financial sector analysis. Monthly bank data, for example could indicate whether or not the deterioration of banks' financial statement *followed* the economic deterioration, thus shedding more light on this causality issue. The question of moral hazard among domestic financial institutions may be clarified by looking at what type of risk management was in place.
- analysing who the market participants were in the 1-year baht/US\$ forward market. This examination would provide some clarification on whether or not the forward market reflected international investors' behaviour.
- using additional news sources that were available to international investors before the crisis, such as Bloomberg or Reuters. Including additional events of interest found in these sources in the event analysis could improve the power of the results.

Furthermore, there is scope for future research to contribute to the understanding of the causes of currency crisis by, for example, extending the financial sector analysis to capital markets, analysing the role of political and institutional aspects and comparing case studies of different countries.

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*Databases:* Bloomberg; ***Datastream***

*Other:* Interview with Ms Anke Richter, credit analyst at Deutsche Bank, London, July 2000.

## Tables

**Table 1: Economic Indicators**

	1991	1992	1993	1994	1995	1996	1997
GDP growth	8.18	8.08	8.38	8.94	8.84	5.52	-0.43
Fiscal Balance (% of GDP)	4.79	2.90	2.13	1.89	2.94	0.97	-0.32
Inflation	5.70	4.07	3.36	5.19	5.69	5.85	5.61
Savings (% of GDP)	34.83	33.73	34.26	33.89	33.25	33.22	32.64

Source: Corsetti et al. (1998)

**Table 2: Average Ratios for 12 Thai Commercial Banks**

	Dec-93	Dec-94	Dec-95	Dec-96	Dec-97	Dec-98
<b>Profit</b>						
Pre-provision Return on Average Total Assets	2.89%	3.13%	2.91%	2.76%	2.39%	-0.49%
Cost to Income Ratio	40.43%	37.76%	39.64%	40.75%	47.08%	103.56%
Net Interest Margin	3.85%	4.03%	3.87%	3.80%	3.45%	0.86%
Pre-provision Profit to Net Loans	3.20%	3.40%	3.16%	3.04%	2.78%	-0.72%
<b>NPL</b>						
NPL to Gross Loans	3.75%	4.13%	3.61%	6.38%	17.14%	42.31%
NPL to (Provisions + Equity)	37.76%	45.25%	38.31%	58.09%	155.61%	268.57%
NPL to Provisions	304.50%	345.14%	273.41%	293.71%	350.28%	444.97%
<b>Capitalisation</b>						
(Equity+Reserves) to Net Loans	13.95%	9.52%	9.62%	9.75%	7.03%	8.33%
Equity to Total Assets	7.12%	7.17%	7.43%	7.70%	5.24%	5.76%
Risk Weighted Capital	8.47%	10.07%	9.62%	10.67%	10.31%	10.76%
<b>Provisions</b>						
Provisions to Pre-Provision Income	18.46%	15.65%	12.98%	15.26%	251.17%	854.13%
<b>Main Business</b>						
Net Loans to Total Assets	84.21%	84.36%	84.66%	85.12%	79.74%	74.84%
<b>Liquidity</b>						
Short Term Assets to Short Term Liabilities	30.09%	33.48%	28.81%	26.61%	39.49%	39.98%

Source: Moody's "Banking Statistical Supplement" for Thailand (various issues).

Note: due to lack of data availability, NPL data includes only 3 banks in 93 and 94, 4 in 95, 8 banks in 96 and 97, 11 banks in 98; Risk Weighted Capital includes only 2 banks in 93, 4 banks in 94 and 95, 8 banks in 96, 7 banks in 97, 4 banks in 98; the liquidity ratio includes only 11 banks.

**Table 3: Profit Ratios for Abbey National and Commerzbank**

	<i>Dec 96</i>	<i>Dec 97</i>	<i>Dec 98</i>
<b>Abbey National</b>			
Pre-provision Return on Av. Total Assets	1.04%	1.02%	
Cost to Income Ratio	44.19%	45.69%	
Net Interest Margin	1.50%	1.30%	
Pre-provision Profit to Net Loans	n.a.	n.a.	
<b>Commerzbank</b>			
Pre-provision Return on Av. Total Assets		0.76%	0.71%
Cost to Income Ratio		60.84%	63.01%
Net Interest Margin		1.26%	1.05%
Pre-provision Profit to Net Loans		1.03%	0.89%

Source: 1997 and 1998 annual report for Abbey National and Commerzbank, respectively.

**Table 4: Consolidated Data (Ratios) for Thai Finance Companies<sup>1</sup>**

	<b>Dec-95</b>	<b>Dec-96</b>	<b>Mar-97</b>	<b>Jun-97</b>	<b>Sep-97</b>	<b>Dec-97</b>
Equity to Total Assets	12.39%	12.49%	12.71%	13.30%	12.58%	12.21%
Equity to Loans	15.05%	15.13%	15.48%	16.17%	15.65%	15.28%
Loans to Total Assets	82.33%	82.54%	82.13%	82.24%	80.42%	79.92%

Source: own calculation of ratios based on data provided by BoT

<sup>1</sup> The finance company data presented here is actually data for „Finance and Security Companies“ by the Bank of Thailand. In this paper, however, it is assumed that this is the same as finance company data. Although monthly data is available for finance companies, annual data for 1995/96 and quarterly data for 1997 is presented in table 4 because little change occurred during this period.

**Table 5: Negative News and Abnormal Changes of the Forward Rate**

Date	Event	Abnormal Change of Forward Rate		
		Day 0	Day 1	Day 2
10 May 1996, Friday	Irregularities at commercial bank Bangkok Bank of Commerce	n.a.	weekend	n.a.
16 May 1996, Thursday	Financial company National Finance reports disappointing results due to bad loans	n.a.	n.a.	n.a.
30 May 1996, Thursday	Moody's puts Thailand's commercial paper programme and commercial bank deposits on watch for possible downgrade due to recent build-up in short-term foreign currency debt	-0.27%	n.a.	n.a.
3 September 1996, Tuesday	Moody's downgrades Thailand's short-term sovereign debt as well as short term obligations of three of the country's four biggest commercial banks: Bangkok Bank, Thai Farmers' Bank and Siam Commercial Bank. Reason: Recent rapid accumulation of short-term debt	0.08%	0.15%	-0.15%
4 December 1996, Wednesday	<i>Somprasong group and other Thai property companies are having problems due to decreasing asset values</i>	n.a.	n.a.	n.a.
14 January 1997, Tuesday	BoT will not help to ease burden of bad property loans on domestic financial system	n.a.	n.a.	n.a.
5 February 1997, Wednesday	<i>Property company Somprasong Land defaults on its USD 80 million eurobond. More bankruptcies expected by sector analysts</i>	n.a.	n.a.	n.a.
14 February 1997, Friday	Moody's puts Thai sovereign debt on credit watch again for possible downgrade due to concerns about the soundness of Thailand's financial sector	1.22%	weekend	-2.55%
28 February 1997, Friday	Near-collapse of Finance One, the country's largest finance company	-0.04%	weekend	0.37%
3 March 1997, Monday	Suspension of trading in financial sector stocks by Thai government plus announcement of a series of measurements to prevent sector from collapsing (i.e.: increase provisions for bad debt => applies to nearly all of the more than 90 finance companies and 15 commercial banks)	0.37%	0.00%	0.22%
9 April 1997, Wednesday	Downgrade of Thailand's foreign currency rating for bonds and bank deposits	0.11%	-0.30%	0.04%
22 April 1997, Tuesday	Profits of some banks worse than expected	0.07%	-0.07%	-0.30%
9 May 1997, Friday	<i>Texas Instruments cancels partnership with Thailand's electronic group Alphatec Group. Result: Alphatec experiences severe financial problems and calls for government bail out</i>	-0.19%	weekend	-0.41%
25 June 1997, Wednesday	BoT will no longer provide unlimited support to financial institutions	-0.14%	-6.63%	6.48%
27 June 1997, Friday	Thai authorities suspend the operations of 16 ailing financial companies	6.48%	weekend	-1.89%



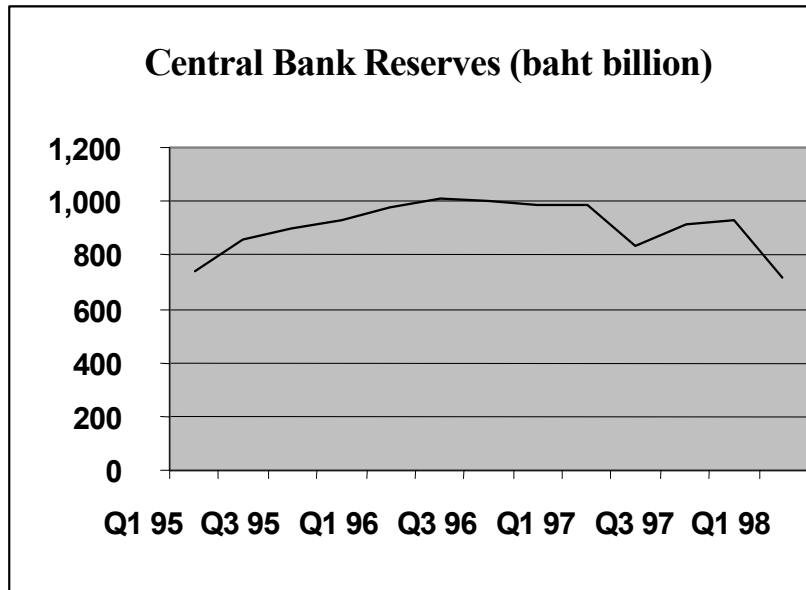
**Table 6: Statistical Data for the 22 Observed Abnormal Forward Rate Changes**

Cumulative Abnormal Change	-4.19%
Average Abnormal Change	-0.19%
Variance	7.4171E-08
Standard Error	0.00027234
T-ratio	-6.99226088

Source: own calculations based on Bloomberg data. The critical value at the 5% significance level of a t-distribution with  $n-2 = 20$  degrees of freedom is 2.086. Since the absolute value of the calculated T-ratio of -6.99 exceeds the critical value, the null hypothesis has to be rejected with 95% confidence.

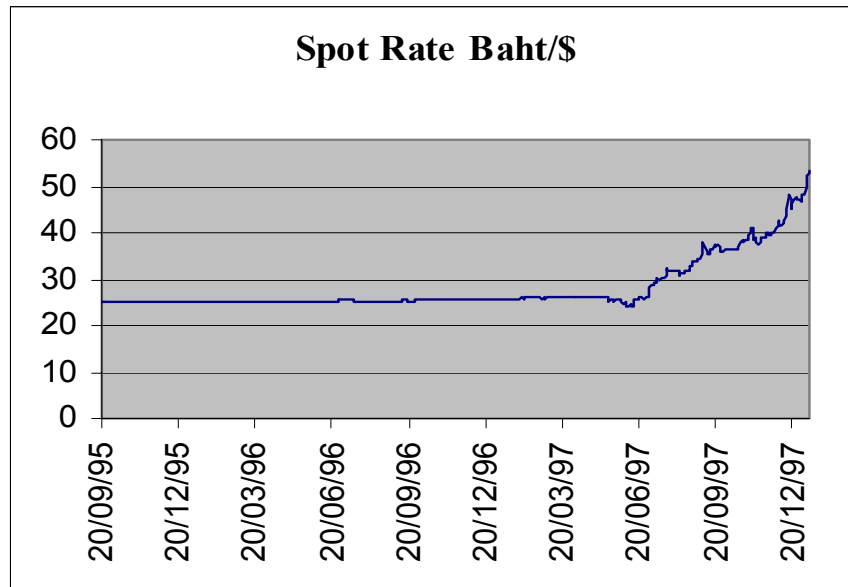
## Graphs

**Graph 1: Central Bank Reserves**



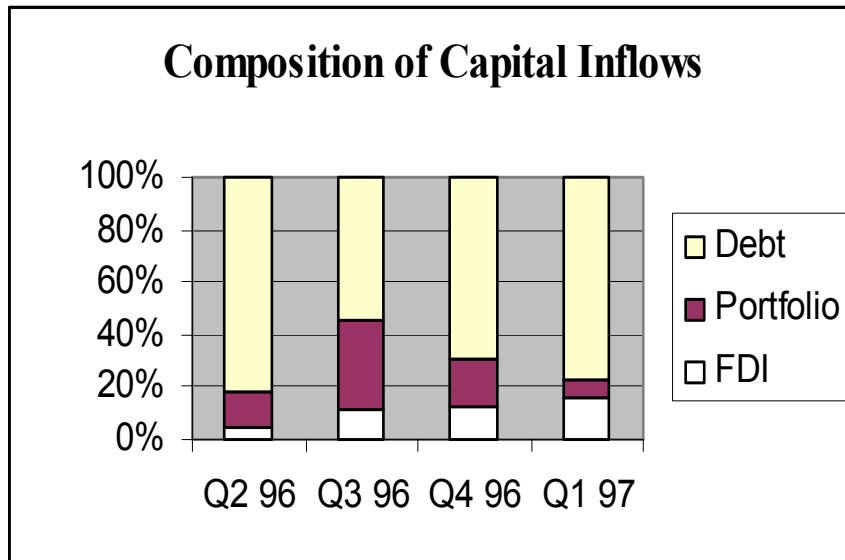
Source: IFS

**Graph 2: Exchange Rate**



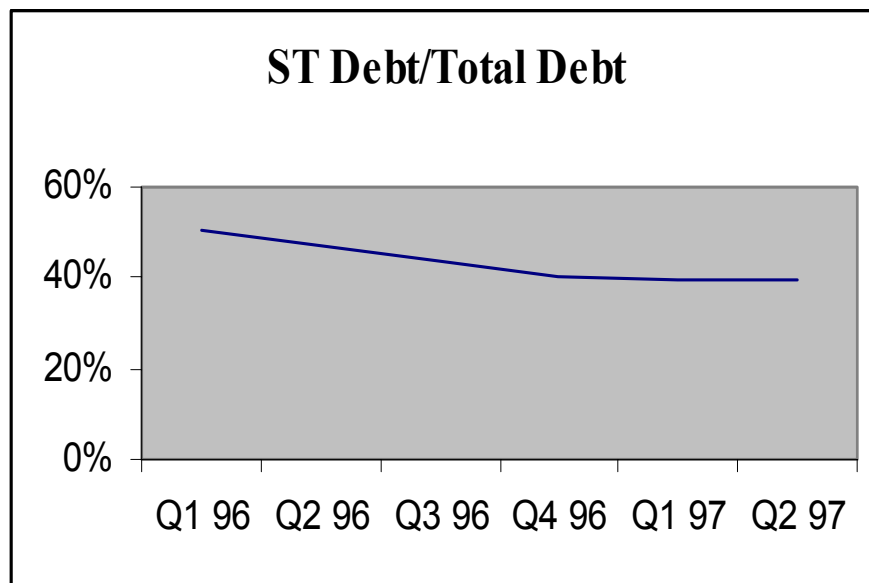
Source: Datastream

**Graph 3: Composition of Capital Inflows**



Source: own calculation based on Datastream for foreign direct investment (FDI) and portfolio investment (Portfolio), BoT for external debt (Debt)<sup>1</sup>

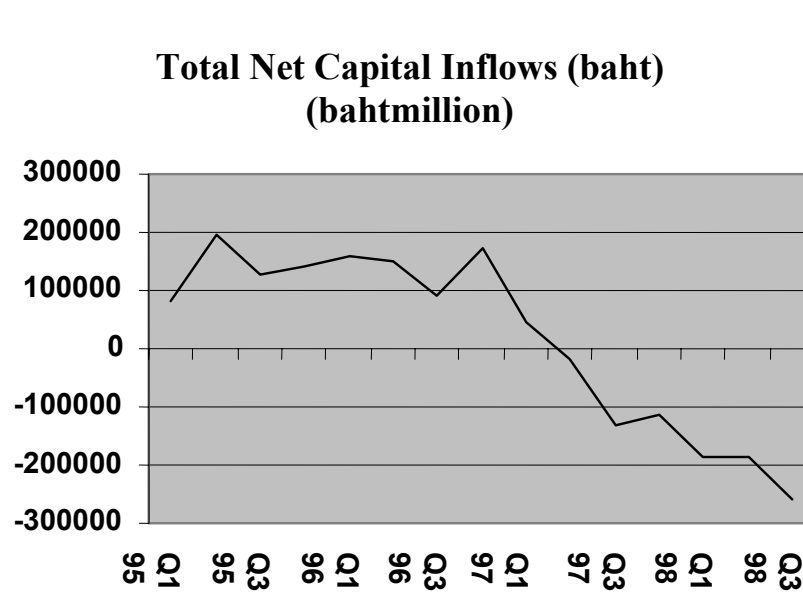
**Graph 4: Proportion of ST Foreign Debt**



Source: own calculation based on data provided by BoT

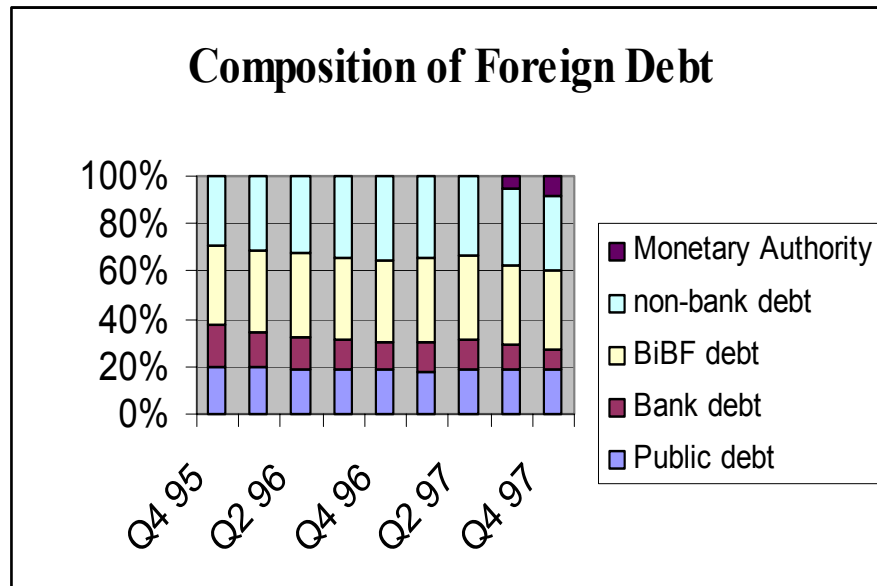
<sup>1</sup> FDI and Portfolio data was converted from baht into US\$ using an exchange rate of 26 baht/dollar. The datastream data has to be treated with *extreme caution*: e.g., it is not stated whether FDI and Portfolio are net or gross. Thus, graph 3 merely gives a rough idea, rather than providing exact information. For the same reason, FDI and Portfolio data provided by datastream is not used for further analysis in this paper. Data before Q2 1996 is not included in graph 3 because complete external debt data from the Bank of Thailand is only available from Q4 1995 onwards and Q1 1996 is an outlier.

**Graph 5: Thailand's Foreign Capital Inflows**



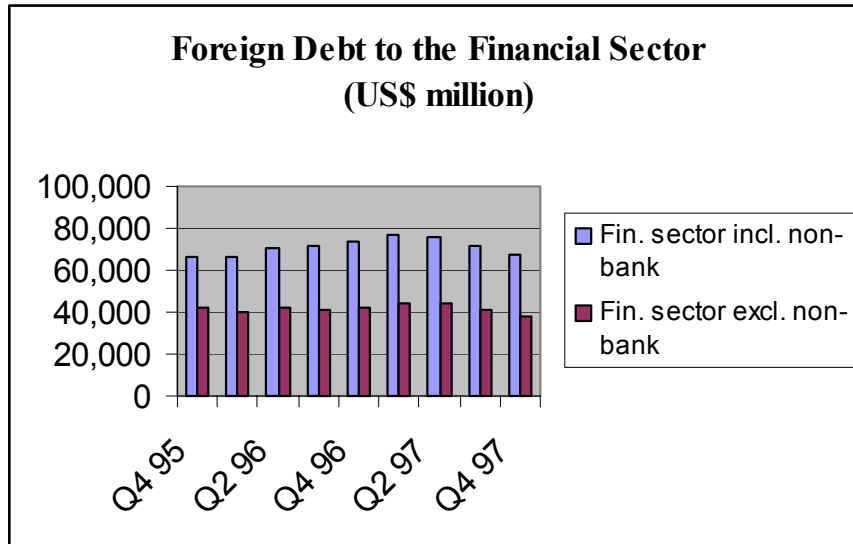
Source: Datastream. Total net inflows calculated as the sum of net public and private inflows.

**Graph 6: Composition of Foreign Debt**

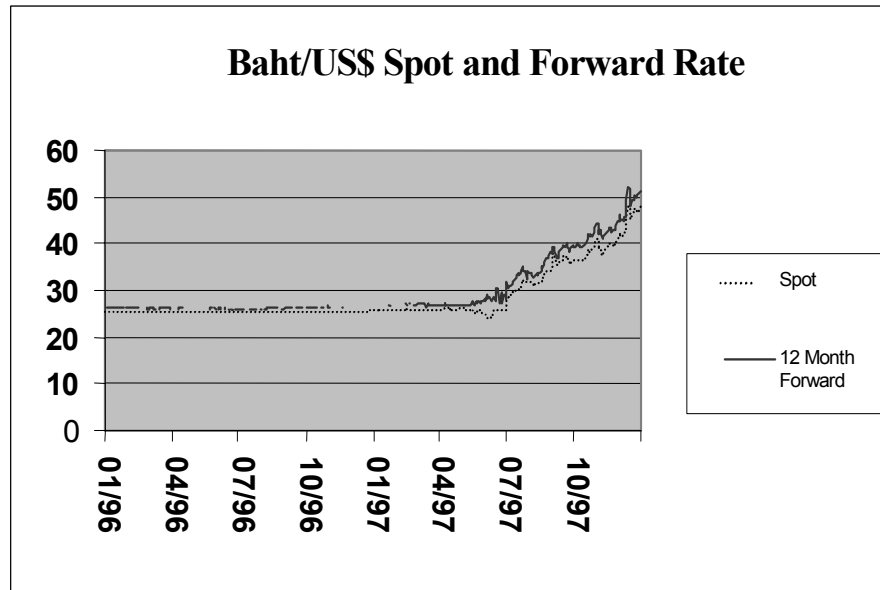


Source: own calculations based on data provided by BoT. Foreign debt to the financial sector is the sum of bank debt (=foreign debt to commercial banks), BIBF debt and part of non-bank debt, reflecting debt to finance companies and other non-bank institutions

**Graph 7: Foreign Debt to the Financial Sector**

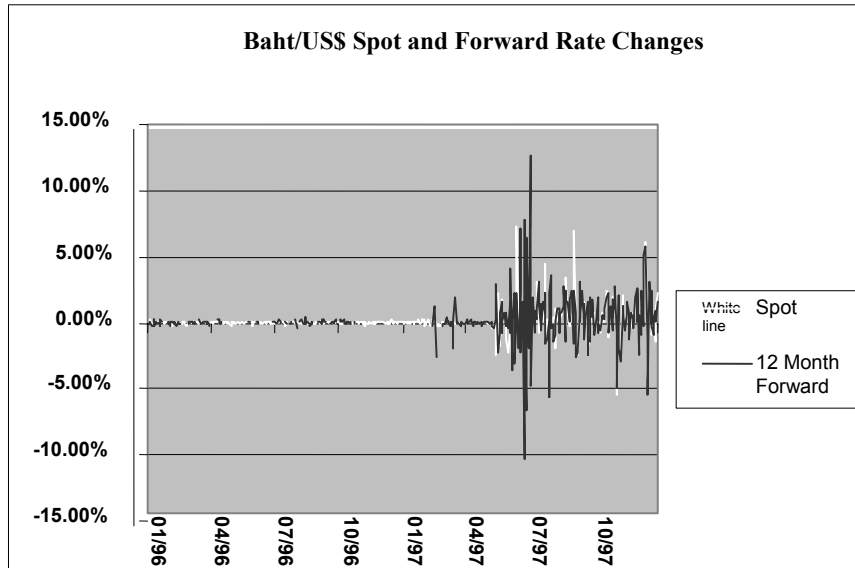


**Graph 8: Baht/US\$ Spot and Forward Rate Levels**



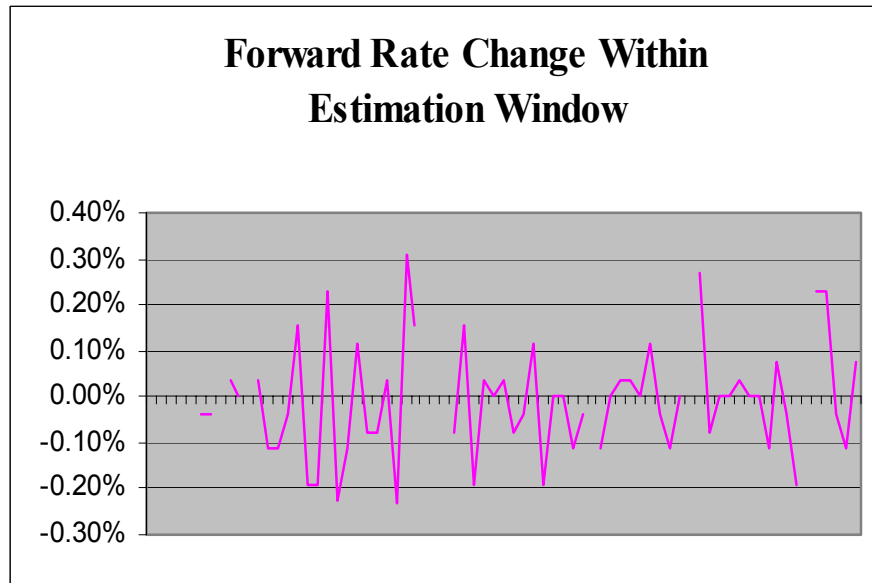
Source: Datastream (spot), Bloomberg (forward)

**Graph 9: Baht/US\$ Spot and Forward Rate Changes**



Source: own calculations based on Datastream and Bloomberg

**Graph 10: Daily Change of the Forward Rate between September 1995 and April 1996**



Source: own calculations based on Bloomberg. The gaps exist because no forward market data is available for these dates.

## Appendix I

### *Detailed Description of Ratios Used in the Bank Analysis*

The choice of the ratios below was based on Moody's rating methodology<sup>1</sup> and an interview with Ms Richter, credit analyst at Deutsche Bank in London.

**Profit Ratios.** Indicate: how much flexibility do banks have in case of an economic downturn? Would a decline in profits immediately lead to net losses?

- *Pre-provision<sup>2</sup> return on average assets.* Shows: ability to generate revenues from balance sheet. Should be high because this would give banks flexibility to withstand a decline in profits.
- *Cost to income ratio* = non-interest expenses divided by operating income. Should be low because this would give banks flexibility to withstand decline in profits.
- *Net interest margin* = net interest<sup>3</sup> income divided by average earning assets. Should be high because this would give banks flexibility to withstand a decline in profits.
- *Pre-provision profit to net loans<sup>4</sup>.* Shows: assuming that all bad loans have been classified as such and adequate provisions have been made, what proportion of currently performing loans could be written off without having to take from equity? Should be high because this gives banks flexibility in case of a deterioration of their loan portfolio.

**NPL Ratios.** Indicate: ability of banks to absorb new NPLs during economic downturn without becoming insolvent. Additionally: could bank trouble have occurred even in absence of an economic downturn?

- *Ratio of NPL to gross loans.* Shows whether bank has tendency to lend to people who don't pay back.
- *NPL to (provisions+equity<sup>5</sup>).* Should be low. A ratio above 100% means that if banks had to write off all loans they would be insolvent.
- *NPL to provisions.* Should be low. Shows how much NPL can be covered from reserves without destroying capital base. Additionally: could be sign of moral hazard as it illustrates that banks did not build up a sufficient safety net.

**Capital Ratios.** Indicate: could a deterioration jeopardise the solvency of banks? Could there have been moral hazard among banks? All capitalisation ratios should be high to ensure

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<sup>1</sup> Moody's (1999b).

<sup>2</sup> Provisions = loan loss provisions.

<sup>3</sup> Interest income – interest expense

<sup>4</sup> Net loans = gross loans – loan loss reserves (= provisions)

<sup>5</sup> Equity = equity + retained earnings from Moody's numbers

solvency in the event of an economic downturn and that banks do not “gamble for resurrection”<sup>6</sup>.

- (Equity + reserves) to net loans
- Equity/total assets
- Risk weighted capital = (equity + quasi-equity [e.g. subordinated debt])/risk weighted assets. What type of funds count as quasi-equity and what weight between 0% and 100% has to be assigned to each group of assets is regulated in the Basle Capital Accord. The Basle Capital Accord requires a minimum ratio of 8%.<sup>7</sup>

**Provision Ratio** Indicates: could there have been moral hazard among banks?

- *Provisions<sup>8</sup> to pre-provision income*. A low ratio indicates that there may have been moral hazard among banks (=> banks did not use a large proportion of their earnings to build up a safety net).

**Ratio Identifying Banks' Main Business** Indicates: is lending the main business?

- *Loans/total assets*. A high ratio means that banks are very vulnerable to a deterioration of their loan portfolio, i.e., an economic downturn that effects their debtors' earnings/value of collateral.

**Liquidity Ratio** Indicates: are banks vulnerable to sudden withdrawal of funds/a collective action problem?

- Short Term Assets/Short Term Liabilities. Should be high.

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<sup>6</sup> Miller & Luangaram (1998).

<sup>7</sup> BIS (April 1998).

<sup>8</sup> I.e. new provisions = provisions in income statement



## Bangkok Bank

	Dec-93	Dec-94	Dec-95	Dec-96	Dec-97	Dec-98
Total Assets (baht million)	777,263	898,014	1,035,931	1,154,930	1,412,866	1,269,561
% of Total Assets in Sector	27.73%	26.25%	25.13%	24.34%	24.61%	21.75%
Pre-provision Return on Average Total Assets	3.72%	3.73%	3.45%	3.36%	3.25%	0.26%
Net Interest Margin	4.29%	4.39%	4.04%	3.97%	3.62%	0.67%
Cost to Income Ratio	33.24%	34.43%	35.38%	35.49%	36.52%	87.54%
Pre-provision profit to net loans	4.05%	4.17%	3.86%	3.85%	4.04%	0.40%
Provisions to Pre-Provision Income	20.27%	16.40%	13.56%	15.54%	68.14%	1389.80%
NPL to Gross Loans	n.a.	n.a.	n.a.	5.23%	16.55%	23.52%
NPL to (Provisions + Equity)	n.a.	n.a.	n.a.	40.41%	118.89%	116.91%
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	n.a.	171.64%	310.73%	220.54%
Risk Weighted Capital	10.11%	10.45%	10.80%	11.27%	10.05%	11.73%
Equity to Total Assets	n.a.	n.a.	n.a.	11.45%	11.72%	n.a.
Net Loans to Total Assets	7.20%	7.51%	8.00%	8.46%	6.64%	7.19%
Short Term Assets to Short Term Liabilities	85.05%	83.42%	83.33%	82.89%	73.13%	67.93%

## Bangkok Metropolitan Bank

	Dec-93	Dec-94	Dec-95	Dec-96	Dec-97	Dec-98
Total Assets (baht million)	110,695	131,580	164,287	186,892	187,837	175,879
% of Total Assets in Sector	3.95%	3.85%	3.99%	3.94%	3.27%	3.01%
Pre-provision Return on Average Total Assets	1.38%	2.20%	2.05%	1.24%	0.85%	-9.03%
Net Interest Margin	2.40%	2.88%	2.65%	2.39%	0.40%	-4.88%
Cost to Income Ratio	58.62%	45.49%	46.76%	59.23%	68.94%	37.71%
Pre-provision profit to net loans	1.47%	2.32%	2.13%	1.35%	0.95%	-13.41%
Provisions to Pre-Provision Income	33.72%	23.22%	27.78%	37.36%	1561.96%	-241.40%
NPL to Gross Loans	n.a.	n.a.	n.a.	18.28%	44.65%	87.99%
NPL to (Provisions + Equity)	n.a.	n.a.	n.a.	166.27%	433.63%	250.51%
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	n.a.	835.17%	310.22%	250.51%
Risk Weighted Capital	9.36%	9.77%	9.22%	9.00%	-4.78%	0.00%
Equity to Total Assets	n.a.	n.a.	n.a.	8.69%	n.a.	n.a.
Net Loans to Total Assets	7.82%	8.51%	7.98%	7.79%	-4.24%	0.00%
Short Term Assets to Short Term Liabilities	83.59%	87.07%	86.59%	86.50%	88.68%	69.62%

**Bank of Asia**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	69,262	82,740	107,803	125,305	156,003	148,375
% of Total Assets in Sector	2.47%	2.42%	2.62%	2.64%	2.72%	2.54%
Pre-provision Return on Average Total Assets	1.84%	2.43%	2.14%	2.27%	0.96%	-1.52%
Net Interest Margin	3.39%	3.71%	3.33%	3.42%	2.61%	-0.03%
Cost to Income Ratio	54.99%	44.95%	45.97%	42.47%	72.15%	238.39%
Pre-provision profit to net loans	1.97%	2.61%	2.33%	2.44%	1.01%	-1.91%
Provisions to Pre-Provision Income	38.85%	14.10%	17.63%	17.41%	128.11%	-251.93%
NPL to Gross Loans	n.a.	n.a.	n.a.	6.92%	12.02%	61.48%
NPL to (Provisions + Equity)	n.a.	n.a.	n.a.	60.09%	134.47%	447.64%
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	n.a.	416.65%	478.01%	872.10%
Risk Weighted Capital Equity to Total Assets	8.93%	8.89%	8.76%	10.39%	6.88%	7.51%
Net Loans to Total Assets	n.a.	n.a.	n.a.	10.15%	8.38%	9.42%
Short Term Assets to Short Term Liabilities	6.92%	7.09%	6.77%	8.67%	5.67%	5.85%
	84.23%	85.38%	81.40%	86.51%	86.11%	81.31%
	89.36%	88.94%	95.75%	87.98%	108.24%	96.74%

**Bank of Ayudhya**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	199,138	284,274	366,443	410,870	489,178	481,300
% of Total Assets in Sector	7.11%	8.31%	8.89%	8.66%	8.52%	8.25%
Pre-provision Return on Average Total Assets	2.19%	2.28%	2.27%	2.14%	2.18%	-0.97%
Net Interest Margin	3.53%	3.59%	3.38%	3.35%	3.41%	1.00%
Cost to Income Ratio	49.93%	47.17%	46.71%	47.66%	49.31%	154.83%
Pre-provision profit to net loans	2.34%	2.24%	2.40%	2.35%	2.43%	-1.28%
Provisions to Pre-Provision Income	5.11%	11.89%	13.15%	14.81%	72.21%	-98.06%
NPL to Gross Loans	2.90%	4.37%	4.59%	4.67%	13.32%	22.80%
NPL to (Provisions + Equity)	29.19%	54.27%	60.17%	51.03%	153.58%	212.14%
NPL to Provisions (Equity+Reserves) to Net Loans	415.31%	589.49%	517.21%	424.35%	502.71%	565.41%
Risk Weighted Capital Equity to Total Assets	9.86%	7.91%	7.23%	8.50%	6.50%	7.34%
Net Loans to Total Assets	8.61%	8.28%	8.31%	10.31%	9.13%	n.a.
Short Term Assets to Short Term Liabilities	8.13%	6.36%	5.69%	7.02%	5.10%	5.32%
	87.41%	86.34%	83.72%	86.18%	82.38%	76.06%
	10.06%	12.17%	14.80%	12.03%	16.08%	22.80%

**Export-Import Bank of Thailand**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	1,874	16,368	28,204	34,567	60,417	53,193
% of Total Assets in Sector	0.07%	0.48%	0.68%	0.73%	1.05%	0.91%
Pre-provision Return on Average Total Assets	1.06%	2.25%	2.26%	2.11%	1.64%	2.84%
Net Interest Margin	2.56%	3.22%	2.49%	2.17%	1.74%	2.45%
Cost to Income Ratio	16.24%	32.72%	23.48%	27.40%	24.12%	17.23%
Pre-provision profit to net loans	74.07%	1.41%	2.00%	2.03%	1.36%	4.27%
Provisions to Pre-Provision Income	0.00%	0.00%	0.60%	7.70%	61.59%	96.53%
NPL to Gross Loans	n.a.	n.a.	n.a.	n.a.	n.a.	7.23%
NPL to (Provisions + Equity)	n.a.	n.a.	n.a.	n.a.	n.a.	28.27%
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	n.a.	n.a.	n.a.	137.89%
Risk Weighted Capital Equity to Total Assets	6900.00%	14.20%	12.82%	11.76%	7.20%	21.45%
Net Loans to Total Assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Short Term Assets to Short Term Liabilities	99.41%	12.64%	11.44%	11.10%	6.85%	15.23%
	1.44%	89.02%	89.27%	94.44%	95.09%	71.00%
	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

**Government Housing Bank of Thailand**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	77,732	110,899	152,895	210,115	293,470	358,851
% of Total Assets in Sector	2.77%	3.24%	3.71%	4.43%	5.11%	6.15%
Pre-provision Return on Average Total Assets	1.74%	2.81%	2.65%	3.12%	2.11%	2.47%
Net Interest Margin	4.73%	3.50%	3.27%	3.67%	3.55%	1.73%
Cost to Income Ratio	22.44%	16.88%	17.21%	16.62%	42.31%	34.06%
Pre-provision profit to net loans	1.86%	2.60%	2.41%	2.78%	1.85%	2.63%
Provisions to Pre-Provision Income	0.00%	10.67%	19.11%	25.01%	45.37%	33.96%
NPL to Gross Loans	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NPL to (Provisions + Equity)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Risk Weighted Capital Equity to Total Assets	6.75%	7.23%	6.50%	6.77%	1.49%	5.94%
Net Loans to Total Assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Short Term Assets to Short Term Liabilities	6.30%	6.65%	6.17%	6.54%	1.46%	5.06%
	93.41%	91.90%	94.97%	96.72%	97.77%	85.29%
	66.55%	59.30%	53.61%	51.62%	59.53%	61.24%

**Industrial Finance Corporation of Thailand**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	70,751	90,469	118,379	172,081	206,937	185,110
% of Total Assets in Sector	2.52%	2.64%	2.87%	3.63%	3.60%	3.17%
Pre-provision Return on Average Total Assets	2.19%	2.38%	2.62%	2.38%	1.90%	0.41%
Net Interest Margin	3.01%	3.07%	3.15%	3.35%	2.50%	0.70%
Cost to Income Ratio	22.78%	22.01%	21.95%	32.82%	26.47%	72.54%
Pre-provision profit to net loans	2.81%	3.03%	3.48%	2.73%	2.29%	0.60%
Provisions to Pre-Provision Income	5.01%	10.37%	6.10%	10.86%	54.15%	394.10%
NPL to Gross Loans	n.a.	n.a.	n.a.	n.a.	n.a.	39.63%
NPL to (Provisions + Equity)	n.a.	n.a.	n.a.	n.a.	n.a.	379.74%
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	n.a.	n.a.	n.a.	1161.71%
Risk Weighted Capital Equity to Total Assets	17.88%	20.80%	19.73%	13.56%	9.99%	7.73%
Equity to Total Assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Net Loans to Total Assets	11.53%	13.76%	12.54%	9.59%	7.27%	5.24%
Short Term Assets to Short Term Liabilities	70.24%	69.90%	66.45%	73.60%	75.83%	72.09%
	189.36%	334.51%	155.44%	70.17%	174.56%	120.17%

**Krung Thai Bank**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	417,529	546,481	630,053	705,433	778,618	1,061,495
% of Total Assets in Sector	14.90%	15.97%	15.29%	14.87%	13.56%	18.19%
Pre-provision Return on Average Total Assets	2.57%	3.02%	2.83%	2.65%	2.60%	0.39%
Net Interest Margin	3.78%	3.99%	4.04%	4.09%	3.91%	1.35%
Cost to Income Ratio	45.71%	38.15%	41.04%	42.82%	42.72%	83.60%
Pre-provision profit to net loans	2.75%	3.15%	3.02%	2.90%	2.88%	0.42%
Provisions to Pre-Provision Income	26.59%	15.37%	14.15%	17.78%	98.24%	1810.78%
NPL to Gross Loans	n.a.	n.a.	n.a.	n.a.	n.a.	45.34%
NPL to (Provisions + Equity)	n.a.	n.a.	n.a.	n.a.	n.a.	204.93%
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	n.a.	n.a.	n.a.	319.41%
Risk Weighted Capital Equity to Total Assets	6.30%	7.08%	8.15%	8.31%	6.83%	9.73%
Equity to Total Assets	n.a.	n.a.	n.a.	n.a.	9.04%	10.74%
Net Loans to Total Assets	5.45%	5.23%	6.47%	6.59%	5.34%	7.47%
Short Term Assets to Short Term Liabilities	86.58%	84.66%	87.46%	86.43%	86.04%	80.85%
	11.81%	13.03%	9.73%	9.14%	10.49%	15.70%

**Siam City Bank**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	123,758	160,269	199,333	231,476	262,471	278,877
% of Total Assets in Sector	4.42%	4.69%	4.84%	4.88%	4.57%	4.78%
Pre-provision Return on Average Total Assets	2.83%	2.72%	2.37%	2.38%	0.20%	-5.56%
Net Interest Margin	4.04%	4.05%	3.58%	3.43%	2.87%	-1.75%
Cost to Income Ratio	40.34%	41.88%	44.44%	43.97%	90.46%	45.83%
Pre-provision profit to net loans	2.98%	2.83%	2.57%	2.69%	0.23%	-7.22%
Provisions to Pre-Provision Income	47.81%	21.75%	11.45%	17.17%	2845.33%	-183.04%
NPL to Gross Loans	6.80%	4.92%	4.89%	6.45%	29.39%	47.79%
NPL to (Provisions + Equity)	64.30%	48.73%	46.10%	60.47%	370.75%	216.36%
NPL to Provisions (Equity+Reserves) to Net Loans	340.38%	172.24%	184.89%	206.21%	355.31%	259.38%
Risk Weighted Capital Equity to Total Assets	8.75%	7.98%	8.61%	8.15%	-0.06%	4.60%
Equity to Total Assets	n.a.	8.62%	9.24%	9.16%	n.a.	n.a.
Net Loans to Total Assets	7.47%	6.36%	6.79%	6.42%	-0.31%	3.36%
Short Term Assets to Short Term Liabilities	85.38%	85.23%	82.97%	82.47%	83.72%	74.77%
	13.00%	11.33%	10.02%	10.03%	13.56%	15.44%

**Siam Commercial Bank**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	324,453	366,944	452,678	538,465	714,397	713,045
% of Total Assets in Sector	11.58%	10.73%	10.98%	11.35%	12.44%	12.22%
Pre-provision Return on Average Total Assets	2.49%	2.98%	2.85%	2.69%	2.69%	-0.99%
Net Interest Margin	3.46%	4.01%	4.15%	3.93%	3.99%	1.56%
Cost to Income Ratio	45.43%	42.22%	44.37%	46.36%	46.64%	169.20%
Pre-provision profit to net loans	2.83%	3.43%	3.09%	2.90%	3.01%	-1.36%
Provisions to Pre-Provision Income	9.44%	13.86%	8.07%	8.43%	68.91%	-178.70%
NPL to Gross Loans	3.11%	3.59%	3.16%	5.41%	11.49%	49.10%
NPL to (Provisions + Equity)	32.89%	36.75%	32.54%	58.26%	118.00%	518.07%
NPL to Provisions (Equity+Reserves) to Net Loans	222.80%	231.37%	215.19%	404.70%	365.80%	782.46%
Risk Weighted Capital Equity to Total Assets	9.65%	9.63%	9.33%	8.86%	5.66%	4.10%
Equity to Total Assets	n.a.	10.19%	9.26%	9.69%	9.60%	n.a.
Net Loans to Total Assets	6.58%	6.83%	6.98%	6.88%	5.34%	2.50%
Short Term Assets to Short Term Liabilities	80.51%	81.73%	83.51%	85.34%	78.38%	73.03%
	84.38%	80.99%	80.43%	78.33%	91.30%	93.88%

**Thai Farmers Bank**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	439,276	506,743	582,590	643,720	793,097	755,784
% of Total Assets in Sector	15.67%	14.81%	14.13%	13.57%	13.81%	12.95%
Pre-provision Return on Average Total Assets	3.21%	3.39%	3.30%	3.17%	2.48%	0.28%
Net Interest Margin	3.90%	4.37%	4.51%	4.41%	4.04%	1.69%
Cost to Income Ratio	38.81%	37.93%	42.20%	40.85%	51.58%	89.81%
Pre-provision profit to net loans	3.55%	3.70%	3.58%	3.52%	3.02%	0.39%
Provisions to Pre-Provision Income	10.91%	8.34%	9.44%	12.01%	94.22%	2057.70%
NPL to Gross Loans	n.a.	n.a.	2.91%	5.07%	17.00%	56.01%
NPL to (Provisions + Equity)	n.a.	n.a.	26.38%	41.90%	125.63%	274.99%
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	195.59%	288.28%	392.74%	445.65%
Risk Weighted Capital	9.86%	10.77%	10.50%	11.26%	9.62%	9.64%
Equity to Total Assets	8.41%	11.45%	10.86%	12.37%	11.58%	11.34%
Net Loans to Total Assets	7.40%	8.40%	8.36%	9.03%	7.16%	6.42%
Short Term Assets to Short Term Liabilities	82.29%	85.47%	86.25%	85.73%	74.47%	71.93%

**Thai Military Bank**

	<b>Dec-93</b>	<b>Dec-94</b>	<b>Dec-95</b>	<b>Dec-96</b>	<b>Dec-97</b>	<b>Dec-98</b>
Total Assets (baht million)	191,022	226,115	283,031	330,911	386,631	354,684
% of Total Assets in Sector	6.82%	6.61%	6.87%	6.97%	6.73%	6.08%
Pre-provision Return on Average Total Assets	2.87%	3.35%	2.74%	2.33%	1.74%	-1.06%
Net Interest Margin	4.01%	3.96%	3.64%	3.50%	2.62%	0.94%
Cost to Income Ratio	41.81%	37.46%	41.35%	44.33%	51.27%	169.53%
Pre-provision profit to net loans	3.04%	3.60%	2.87%	2.53%	2.08%	-1.36%
Provisions to Pre-Provision Income	17.39%	34.89%	14.75%	9.10%	56.16%	-117.49%
NPL to Gross Loans	n.a.	n.a.	n.a.	9.66%	15.19%	55.83%
NPL to (Provisions + Equity)	n.a.	n.a.	n.a.	96.29%	150.75%	516.29%
NPL to Provisions (Equity+Reserves) to Net Loans	n.a.	n.a.	n.a.	96.29%	150.75%	516.29%
Risk Weighted Capital	9.00%	8.23%	8.69%	8.54%	7.41%	7.28%
Equity to Total Assets	n.a.	n.a.	n.a.	9.00%	8.70%	10.15%
Net Loans to Total Assets	6.86%	6.42%	7.00%	6.91%	5.75%	5.62%
Short Term Assets to Short Term Liabilities	84.79%	85.93%	86.01%	85.48%	77.56%	81.13%

## APPENDIX III

### *Loan Classification and Provision Requirements Before and After July 1998*

#### *Classification*

	Time overdue in months	
	Old	New
<b>Performing loans</b>	<b>&lt; 12</b>	<b>&lt; 3</b>
Pass	...	0-1
Special Mention	...	1-3
<b>Non-performing loans</b>	<b>&gt; 12</b>	<b>&gt; 3</b>
Substandard	...	3-6
Doubtful	...	6-12
Loss	...	> 12

#### *Provision Requirements*

% of loan principal

	<u>Old</u>	<u>New</u>
<b>Performing loans</b>		
Pass	0%	1%
Special Mention	0%	2%
<b>Non-performing loans</b>		
Substandard	15-20%	20%
Doubtful	100%	50%
Loss	100% or write-off	100% or write-off

Source: IMF (2000)

## APPENDIX IV

### Changes of the 1-year Baht/US\$ Forward Rate Within the Estimation Window

Date	1-year Forward Rate	Change	Date	1-year Forward Rate	Change
20/09/1995	26.19		07/02/1996	26.18	-0.08%
21/09/1995	26.13	-0.23%	08/02/1996	26.17	-0.04%
25/09/1995	26.14		09/02/1996	26.2	0.11%
11/12/1995	26.23		12/02/1996	26.15	-0.19%
13/12/1995	26.25		13/02/1996	26.15	0.00%
14/12/1995	26.24	-0.04%	14/02/1996	26.15	0.00%
15/12/1995	26.23	-0.04%	15/02/1996	26.12	-0.11%
19/12/1995	26.23		16/02/1996	26.11	-0.04%
20/12/1995	26.24	0.04%	26/02/1996	26.09	
21/12/1995	26.24	0.00%	27/02/1996	26.06	-0.11%
27/12/1995	26.3		28/02/1996	26.06	0.00%
28/12/1995	26.31	0.04%	29/02/1996	26.07	0.04%
29/12/1995	26.28	-0.11%	01/03/1996	26.08	0.04%
02/01/1996	26.25	-0.11%	04/03/1996	26.08	0.00%
03/01/1996	26.24	-0.04%	05/03/1996	26.11	0.12%
04/01/1996	26.28	0.15%	06/03/1996	26.1	-0.04%
05/01/1996	26.23	-0.19%	07/03/1996	26.07	-0.11%
08/01/1996	26.18	-0.19%	08/03/1996	26.07	0.00%
09/01/1996	26.24	0.23%	14/03/1996	26.07	
10/01/1996	26.18	-0.23%	15/03/1996	26.14	0.27%
11/01/1996	26.15	-0.11%	18/03/1996	26.12	-0.08%
12/01/1996	26.18	0.11%	19/03/1996	26.12	0.00%
15/01/1996	26.16	-0.08%	20/03/1996	26.12	0.00%
16/01/1996	26.14	-0.08%	21/03/1996	26.13	0.04%
17/01/1996	26.15	0.04%	22/03/1996	26.13	0.00%
18/01/1996	26.09	-0.23%	25/03/1996	26.13	0.00%
19/01/1996	26.17	0.31%	26/03/1996	26.1	-0.11%
22/01/1996	26.21	0.15%	27/03/1996	26.12	0.08%
24/01/1996	26.18		28/03/1996	26.11	-0.04%
25/01/1996	26.21	0.11%	29/03/1996	26.06	-0.19%
29/01/1996	26.21		09/04/1996	26.03	
30/01/1996	26.19	-0.08%	10/04/1996	26.09	0.23%
31/01/1996	26.23	0.15%	11/04/1996	26.15	0.23%
01/02/1996	26.18	-0.19%	12/04/1996	26.14	-0.04%
02/02/1996	26.19	0.04%	15/04/1996	26.11	-0.11%
05/02/1996	26.19	0.00%	16/04/1996	26.13	0.08%
06/02/1996	26.2	0.04%			

Source: Bloomberg, own calculations



## APPENDIX V

### Statistical Tests for the Forward Rate Changes Within the Estimation Window

To test for stationarity of the daily forward rate change within the estimation window, an Augmented Dickey-Fuller unit root test has been conducted. The Microfit results of this test are presented below:

```

Unit root tests for variable CHANGEFWR
    The Dickey-Fuller regressions include an intercept but not a trend
*****
49 observations used in the estimation of all ADF regressions.
Sample period from 14 to 62
*****
      Test Statistic      LL      AIC      SBC      HQC
DF          -8.8225      35.1364  33.1364  31.2446  32.4186
ADF(1)      -6.4507      35.9749  32.9749  30.1372  31.8983
ADF(2)      -4.3095      36.1200  32.1200  28.3363  30.6845
ADF(3)      -3.3380      36.2451  31.2451  26.5156  29.4508
ADF(4)      -3.4143      36.8455  30.8455  25.1700  28.6922
ADF(5)      -2.5961      37.1968  30.1968  23.5754  27.6846
ADF(6)      -2.6129      37.3975  29.3975  21.8302  26.5265
ADF(7)      -2.2018      37.5858  28.5858  20.0726  25.3559
ADF(8)      -2.0415      37.5887  27.5887  18.1296  24.0000
ADF(9)      -2.6252      39.9922  28.9922  18.5872  25.0446
ADF(10)     -2.6282      40.2289  28.2289  16.8780  23.9224
ADF(11)     -2.0744      40.6973  27.6973  15.4005  23.0319
ADF(12)     -1.7394      41.2519  27.2519  14.0092  22.2276
*****
95% critical value for the augmented Dickey-Fuller statistic = -2.9215
LL = Maximized log-likelihood      AIC = Akaike Information Criterion
SBC = Schwarz Bayesian Criterion    HQC = Hannan-Quinn Criterion
    
```

The three information criteria AIC, SBC and HQC all suggest that the simple Dickey-Fuller test without any lags in the test equation is the best fit for the data. The calculated test-statistic of  $-8.8225$  is smaller than the 95% critical value of  $-2.9215$ . This indicates that the null hypothesis of no stationarity has to be rejected.

Since the data is stationary, a t-test can be used to test whether or not the average daily change of the forward rate within the estimation window is 0. The test statistic is the sample average change divided by an estimator for the standard error of the average change. The standard error of the observations is used as this estimator. Under the null hypothesis, the test statistic follows a t-distribution with  $n-2 = 60$  degrees of freedom.

The critical value at the 5% significance level of a t-distribution with 60 degrees of freedom is 2.<sup>9</sup> The calculated test-statistic is  $-0.078$ . Since the absolute value of the calculated test-statistic is smaller than the critical value, the null hypothesis that the average change of the forward rate within the estimation window is 0 cannot be rejected (with 95% confidence).

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<sup>9</sup> Gujarati (1995).

**APPENDIX VI Event Analysis of the Baht/US\$ Spot Rate**

Date	Event	Abnormal Change of Spot Rate		
		Day 0	Day 1	Day 2
10 May 1996, Friday	Irregularities at commercial bank Bangkok Bank of Commerce	0.03%	weekend	-0.01%
16 May 1996, Thursday	Financial company National Finance reports disappointing results due to bad loans	0.07%	-0.05%	0.08%
30 May 1996, Thursday	Moody's puts Thailand's commercial paper programme and commercial bank deposits on watch for possible downgrade due to recent build-up in short-term foreign currency debt	-0.20%	0.03%	0.02%
3 September 1996, Tuesday	Moody's downgrades Thailand's short-term sovereign debt as well as short term obligations of three of the country's four biggest commercial banks: Bangkok Bank, Thai Farmers' Bank and Siam Commercial Bank. Reason: Recent rapid accumulation of short-term d	-0.01%	-0.07%	0.19%
4 December 1996, Wednesday	<i>Somprasong group and other Thai property companies are having problems due to decreasing asset values</i>	0.04%	-0.02%	-0.06%
14 January 1997, Tuesday	BoT will not help to ease burden of bad property loans on domestic financial system	0.04%	0.05%	-0.01%
5 February 1997, Wednesday	<i>Property company Somprasong Land defaults on its USD 80 million eurobond. More bankruptcies expected by sector analysts</i>	0.12%	0.17%	0.17%
14 February 1997, Friday	Moody's puts Thai sovereign debt on credit watch again for possible downgrade due to concerns about the soundness of Thailand's financial sector	0.27%	weekend	-0.08%
28 February 1997, Friday	Near-collapse of Finance One, the country's largest finance company	0.04%	weekend	0.04%
3 March 1997, Monday	Suspension of trading in financial sector stocks by Thai government plus announcement of a series of measurements to prevent sector from collapsing (i.e.: increase provisions for bad debt => applies to nearly all of the more than 90 finance companies and	0.04%	0.14%	0.04%
9 April 1997, Wednesday	Downgrade of Thailand's foreign currency rating for bonds and bank deposits	0.00%	-0.02%	0.02%
22 April 1997, Tuesday	Profits of some banks worse than expected	0.01%	-0.02%	0.06%
9 May 1997, Friday	<i>Texas Instruments cancels partnership with Thailand's electronic group Alphatec Group. Result: Alphatec experiences severe financial problems and calls for government bail out</i>	-0.35%	weekend	-0.23%
25 June 1997, Wednesday	BoT will no longer provide unlimited support to financial institutions	-0.25%	0.15%	0.00%
27 June 1997, Friday	Thai authorities suspend the operations of 16 ailing financial companies	0.00%	weekend	0.12%

Cumulative Abnormal Change	0.51%
Average Abnormal Change	0.01%
Variance	1.70782E-08
Standard Error	0.000130684
T-ratio	1.027441609