Official Intervention in Forward Foreign Exchange Market and the Financial Loss for the Case of the Bank of Thailand in the 1997 Currency Crisis

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Though the forward foreign exchange market whether in terms of the outright transaction or foreign exchange swap can be potentially useful as an official policy tool, there are also pitfalls in its uses. The Thai Central Bank, during the 1996-1997 currency crisis, utilized intensively the forward market as a tool for the domestic monetary policy and for counter-speculation against the fixed baht value. After the initial defense of the baht in the spot market, the Bank of Thailand usually followed it up with a buy-sell swap. The sterilized foreign exchange intervention resulted in a substantial forward liability for the Bank of Thailand. The speculation was enticed into operating in the forward market due to an ample supply from the official source. The forward intervention could prevent the immediate loss of international reserves without causing much impact on domestic interest rates to rise. But speculators expected large gains when the forward rate was relatively subdued or implicitly and unintentionally subsidized by the large official intervention. Thus, substantial forward intervention was very risky when it helped to prolong the expected unsustainability of the pegged value of the baht in the midst of rapidly deteriorating external sector, the accumulation of huge short-term external debt and domestic financial institution problems. Estimates of the financial loss in the forward intervention to the Bank of Thailand after the Baht floated in July 1997 amounted to US$ 8.44 billion. There was an additional estimated loss in the spot market intervention of US$ 6.71 billion. Injudicious and unlimited use of the forward exchange intervention was a crucial factor contributing to serious economic ramifications that followed after the fall of the baht.

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1. Introduction

The 1997 financial crises (currency and banking and sometimes called the twin crisis) in East and Southeast Asia together with their severe economic consequences in these countries have led to substantial literature on the causes, onsets, evolutions and economic consequences as well as the appropriate (or inappropriate) policy responses both at the level of the domestic authorities in the crises countries and the international organizations, notably the policy prescriptions as the conditionality for an assistance in the IMF programs. The vast literature attempts to provide a better understanding of the causes and consequences of the economic crisis. Different causes of the crises require, of course, different policy responses. A better understanding is then essential so that future and similar problems can be properly and timely managed at a lower cost. Though it is not the objective of this paper to run through a review of this literature, it is useful to the later analysis of this paper to provide a very short reference to some aspects of their important theoretical analyses.

Central to the analysis of the financial crises in East Asia is the cause of speculative attacks on the fixed or semi-fixed exchange rate regimes; for example, Thailand in 1996-1997. There are two general primary explanations for a currency crisis. The first explanation is usually known as the first-generation model. The argument is based on the deterioration in economic fundamentals of an economy leading to a crisis in its external account. In our particular case of Thailand, there were large and long-accumulated current account deficits and hence substantial private external debt financed by relatively large private and short-term portfolio (including bank) finances under the rapid financial liberalization in the capital account. This eventually leads to a currency crisis and its speculative attacks when it is perceived that a large current account deficit

can no longer be financed by external sources.[2]

The second and alternative explanation or the so-called second-generation model is based on the self-fulfilling prophecy. A currency crisis can still occur in a country even without unsound long-term economic fundamentals. But speculators think that the currency is in a crisis. So, they prey on it in an individually rational self-fulfilling expectation that the currency is going to be devalued. The country under attack is then led finally to a lower-level (bad) equilibrium under a possible "multiple equilibria" condition.[3] This is a popular view of many policy makers in crisis countries who also argued that the IMF should provide adequate resources to fight against the predatory attacks on the currency. Though the literature on self-fulfilling expectation primarily leans on an individual rational behavior which may turn out to be herd behavior, all the second-generation models also hinge more importantly on some current and expected fundamental weakness. They, however, reject the notion that current levels of traditional economic variables on fundamental weakness were by themselves adequate, using what Furman and Stiglitz called Occam's razor, to cause with a high probability in the sense of a stochastic

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[2] See Krugman (1979) who exampled the on-going fiscal deficit leading to sustained reserve losses and eventual exchange rate speculation and abandonment of a fixed exchange rate. But, the large annual current account deficit in the case of Thailand, due to a very large private saving-investment gap, was financed principally by private short-term capital inflows, which could potentially and abruptly reverse when private expectations changed.

[3] See for example Obstfeld (1986, 1996), Sachs, Tornell and Velasco (1996) and Burnside, Eichenbaum and Rebelo (1999). The last work cited here argues that even though governments of Asian countries ran fiscal surpluses or small deficits prior to the crises, the model they present shows that prospective large fiscal deficits associated with implicit bailout guarantees for the failing banking system through the seignorage revenues rather than taxes (especially the case of Thailand and Korea) resulted in a speculative attack on the currencies.

model the extent of severity in the recent Asian economic downturns.[4]

It is thus pertinent to this paper that the speculative attacks on the currency and in our particular case on the Thai baht were not void of the deterioration in both current and expected economic fundamentals. To my mind, the important economic fundamental variables should be interpreted broadly including not only the changing external account of the country (long-running and large current account deficits financed substantially by short-term bank and other forms of portfolio capital inflows under a premature international account liberalization with a fixed exchange rate regime), large accumulated external debt, highly leveraged domestic economy, the relative rapid expansion of non-traded *vis-à-vis* tradable sector production with its speculative real-estate and stock market bubble and overvaluation of the domestic currency in real terms, but also the expected Thai government's own perception and policy responses before the economic crisis in Thailand erupted in early July 1997.

Having taken the above position, it is then appropriate to concentrate on the narrow aspects of this paper, i.e. the official intervention in the forward foreign exchange market. Since it is presently a well-known fact that the Bank of Thailand prior to the eruption of the crisis on July 2, 1997 had intervened heavily in the foreign exchange market to defend the value of the baht, I have two objectives. First, I will discuss the primary elements of the forward market (and the swap foreign exchange

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[4] See Furman and Stiglitz (1998) for a detailed study of the important causes of the Asian economic crises, which go beyond the self-fulling expectation models. Nevertheless, both Radelet and Sachs (1998) and Furman and Stiglitz (1998) also argued that IMF policy conditionality unintentionally exacerbated the crises. See also the comments (in terms of an *ex ante* rather than *ex-post* perspective of IMF policies) on the point of some misguided key elements of the IMF programs by R.N. Cooper on the paper by Radelet and Sachs as well as comments and discussions by other economists including B.P. Bosworth, J. Duesenberry, W. Clien and M. Obstfeld. Fischer (1998) and Dornbusch (2000) joined the debates and defended most of the IMF prescriptions.

market) with a particular aim to understand the theoretical potentialities and pitfalls of the official intervention in this market. This theoretical analysis will be done with the case of Thailand's central bank intervention in the forward and swap market. My analysis on the desirability of the official intervention in the forward market gains much from the literature on this matter in the latter part of the 1950's and 1960's when the world was in the adjustable-peg system.[5] Second, the paper provides an estimate of the financial loss by the Thai central bank as a result of its heavy intervention which occurred after the baht was finally floated on July 2, 1997.

2. The Forward Market and Interest Rate Parity

Foreign exchange dealing may take place at the spot level or at the forward level. The spot transaction with the spot exchange rate is for immediate or almost immediate (say 2 days) delivery of the currency. The separate forward dealing, in which foreign exchange contracts are made for future delivery, may be of different maturities ranging from, for example, days to months or even years. The most common forward contract is said to run for 9 months. In addition to the outright forward market and for the particular concern of this paper for Thailand, there is also a swap market, which is directly related to the forward market. The foreign exchange swaps are the transactions, which constitute the simultaneous executions of a spot and forward transaction in an opposite direction. The buy-sell swap for the dollar-baht transaction is a purchase of dollar in the spot market (or selling baht spot) with a simultaneous sale of dollar in the forward

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[5] Though the controversy in the policy prescription for the official intervention in the forward market is basically related to the British Sterling, it can be relevant for any other currency in a pegged exchange rate regime. The controversy, referred to as the Jasay-Spraos case for intervention and with the literature that followed, results in an increase of understanding on the potentialities as well as limitations of the official intervention in the forward market under a pegged exchange regime.

market (selling dollar for baht in the forward market). The sell-buy swap, on the other hand, is the simultaneous spot and forward transactions in the opposite direction of the buy-sell swap, i.e. selling dollar spot and buying back the dollar forward. It should also be noted that the buy-sell swap for one party of the transaction is the sell-buy swap for the other party.

Thus, the forward market together with the swap market is a part of the overall foreign exchange market. The forward market can be then considered to be a set of relationships among commercial banks both domestic and international through which corporations, the non-bank entities and individuals in an economy who wish to do so may buy or sell currencies for future delivery. There are generally four reasons a person or an individual may enter into a forward contract. These are interest arbitrage possibilities, trading risk minimization, speculation and the forward exchange rate arbitrage.

A covered interest arbitrage possibility occurs when a difference exists between interest rates in two currencies (countries) which is not offset by the difference in the forward and spot rate, given the relative country risk premium. In this situation, it becomes profitable for an arbitrager to buy the currency of the higher interest rate spot, use that currency obtained to buy a security yielding an interest payment and then covers himself by selling the expected receipt in the forward market. This is called a covered interest arbitrage because the arbitrager protects himself from the possibility of the change in the exchange rate (e.g. devaluation of the higher-interest currency) by entering into a forward contract to sell this currency when the security he has invested matures.

As may be expected, the actions of interest arbitragers will tend to drive the price of the forward exchange for the higher interest currency down. This is due to the additional supply of the forward currency. If the spot rate is pegged or supported under the fixed exchange rate regime and the forward rate is flexible as is usually the case without official

intervention, the increased demand for the higher-interest-rate currency spot will not be allowed to cause its spot price to rise. Hence, all the adjustment in the foreign exchange market must come from the forward rate. With a given interest rate differential, interest arbitragers will continue to operate under a free international capital mobility, i.e. buying spot to invest and selling forward to cover their foreign exchange risks until the forward rate of the currency is pushed down to a point where the discount from the spot rate is now equal to the interest rate differential. At this point, there is no longer any profitable incentive for arbitragers to move their additional funds. There is a flow equilibrium and it is called the interest parity theory. The theory simply states that the interest rate differential will be reflected, given relative risks of the two currency assets, in the forward rates on various currencies. I must state again that this is only a tendency, i.e. the interest rates in different currencies will tend to equalize. It is because the net capital inflows may not be freely mobile and the net international capital flows may be only a small fraction of the total fund flow crossing the market. Nevertheless, in normal times, the theory does hold basically true. This is especially the case for Thailand, a small open economy, where there was a continuous and large net capital inflow after the capital account and foreign exchange market liberalization in the early 1990s up to 1996. This was especially the case for the establish-ment in 1993 of the Bangkok International Banking Facilities (BIBFs) to facilitate the growth of international banking activities. BIBFs is an off-shore financial market, which enjoyed tax and regulatory advantages to foster Bangkok as a regional financial center. There were also other liberalization measures including a non-resident baht (local currency) account and gradually relaxing or eliminating restrictions on purchase of foreign exchange by residents as well as transfer of baht overseas. Thus, there was (and still is) an offshore baht market linked to the onshore market. The so-called offshore and domestic banking transactions exist side by side locally.

Equation (1) below shows the equilibrium in covered interest arbitrage and Figure 1 indicates how effective interest rate equalization operates.

Let $\quad$ S $\quad$ = $\quad$ spot exchange rate in baht per U.S. dollar or $\dfrac{B}{\$}$

$\quad\quad$ F $\quad$ = $\quad$ forward exchange rate in baht per U.S. dollar say for one-year forward contract

$\quad\quad$ p $\quad$ = $\quad$ $\dfrac{F\text{-}S}{S}$ or premium for dollar in the forward market if positive. (A negative p means a discount for forward U.S. dollar or a forward premium for baht.)

it $\quad$ = $\quad$ one-year interest rate in baht asset expressed as a decimal point.

ius $\quad$ = $\quad$ one-year interest rate in comparable U.S. asset expressed as a decimal point

Assuming perfect capital mobility and given transaction costs and relative risk premium of the Thai and U.S. assets, the covered interest arbitrage yields the below equation.
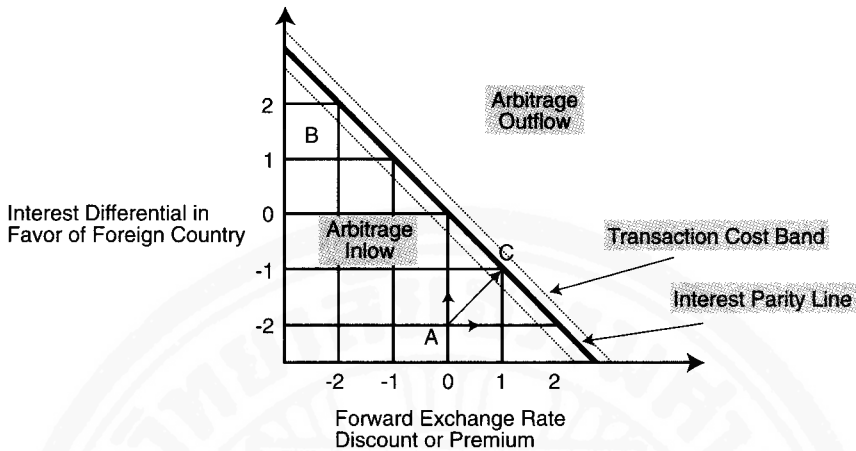
$$(1 + ius) = S(1+it)\,\frac{1}{F}$$

$$= \frac{1}{1+p}(1+it)$$

$$(1 + ius)(1 + p) = (1+it)$$

$$(it - ius) = p \ldots\ldots\ldots\ldots\ldots(1)$$

Figure 1. Interest Parity: The Relationship between
Interest Rate and Forward Exchange Rate

Noting that the product of the two small decimals (p and ius) is negligibly small, equation (1) is then a very useful simplification for our analysis.

Figure 1 indicates that any point out of the interest rate parity line will result either in an inflow or outflow of funds.

Point A, for example, is such a position. Since it is under the interest parity line, an interest arbitrage incentive exists. The interest differential in favor of the foreign country (U.S.) is negative and it is not offset by the forward premium for the dollar. Given the foreign or dollar interest rate there is an incentive for profitable arbitrage inflow into Thailand. If monetary policy is passive and the forward rate is not supported, the large capital inflow will raise domestic liquidity and push down the interest rate in Thailand, a small open economy with an open international capital account as the case in the 1990s before the crisis in 1997. As a matter of fact, the monetary authority of Thailand attempted to sterilize some of the rapid capital inflow. But, sterilized foreign exchange intervention measures were found to be not very effective to the extent that there continued to be confidence in the strength of the local currency.

In this situation the dollar forward rate should also increase. The adjustment will tend to take a path toward a point like c where the interest differential tends to fall and be offset by the positive forward rate for the dollar (a dollar premium in the forward market). The covered interest arbitrage equilibrium will then occur at point c.

Uncovered interest arbitrage can also occur which means that arbitragers take a short or long position without covering their foreign exchange risks. In this situation, the interest differential in favor of the baht is offset by its expected future depreciation. Many domestic borrowers in Thailand took their exchange risks by not hedging in the forward market. These activities can then shade into speculation where the asset and liability in a specific currency of a borrower is not equally matched over time. Uncovered interest arbitrage is sometimes called speculator-arbitrage, which is different from pure speculation in the forward market.

3. The Forward Market and Speculation

A second reason that an individual may enter into the forward contract is the possibility of a speculative gain. It is concerned with a currency, which is expected to be altered in value in one way or the other relative to other currencies. When such an expectation occurs, it provides an incentive for an individual to sell or buy forward exchange without covering. In reality, this is the essential definition of a speculator, a person who does not cover his risks. A speculator takes a short or long position in a currency in the forward (or spot) market.

Let F = forward rate in baht per U.S. dollar say for one-year forward contract

$E(S^F)$ = expected future spot rate in baht per U.S. dollar one year hence

The expected gain per unit from a forward speculation is the absolute difference between the expected future spot rate and the

forward rate or $\left| E(S^f) - F \right|$. If there is an expected revaluation of the domestic currency, the speculator will buy it forward. On the contrary, if there is an expected devaluation of the domestic currency (B), then the speculator will sell the weak domestic currency forward when the expected future spot rate exceeds the prevailing and corresponding forward rate. If devaluation does occur accordingly, the speculator can fulfil his forward contract by purchasing the domestic currency spot at a cheaper price. There will then be a speculative gain. As an example, if a speculator's expected future spot rate is 33 baht per dollar and supposes that the dollar forward rate is 27 baht. The current officially pegged rate is 25.30 baht per U.S. dollar. The speculator then sells baht forward at 27 baht for a future delivery of six months hence hoping to purchase it back at a devalued spot rate of 33 baht per dollar. If the baht goes down in value to 33 baht as expected, there will be a speculative gain of around 6 baht per dollar.

Though the size of the speculation on a domestic currency depends on the balancing of the expected gain per dollar against the risk incurred in the speculation, it is reasonably well-known that under a fixed or pegged exchange rate regime, the change in the official value of a currency is very unlikely to be in a direction other than that expected. Hence, speculators tend to have what is called a one-way speculative option against a weak currency. They tend to have a large speculative profit against a relatively small risk that they will incur any appreciable loss. In our example above, if the expected devaluation does not materialize, then the loss to the speculative sale of the baht for dollar tends not to be large if the relatively fixed spot rate is not diverging much from the forward rate. The speculator can buy the baht he sold forward at a rate of not much below 27 baht, e.g. 26 baht per dollar which is considered here to be the upper bound of the pegged rate regime. Nevertheless, on certain occasions, the freely fluctuating forward rate may actually diverge substantially from the current pegged spot rate due

to a heavy speculation or the official intervention in the foreign exchange market, the loss to the wrong speculation activities in the forward market can then turn out to be substantial as well.

In addition to the forward market, speculation can also take place in the spot market. In this situation, the speculator sells the weak baht spot transferring his funds into a stronger currency say the dollar. After devaluation, he then can convert back to the baht with a profit. Speculation in the spot market, if substantial, tends to cause the monetary authority to immediately lose its international reserve, which can eventually result in a forced or compelled devaluation, even without an underlying reason to do so. This then is called a self-fulfilling kind of speculation. Nevertheless, a speculative attack on a currency is usually based on an analyzed perception of the prevailing and expected fundamental weakness of that particular currency. This usually occurs for a particular case in the one-way speculation of a weak currency in a pegged exchange rate regime.

It is also important to note that in a normal situation where there is no speculative attack say on the normally higher interest rate domestic currency, the net excess demand for the foreign currency in the forward market by interest arbitragers (and also by traders, i.e. importers plus exporters due to a trade deficit) must be offset by the net excess supply of the same currency by the speculators, resulting in the forward rate equilibrium. The higher forward rate for a foreign currency is a reflection of the normally higher interest rate in the domestic currency and the continued trade deficit in the domestic economy. But the situation can change when there is an expected devaluation of the domestic currency giving rise to an increasing forward rate, which goes beyond the interest-parity forward rate. In other words, the domestic currency has a higher discount in the forward market than the interest-parity forward discount. An arbitrager will borrow the domestic currency, say baht, even at a higher interest rate of 10 per cent. The arbitrager sells baht spot for dollar. He then invests the borrowed funds in the dollar asset earning a lower interest rate

at say 4 per cent and enters into a forward contract selling dollar forward for baht at a much higher premium for dollar of 12 per cent. Arbitragers then make a profit of approximately 6 per cent. In this situation, the arbitragers and speculators enter the forward foreign exchange market in a different condition as compared to a normal situation above, i.e. with the former buying and the latter selling the weak domestic currency. The problem is that whether funds available to arbitragers or speculators dominate the market. Earlier and traditional analysis tends to indicate that the funds available to arbitragers are more limited as compared to forward exchange speculation. In the forward market speculation, speculators need no funds even though speculators may be required to put up some collateral sufficient for any possible loss. The collateral requirement is unlikely to put much restrictive limit to the desired level, if any, of specula-tion especially for large financial institutions, various investment funds and major corporate speculators. If that is the case, the forward rate during the heavy speculation may be pushed up very high, especially under a normally thin foreign exchange market for a developing economy like Thailand. This is usually the case for a short-run and immediate impact of speculation on the forward rate, which is not supported by the central bank intervention. But with the official forward intervention, the situation may be different for the forward rate. I will come back on this point later for the case of the Bank of Thailand in the 1997 currency crisis.

4. Commercial Covering and Speculation

In addition to the pure and speculative arbitrage, the third group of persons using the forward market is the exporters and importers (or traders). International trade is invariably linked to financings (commercial financings). It is known as trader-arbitrage because it involves the domestic and foreign interest rate as well as the two currencies involved in the spot and forward market. Traders may use the forward transactions to protect themselves from the foreign exchange risk. A local importer in Thailand may, as is usually the case, finance his import in dollar (or local import is

financed by the country from which the goods originate). He then pays the interest rate in dollar. He can then protect himself from the exchange risk by buying dollar forward. Alternatively, a local importer may finance his trade by borrowing in Thailand, in which he has to pay a local interest rate (in baht). He can then convert his borrowed baht into dollar in the spot market for an immediate payment of his commercial obligation. Choosing between these two alternatives of import financing gives rise to an importer interest arbitrage in commercial financing. Similar reasoning can also be applied on the side of a Thai export. An exporter who finances his export locally and expects a dollar receipt, for example, may enter into a forward contract to sell dollar forward. Since the forward rate may not be equal to the spot rate and interest rates differ for different currencies, commercial hedging or covering can be treated just like an additional cost in an international trade transaction. If a trader does not hedge his expected foreign exchange export receipt or import payment, he is considered to take a position and hence enters into a speculation. For example, if a foreign currency he expects to receive is selling at a premium, he may choose not to enter the forward market because market expectations do not indicate an immediate devaluation. Moreover, traders may also lead or lag their payments depending upon their expectations of the future movements in the exchange rates. If the baht is expected to be devalued, an importer who has a dollar liability and not wanting to be caught up with a dollar (foreign-currency) obligation, will "lead" or accelerate his remittance or import payments. Similarly, an exporter may "lag" or delay his receipt of foreign exchange in expectation of a devaluation of the baht. Though leading and lagging the commercial payments or remittances is a form of foreign exchange speculation, its extent is very difficult to ascertain.

5. Rationales for Official Intervention

There are two main reasons for the official intervention in the forward foreign markets. These are monetary policy reinforcement and counter-speculative intervention.

5.1 Monetary Policy Reinforcement

Keynes (1923), in his Tract on Monetary Reform, was the earliest economist who concerned himself with the theory and practice of the forward foreign exchange market. The process envisioned by him is as follows. When there is a recession or a depression, a low level of the domestic interest rate is desirable in order to promote more investment and other economic activities. However, such a lower domestic interest rate will widen the interest differential in favor of the foreign country, given the foreign interest rate. Interest-sensitive funds will then follow out of the country, tending to raise the domestic interest rate and undoing or moderating the effect of the expansionary monetary policy. The higher the sensitivity and mobility of the international interest arbitrage flow of fund, the more for the undoing or moderating of the effect the monetary authority attempts to accomplish. When the domestic capital flows out, then the domestic currency will tend to move to a forward premium roughly equal to the interest differential between the two currencies. The domestic interest rate is, for example, lower than the foreign interest by 2 per cent, the domestic currency or baht will then have a 2 per cent premium in the forward market. At this premium rate for the baht, domestic arbitragers in Thailand will no longer have any incentive to transfer their funds, either borrowed or owned, abroad because the gain in interest payments will be offset by the loss incurred in purchasing the baht back in the forward market at a higher price than they will in the spot market.

Now, it is suggested that the monetary authority or the central bank intervenes in the forward market by buying baht forward (or selling dollar forward). This will push the price of baht to rise in the forward market. The intervention will raise the additional forward exchange cost to the domestic arbitrager outflow and hence helps to reduce the outflow of domestic funds abroad.

The domestic central bank can choose as a policy choice to sell

the dollar forward in a substantial amount such that the forward discount for the dollar is pushed above 2 per cent. This will cause the domestic interest arbitragers to incur a loss if they invest in dollar assets because the interest gain is more than offset by the loss in the forward cover. Instead, foreign interest arbitragers will disinvest in the dollar assets and invest more in domestic assets in Thailand. By selling dollar spot and investing the baht in Thailand even at a relatively lower interest rate and simultaneously selling baht forward at a higher premium, the arbitragers will earn a higher effective rate of return in Thailand than in the U.S. In terms of Figure 1 above the official forward intervention aims to keep the net interest differential below the interest parity line say around point B. This will cause a net capital inflow into the domestic economy and helps to strengthen the domestic expansionary monetary policy. Though the manipulation of the forward market can strengthen the monetary policy for domestic stabilization purposes, it must be understood that such a forward rate policy means a payment of an implicit interest subsidy to foreign arbitragers. Moreover, if the policy is adopted in the situation where there is speculation on the value of the domestic or baht currency, which pushes the forward rate for the dollar to a high level, the foreign interest subsidy may turn out to be substantial due to a larger intervention required. The higher interest subsidy cost must be traded off with the gain from more employment (less unemployment) in the economy. The higher interest payment also implies that the marginal productivity of capital is lower than that indicated by the interest rate resulting in a relatively and marginally inefficient utilization of domestic resources.

5.2 Counter-speculative Intervention

The second reason for official intervention in the forward market is to fight against and deflect a speculative attack on its currency. As explained in the earlier section above, speculation can operate in either the spot or forward market (or in both markets) in an uncovered manner. When a speculator operates in a sport market he must use his own or

borrowed fund in order to sell the suspect baht currency, i.e. he sells baht and buys dollar spot. The cost of operation in the spot market includes basically the interest rate foregone or the interest rate paid. He hopes, however, to go back to the devalued baht covering both the opportunity cost (interest cost) and a profit by obtaining more baht than he borrows or puts up earlier. The speculator can also convert the speculative profit back into dollars.

If the speculator does not own the funds and does not want to borrow the local currency or the baht for speculation, he must operate in the forward market. But in both cases of operation either in the spot or forward market, there are costs that a speculator must accrue if the expected devaluation does not materialize. The cost of spot speculation with the borrowing funds is basically the difference in the interest rate between the two currencies. But the cost in dealing in the forward market when devaluation does not occur becomes greater as the forward rate rises to a higher and higher level or the baht has a greater discount. Therefore, the greater the forward rate, the more speculators will move into the spot market, putting an immediate pressure on the country's international reserve. And also, as analyzed above, arbitragers will find it profitable to sell the suspected weak baht spot and buy them back forward. In this unusually heavy speculative period, both speculators and arbitragers can operate to substantially drain international reserves from the country.

Therefore, it has been suggested that in order to lessen the impact, during a speculative attack on a domestic currency, in the spot market and hence on the country's international reserve, the monetary authority may choose to intervene in the forward market by contracting to buy its own currency in the forward market (buy baht and sell dollar forward). This will help to prop up the value of domestic currency in the forward market or lessen its forward discount. It will then lower the incentive for arbitragers to sell baht spot and buy it forward, relieving some of the pressure on the reserve. Also the lower discount rate for the

baht (or a lower forward dollar premium) will essentially subsidize the speculative activity. Such an effort will then reduce the cost to a speculator of operating in the forward market. It is thought that this will induce them away from operating in the spot market helping to reduce (though not totally alleviating) the immediate pressure on reserves that spot sales by speculators can cause.

When the forward contract expires, the monetary authority will have to pay the foreign currency (or the dollar in the Thai case) for its own currency or the baht. If speculators operate under the uncovered or short position, then they will have to buy the baht they speculate to fulfill their parts of the contracts. Therefore, it is expected that the net change on the official international reserve can well be close to zero, i.e. the monetary authority will pay out the foreign currency but will at the same time collect the foreign currency from the speculators who need to fulfill their contracts. In short, the same amount of the foreign currency will flow in as flown out from the official reserve.

6. Counter-speculative Intervention: Problems

The official interventions in the forward market to staunch a speculative movement against a domestic currency are often a debate. As analyzed above, the mechanical efficacy of this kind of proposal revolves principally around the supposition that speculators selling the weak domestic currency (baht) forward (either outright forward transaction or through the swap foreign exchange market) will have to buy the domestic currency in order to meet their forward contracts. To do so, they will have to supply the monetary authority with the foreign exchange (dollar) needed to pay off its forward commitments. As a result, the volume of the forward contracts entered into by the monetary authority is of no consequences. In fact, the central bank will even earn some profit because the forward rate in the contract exceeds the pegged spot rate when no change in the exchange rate policy is undertaken.

This proposal of forward market intervention is too simplistic and has a number of shortcomings.

First, the monetary authority may not know *ex ante* the precise amount how large of the total speculation is from those holding no domestic currency or without an easy access to it and how much derives from those who do, such as domestic and foreign companies in the country, banks and traders. In the case of the Thai currency crisis in 1997, there was overall recorded data on forward transactions by the Bank of Thailand categorized into on-shore and off-shore transactions. With an open and liberalized foreign exchange and international capital account in the balance of payments since the early 1990's off-shore transactions in baht increased rapidly. And in the speculative period during November 1996 up to the baht floating on July 2, 1997, the total off-shore and on-shore forward and swap outstanding transactions of all maturities by the Bank of Thailand respectively rose from U.S.$ 0.05 billion and U.S. $ 0.8 billion at the end of the November 1996 to as much as U.S.$ 19.77 billion (offshore) and U.S.$ 9.74 billion (onshore) by the end of June 1997. Off-shore speculators like their on-shore counterparts could, of course, easily obtain baht for their forward commitments until the intervention and restriction by the Bank of Thailand in the foreign exchange market on May 15, 1997. The Thai monetary authority requested (and followed it up later by the legal measures or order) financial institutions in Thailand not to enter into financial dealings with those non-residents without basic proof of normally underlying trade and investment transactions. The main purpose was to cut off the baht supply to non-residents. Later, there was also a restriction of the transfer of baht outward after liquidation by non-residents of domestic stock and other financial investment in Thailand. This resulted in a so-called *de facto* two-tier or separated foreign exchange market basically for baht and U.S. dollar, i.e. off-shore and on-shore market. As a result, the dollar price for baht diverged from each other in the two foreign exchange markets. With a restricted supply of baht in the offshore market, the baht appreciated abruptly in the off-shore

market relative to the on-shore rate. The spot rate fixed on Friday 16, 1997 by the Bank of Thailand was, for example, 25.81 baht per U.S. dollar while the offshore spot rate was 25.10-25.50 baht for the dollar. This offshore spot rate for the dollar did not recover until days later. And the average on-shore spot rate for May and June was 25.85 and 25.81 baht per dollar as respectively compared to 25.74 and 24.50 baht a dollar in the off-shore market. The baht, therefore, tended to have a relatively higher value in the off-shore market until the abolishment of the strict control of the supply of baht to the off-shore market. It inflicted a substantial loss to those speculators who decided to close their positions which came due. In their settlements, they either borrowed baht at a very high short-term interest rate from the monetary authority's permitted supply of baht from the on-shore market or disinvested their baht assets at heavy discounts. Speculators being unable to obtain baht could also roll over the forward contracts, i.e. buying the baht forward but at a relatively much higher discount. The 7-day forward premium for the dollar, for example, rose to an annualized rate of about 60-80 per cent. But forward liability of the Bank of Thailand in the onshore market continued to increase during May to the end of June 1997 by U.S$ 2.56 billion. On-shore speculation against the baht, therefore, continued to rise during this two-month period.

The second reason to support the official intervention in the forward market (or in the spot market) is that the central bank must not devalue. Nevertheless, with the official intervention resulting in a large build-up of forward contracts, the monetary authority tends to lose its freedom to devalue or adopt a new exchange rate regime. The massive losses that will result in the event of devaluation can then prove to be immediately unacceptable to the central bank as well as the government. The substantial forward obligation may tend to submerge or, to some critiques, hide the pressures building up against the domestic currency. But, the difficulty to keep the large extent of the official forward obligation secret can easily lead to uneasiness in the market resulting in an increase of pressure to a point no manner of official support can hold the par value

or the officially fixed rate. Hence, the official intervention in the spot market may be preferable to the forward intervention. This is because the speculative climax occurs relatively more quickly in the spot market and the decision to resolve the problem may also be taken one way or the other in a shorter time period.

The third and most important reason that is really required to support the official forward intervention (as well as the spot market intervention) is that the authority is relatively certain that there are no basic reasons for a devaluation. This basically means that there is no fundamental balance of payments problem with an excessive accumulation of the country's external debt financed by a relatively large short-term inflow of the portfolio investment, and other basic economic and financial weaknesses referred to in the introduction of the paper. The official forward intervention is not undertaken to prolong the adjustment required under the macroeconomic imbalance giving rise to a fundamental external disequilibrium. This means that the actions by speculators have no basic economic grounds to be supported. But, the primary aspect of this matter is that who, the monetary authority or the so-called professional speculator, is right. Speculators under an adjustable-peg exchange rate regime have a good record of assessing when a country is facing an unsustainable external disequilibrium and hence an overvaluation of the real exchange rate. Thus, speculators seem to have almost (even though not always) a sixth sense. Speculation when viewed without passion may actually perform an appropriate service to a country whose monetary authority and or the government may not be willing over a certain period of time to face up to the economic realities. Speculation in the foreign exchange market should, therefore, be taken seriously because it may be an indication that a country's currency may be overvalued against other currencies given the deteriorating and further prospective macro-economic imbalances as well as other weak economic and financial fundamentals. A timely adjustment with an expenditure-switching policy (exchange rate changes) and expenditure-reducing policy

(fiscal or monetary policy changes) are normally required.

7. Empirical Estimates of the Financial Loss of Intervention

The exchange rate regime adopted by the Bank of Thailand had been a basket-peg during November 5, 1984 up to the managed floating exchange rate on July 2, 1997. The central rate was first announced at 27 baht to the U.S. dollar on the day of the introduction of this regime which was an approximately 17.4 per cent rise in the dollar price against the baht. Though the Thai discretionary peg system gave the U.S. dollar a dominant weight in the basket, it was originally designed to inject some flexibility in the movement of the exchange rate. The exchange equalization fund, under the law, could change the central rate according to their analysis of the economic and financial conditions of Thailand *vis-à-vis* its important trading partners. In fact, after the adoption of the basket peg system, the nominal dollar price in terms of baht was less rigid during the period of November 1984 up to the 1986. The baht depreciated to approximately 28 baht per dollar and there were periods; for example, in the early 1990s, in which the baht appreciated to about 24.50 to 25 baht per dollar.

When there was a new round of no confidence in the viability of the pegged value of the baht during November 1996 up to the Baht floating on July 2, 1997, the market dollar baht rate (on-shore exchange rate) fluctuated narrowly between 25.405 and 26.13 baht to the U.S. dollar with the rate occasionally and marginally pushed up above the upper band set by the exchange equalization fund.

Figure 2 shows the movements of total swap transactions both on-shore (panel a) and off-shore (panel b) during December 1996-July 1998 and January 1997-July 1998 respectively. Figure 3 provides comparisons of the total swap or forward on-shore and off-shore transactions in terms of dealings and in terms of settlements of the contracts. The swap

transactions are defined to include all forms of forward transactions whether they are the outright forward contracts or the forward transaction associated with the counter spot transaction in a swap dealing. They are all plotted from the figures in Table 1 and Table 4. The data in Table 1 and Table 4 are the difference between the outstanding stock of forward foreign exchange obligations of the Bank of Thailand at the end of each month for the corresponding period of different maturities. The negative entry in Table 1 and Table 4 refers to the Bank of Thailand's buy-sell swap or outright forward sale of the dollar while the plus sign is the opposite situation, i.e. sell-buy swap or outright forward purchase of the dollar by the central bank. There are a number of observations that can be made from Table 1 and Table 4.

First, there were relatively small, as expected, forward foreign exchange activities by the Bank of Thailand in the initial period of November and December 1996. In fact, data on outstanding stock of forward obligation by the central bank in October was only U.S.$0.5 billion for the on-shore market and none for the offshore market. However, forward activities were slowly built up resulting in the overall outstanding liabilities of U.S.$0.85 billion (0.8 for on-shore market plus 0.05 for off-shore market) in November and U.S.$4.89 billion (3.9 billion for on-shore market plus 0.99 billion for off-shore market) in December 1996. In this initial period ending in December 1996, the large part of the monetary authority's-forward obligation was, therefore, much more in the on-shore market relatively to the off-shore market.

Second, the forward liability of the Thai monetary authority increased rapidly after the end of 1996 to U.S.$8.87 billion (5.91 billion for on-shore and 2.96 billion for off-shore) and U.S.$12.19 billion (5.63 billion for on-shore and 6.59 billions for off-shore) respectively in January and February 1997. The extent of the overall forward intervention tended to be stabilized temporarily in the months of March and April with the end-of-the-month total forward liability by the central bank of an approximate

outstanding amount of 13-14 billion dollars. The heaviest attack on the baht and the large and rapid net private capital outflow occurred during May 1997. Out of the estimated negative net total private capital flow of U.S.$2.82 billion in May, the non-resident domestic currency or baht deposit accounted as much as 78.01 per cent of the net total private capital outflow. Short-term capital could flow out as rapidly as flowing in. There was also an increase in loan payments abroad of U.S.$0.64 billion. This net loan outflow constituted about the other 22 per cent of the total net private outflow in May. As a result, it gave rise to a substantially large intervention by the monetary authority in the forward as well as the spot market. The forward intervention for different maturities was especially substantial in the off-shore speculation amounting to U.S.$13.39 billion as compared to only U.S.$2.54 billion for the on-shore transaction. Therefore, the outstanding forward liability of the Bank of Thailand in the on-shore market increased from U.S.$5.51 billion by the end of April to U.S.$7.2 billion in May 1997 and to U.S.$9.76 billion before the floating of the baht in early July 1997. But the far greater attack on the baht in the off-shore market resulted in an even more forward liability to the Thai monetary authority. This was because the Bank of Thailand attempted to keep the dollar off-shore spot rate against the baht from moving above the level of the officially pegged spot rate in the domestic market. The deviation could cause a further damaging net capital outflow aggravating the existing domestic pressure on its own international reserve. The total off-shore forward obligation then jumped abruptly from U.S.$8.57 billion at the end of April to U.S.$20.03 billion in May and then stayed approximately at this level until the end of June 1997. As a result, the combined forward shortfall position for the Bank of Thailand was U.S.$29.55 billion. It should be noted that approximately 67 per cent of this outstanding forward obligation prevailing in June 1997 was undertaken in the off-shore market. Over the whole period of these speculative activities, the central bank's forward liability was then more than proportionally owed to foreigners to the extent that off-shore market participants are not domestic entities. And

though the longest maturity of the total forward obligation (both on-shore and off-shore) prior to the baht floating in July 1997 was one year, 73 per cent of it had a maturity not exceeding 6 months. Therefore, there were large settlements of the forward contracts as well as some roll-over and or new forward transactions in the first six months after July 1997. (See the sum of the column and row in Table 1 and Table 4)

Third, underlying the forward transactions as shown in Table 1 and Table 4 was the central bank policy of defending the pegged value of the baht. The rapid net private capital outflow both due to speculation and other interest rate arbitrage including the payment of previously contracted loans resulted in the run-down of the international reserve. This potentially affected the domestic money supply causing it to fall under the pegged exchange rate regime. In turn, the domestic interest rate could rise due to a rapid decrease in the domestic monetary liquidity. The Bank of Thailand's policy during this period was not only of defending the pegged value of the baht but importantly also of trying to keep domestic liquidity at an approximate bay such that it would not cause the domestic interest rate to deviate from the officially desired level. This was, of course, the theoretically well-known sterilized foreign exchange intervention. Yet, the domestic short-term interest rate as represented by the inter-bank and 7-day repurchase market rate respectively rose by 38.63 and 25.50 per cent in May and 24.48 and 12.14 per cent in June. There was, of course, an expected fall in the value of the baht.

The instrument adopted by the Bank of Thailand in this particular sterilization policy was the foreign exchange swap. In addition to the out-right forward transaction, the Thai monetary authority utilized the swap transaction. The mechanism is simple. After the defense of the baht initially in the spot market, the buy-sell swap was then usually used by the Bank of Thailand. In this second process, it bought back the dollar spot (selling baht spot) and at the same time contracted to sell back the dollar forward (buying baht forward). The swap could be practically transacted in

direct consonant with the speculative activities as well as the rapid net private capital outflow. The policy eventually, as indicated above, resulted in a massive forward foreign exchange liability by the Bank of Thailand. The swap was then tantamount to an enticed forward speculation. The forward transaction in the swap deals carried an implicit and unintended subsidy because the forward rate for the dollar was subdued. Except for May and June 1997 and especially in the off-shore market the discount rate for the baht in the forward market rarely exceeded 5 per cent before the baht's floating. Speculation then abounded as a result of the ample official forward market supply. This had an important implication when the baht was finally allowed to float in July 1997.

To calculate a financial loss of the official forward market intervention, it is necessary to have information on the forward rate and the future spot rate associated with the different flows of forward transactions shown in Table 1 and Table 4. As analyzed above, the expected gain for a speculation is the absolute difference between the expected future spot rate and the forward or swap rate under the contract. I have taken the differential between the actual future spot rate and the corresponding forward rate to indicate the gain or loss per dollar of the forward transaction. This is called the spread and is shown in Table 2 for the on-shore market and in Table 5 for the off-shore market. Given data in Table 1 and Table 2, the estimates of gross financial profit and loss on the official forward transactions can now be established. They are shown in Table 3 for the on-shore operation during the period of November 1996 to August 1998. The estimates of profit or loss for the official forward foreign exchange operation in the off-shore market are shown in Table 6. Figure 4 and Figure 5 illustrate the estimates of the profit or loss of the intervention and make comparisons for the on-shore and off-shore results respectively.

The empirical estimates indicate that most of the official forward transactions turn out to be a loss simply because the Bank of Thailand had a forward dollar liability and the baht depreciated substantially after

the July floating. There were, of course, some large financial profits especially during May and June 1997 when the foreign exchange market was separated into on-shore and off-shore markets by the monetary authority's restriction of baht supply to the off-shore market. A large wedge occurred between the actual future spot rate and the forward rate especially in the off-shore market. This was particularly the case in June where the Bank of Thailand had a gain of 3,398 million baht in the off-shore market transactions and 689.3 million baht for its on-shore settlements (See the sum on the column in June in Table 6 and Table 3). There were also very substantial gains for the monetary authority from the on-shore forward market settlements during March-June 1998 to a combined amount of 33,993 million baht. This was due to the appreciation of the baht after its plunge to as low as 49.85-56.2 baht per dollar in January 1998. The reversal in the currency movement of the earlier overshooting exchange rate gave rise to a number of profitable swap liquidations which matured during this period. Nevertheless, when all the official forward market settlements were summed up, there was a total net loss of 119.14 billion baht (U.S.$2.75 billion measured at the future spot rate corresponding to the settlement periods) and 222.56 billion baht (U.S.$5.69 billion) for the on-shore and off-shore forward obligations respectively. The total financial loss in the forward market was then U.S.$8.44 billion. When the loss in the forward intervention is combined with an estimated loss of the spot market intervention in an amount of U.S. $6.71 billion, the total calculated loss was U.S.$15.25 billion. Such a heavy loss could very likely lead the Thai monetary authority to join the rank of the highest cost in the official defense of a currency in the foreign exchange market.

8. Conclusions

The forward foreign exchange market be it the outright forward or swap transactions or any other form of foreign exchange derivatives can be very useful for a number of purposes. Its useful potentialities do not

concern only with the private activities in interest and foreign exchange arbitrage, hedging for traders and investors, and speculation but also with official forward intervention as a policy tool. Official interventions in the forward foreign exchange market can be adopted for two main reasons, namely, reinforcement of the monetary policy and counter speculative intervention. In the particular case of the Thai currency crisis in 1996-1997, the central bank of Thailand also utilized the forward market to defend the pegged value of the baht as well as to shore up the domestic liquidity. After the initial defense of the baht in the spot market, the Bank of Thailand followed it up with a buy-sell swap. The sterilized foreign exchange intervention basically through the foreign exchange swap resulted in a substantial forward liability for the Bank of Thailand. The speculation was enticed into operating in the forward market due to an ample supply from the official source. Through this mechanism of forward intervention, the central bank could prevent both the immediate loss of international reserves and domestic interests to rise. The speculators expected large gains when the forward rate was relatively subdued or implicitly and unintentionally subsidized by the large official intervention. Thus, substantial forward intervention was very risky when it helped to prolong the expected unsustainability of the pegged value of the baht in the midst of the deteriorating external sector, the accumulation of huge short term external debt and the domestic financial institution problems. Estimates of the financial loss in the forward intervention to the Bank of Thailand after the baht floated in July 1997 amounted to US$ 8.44 billion. There was an additional financial loss of U.S.$6.71 billion for the spot market intervention. Injudicious and unlimited use of the forward exchange intervention was a crucial factor contributing to serious economic ramifications that followed after the fall of the baht. The adoption of the managed floating exchange rate regime can hopefully help to dispense with a large official intervention in the forward market.

Figure 2. Total Swap Transactions

Panel a: On-shore, December 1996 - July 1998
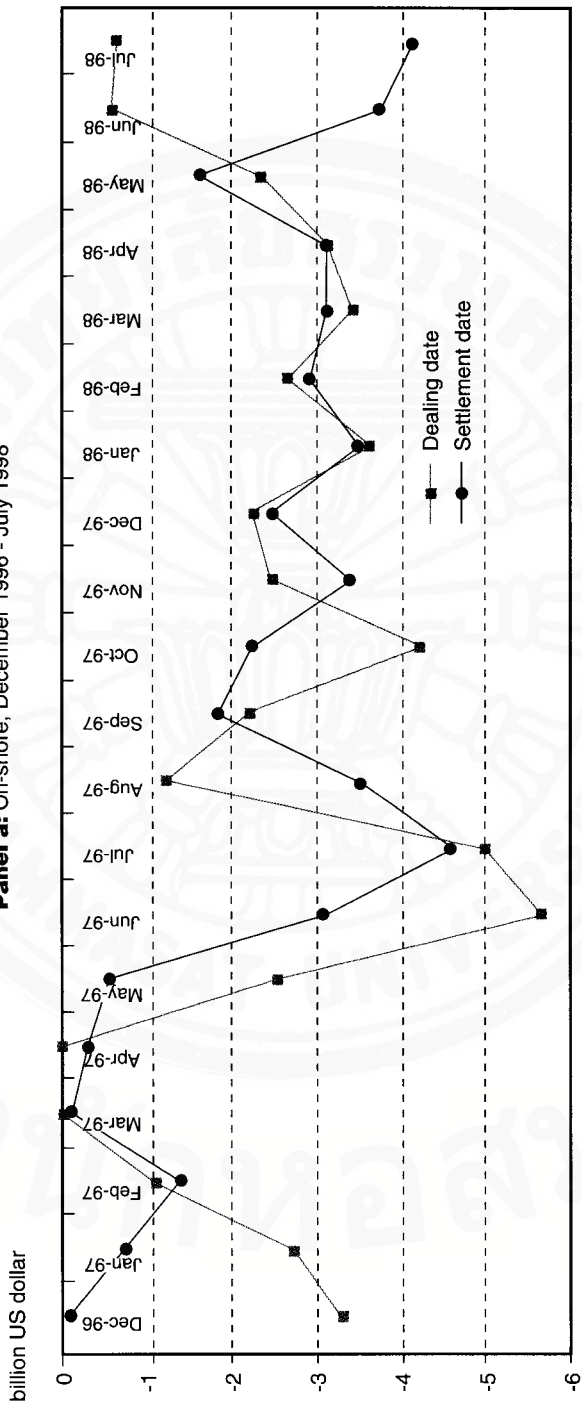
Panel b: Off-shore, January 1997 - July 1998
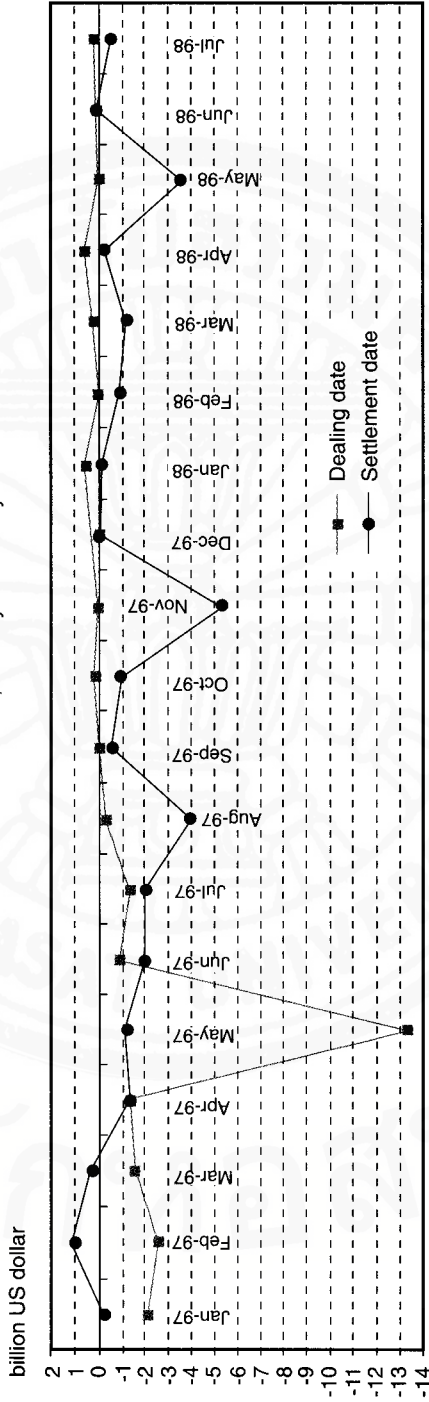
Figure 3. Comparison of Total Swap Transactions in On-shore and Off-shore Market

Panel a: Dealing date, December 1996 - July 1998

Panel b: Settlement date, January 1997 - August 1998
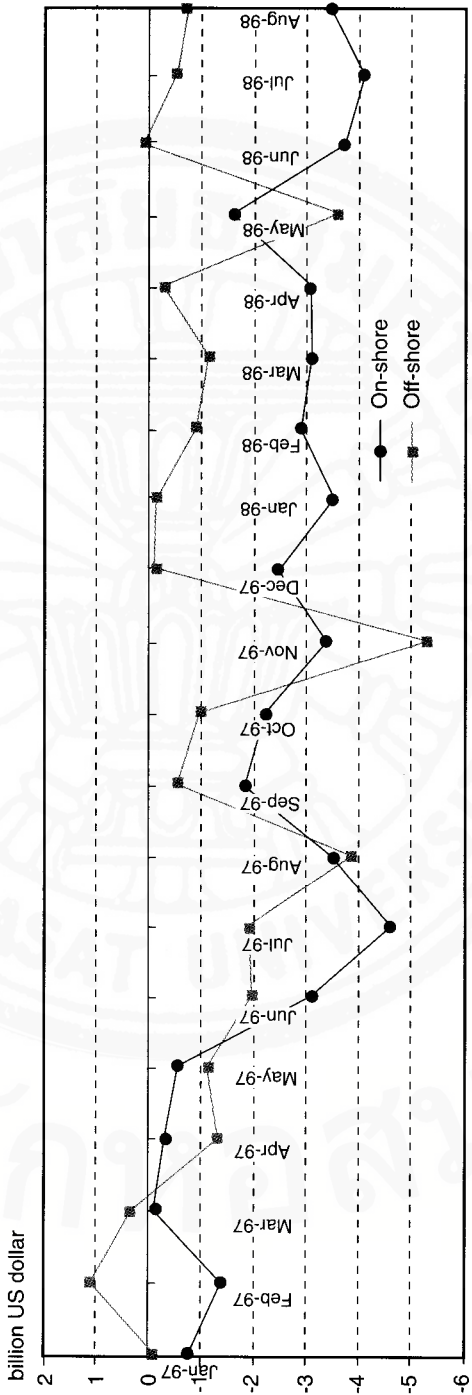
Figure 4. Estimates of Bank of Thailand's Profit or Loss from Swap Transactions

Panel a: On-shore, December 1996 - July 1998
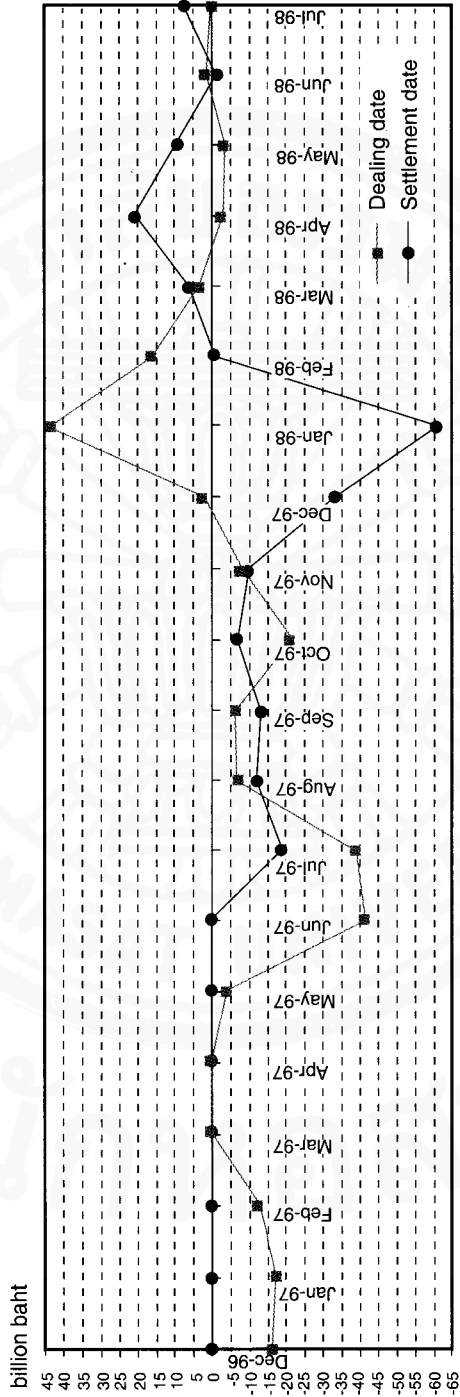
Panel b: Off-shore, January 1997 - July 1998
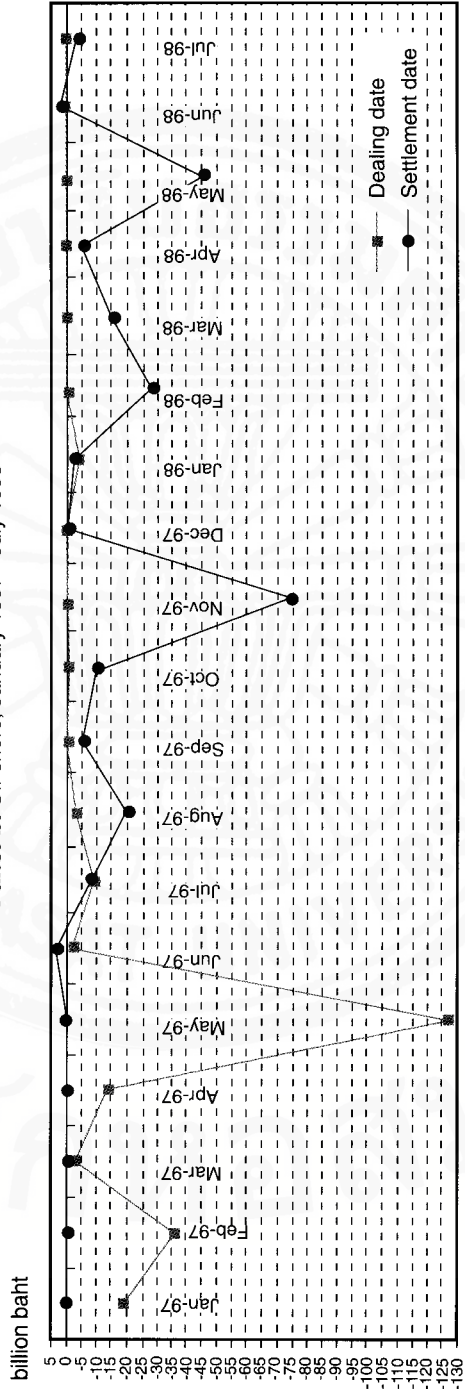
Figure 5. Comparison of Profit or Loss of Bank of Thailand in On-shore and Off-shore Market
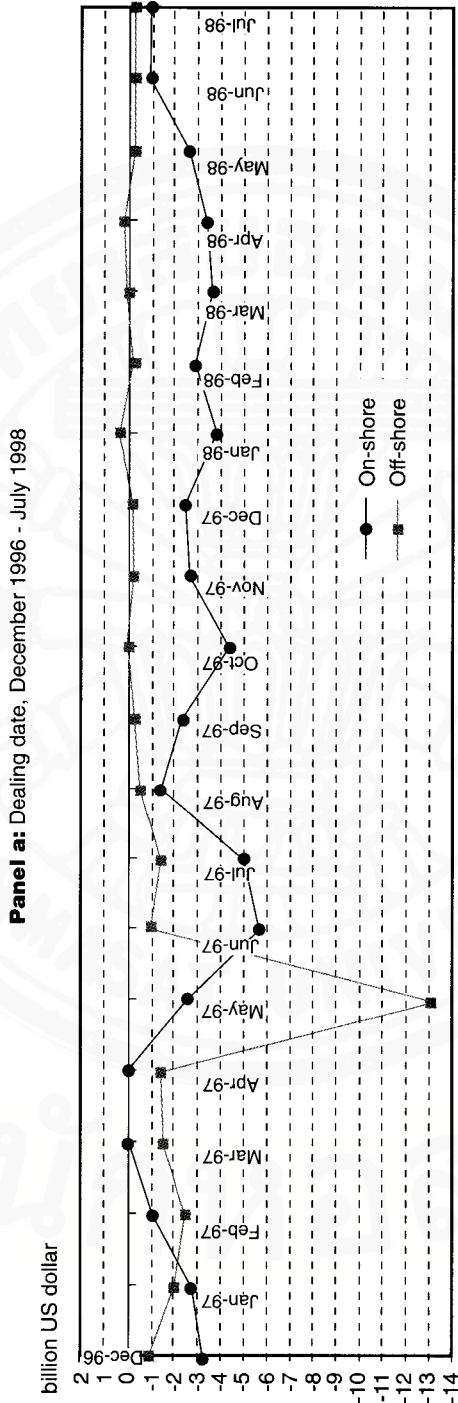
Panel a: Dealing date, December 1996 - July 1998
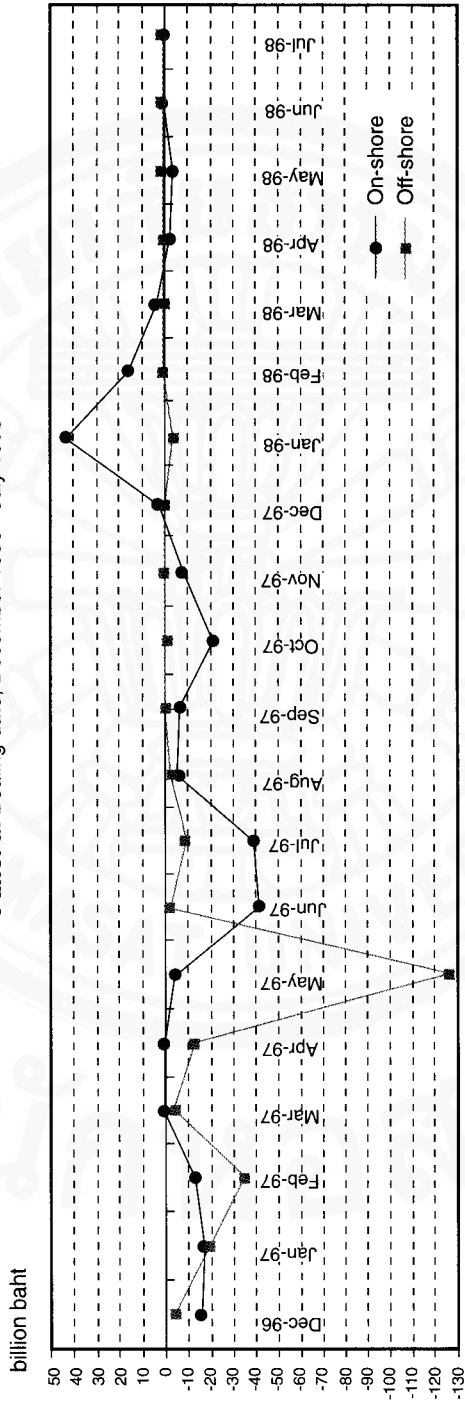
Panel b: Settlement date, January 1997 - August 1998
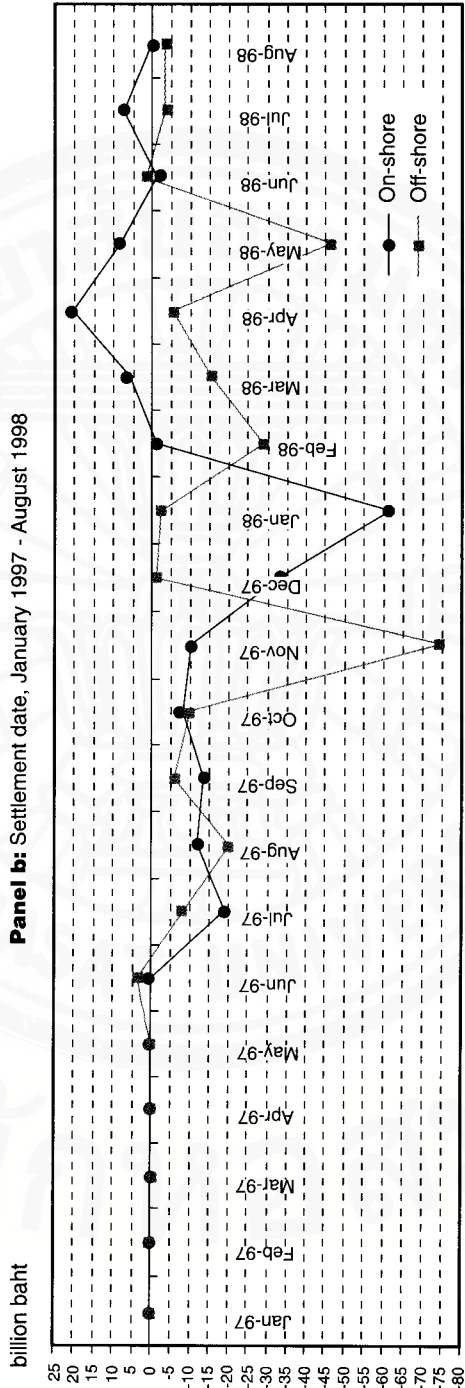
Table 1. Bank of Thailand's Forward Transactions (On-Shore)

(Unit: Billion U.S.dollar)

Time	Dec-96	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97	Jan-98	Feb-98	Mar-98	Apr-98	May-98	Jun-98	Jul-98	Aug-98
Nov-96	-0.1	-0.1	-0.15	-	-	-0.2	-	-	-	-	-	-0.15	-	-	-	-	-	-	-	-	-
Dec-96		-0.65	-0.3	-0.5	-	-	-0.73	-	-	-0.6	-	-	-0.53	-	-	-	-	-	-	-	-
Jan-97			-0.94	-0.45	-0.1	-	-	-0.5	-0.22	-	-	-	-	-0.43	-0.11	-	-	-	-	-	-
Feb-97				0.83	-0.2	-0.35	-0.18	-	-0.57	-0.11	-	-	-0.05	-	-0.28	-0.2	-	-	-	-	-
Mar-97					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apr-97						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
May-97							-2.19	-0.05	-0.05	-0.33	-0.02	-0.1	-0.15	-0.09	-0.02	-0.2	-	-	-0.24	-	-
Jun-97								-4.05	-0.1	-0.14	-0.95	-0.06	-0.63	-1.08	-0.09	-	-	-	-	-	-
Jul-97									-2.57	-	-	-	-0.02	-	-	-	-	-	-	-0.14	-
Aug-97										-0.64	-0.01	-0.36	-0.07	-	-	-0.03	-	-	-	-	-0.01
Sep-97											-1.23	-0.17	-0.49	-0.01	-	-0.28	-0.01	-	-	-	-
Oct-97												-2.53	-	-1.1	-	-	-0.5	-	-	-	-
Nov-97													-0.51	-0.06	-0.86	-0.11	-	-0.72	-0.19	-0.06	-0.01
Dec-97														-0.71	-0.01	-0.71	-0.05	-	-0.71	-0.05	-
Jan-98															-1.52	-0.09	-1.09	-0.09	-0.05	-0.64	-0.12
Feb-98																-1.47	-0.17	-0.72	-0.07	-	-0.22
Mar-98																	-1.25	-0.09	-1.8	-0.25	-
Apr-98																		0.02	-0.17	-2.57	-0.4
May-98																			-0.48	-0.04	-1.8
Jun-98																				-0.33	-0.22
Jul-98																					-0.59
sum	-0.1	-0.75	-1.39	-0.12	-0.3	-0.55	-3.1	-4.6	-3.51	-1.82	-2.21	-3.37	-2.45	-3.48	-2.89	-3.09	-3.07	-1.6	-3.71	-4.08	-3.37

Note:

1. Time period by column refers to the period that the BoT enters into the out-right forward and swap transactions while time on the row basis refers to obligation under different maturity structure in out-right forward and swap transactions taken by the BoT.

2. Minus sign refers to BoT's Buy-Sell swap and out-right forward obligations while plus sign is the opposite situation for the BoT i.e. Sell-Buy swap and out-right forward purchase of dollar.

3. The data used in the above calculation is based on the Bank of Thailand's outstanding forward obligations.

Table 2. Spread between Actual Spot Rate and Swap or Forward Rate under the Forward Obligations (On-Shore)

(Unit: Baht per U.S.dollar)

Time	Dec-96	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97	Jan-98	Feb-98	Mar-98	Apr-98	May-98	Jun-98	Jul-98	Aug-98
Nov-96	0.03570	0.08771	0.23099	0.16157	0.19411	-0.08199	-0.17902	4.15455	6.70241	10.06714	11.21668	12.84057	-								
Dec-96		0.04169	0.19211	0.11803	0.15315	-0.12037	-0.22171	4.11379	6.66357	10.03570	11.18912	12.81689	18.85458	0.00000	-						
Jan-97			0.13356	0.06066	0.08974	-0.18532	-0.28819	4.03953	6.58536	9.95352	11.10649	12.73207	18.76756	26.97190	18.22066	-					
Feb-97				-0.14924	-0.16831	-0.49602	-0.62898	3.66866	6.18058	9.52772	10.65967	12.26596	18.28923	26.48133	18.58191	12.57849					
Mar-97					0.00594	-0.29386	-0.42148	3.88083	6.39743	9.73636	10.87589	12.48976	18.51355	26.71138	18.81768	14.02865					
Apr-97						-0.26577	-0.36514	3.96610	6.50617	9.86858	11.01579	12.63476	18.66363	26.86136	18.97728	14.19786	12.51286				
May-97							-0.18916	4.11034	6.62414	9.98543	11.13152	12.75197	18.78637	26.98961	19.10132	14.29918	12.59146	12.30975			
Jun-97								4.17381	6.59060	9.82972	10.91186	12.46836	18.43476	26.63081	18.73532	13.94450	12.23349	11.94848	14.80812		
Jul-97									2.35980	5.52500	6.47500	7.99009	13.91509	22.00894	14.05126	9.19825	7.43964	7.12446	9.95392	8.77298	
Aug-97										3.63628	4.66135	6.16076	12.07369	20.15546	12.14571	7.26720	5.48311	5.12503	7.90851	6.68158	7.01025
Sep-97											0.90318	2.32469	8.15611	16.17801	8.10838	3.14341	1.29573	0.87407	3.59705	2.29098	2.54052
Oct-97												1.57788	7.47504	15.54104	7.50633	2.57629	0.74066	0.32573	3.05545	1.77477	2.00839
Nov-97													5.89439	14.01248	6.03904	0.96315	-1.01833	-1.57380	1.35681	0.27702	0.75282
Dec-97														7.93743	-0.08100	-4.99475	-6.80523	-7.18970	-4.42952	-5.70528	-5.42545
Jan-98															-8.23274	-13.29422	-15.26128	-15.71343	-13.02092	-14.33882	-14.06121
Feb-98																-5.02576	-6.98622	-7.52068	-4.90187	-6.29346	-6.12946
Mar-98																	-1.93798	-2.42245	0.23773	-1.47947	-1.64108
Apr-98																		-0.54470	2.15514	0.84457	1.06365
May-98																			2.61441	1.27817	1.49753
Jun-98																				-1.51205	-1.44805
Jul-98																					0.29193

Note: 1. See note 1 in Table 1 for the interpretation of time in terms of columns and rows

2. The spread is the difference between the actual (future) spot rate at time t and the swap or forward rate under the obligation due at the same t period

Table 3. Estimates of Gross Profit and Loss on official Forward Operations (On-Shore)

(Unit: Billion baht)

Time	Dec-96	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97	Jan-98	Feb-98	Mar-98	Apr-98	May-98	Jun-98	Jul-98	Aug-98	Sum
Nov-96	-0.00357	-0.00877	-0.03465	-	-	-	-	-	-	-	-	-1.92609	-	-	-	-	-	-	-	-	-	-1.95668
Dec-96		-0.0271	-0.05763	-0.05901	-	0.016398	0.161851	-	-	-6.02142	-	-	-9.99293	-	-	-	-	-	-	-	-	-15.99624
Jan-97			-0.12554	-0.0273	-0.00897	-	-	-2.01977	-1.44878	-	-	-	-	-11.5979	-2.00427	-	-	-	-	-	-	-17.23255
Feb-97				-0.12387	0.033661	0.173606	0.113216	-	-3.52293	-1.04805	-	-	-0.91446	-	-5.20294	-2.5157	-	-	-	-	-	-13.00746
Mar-97					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00000
Apr-97						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00000
May-97							0.414264	-0.20552	-0.33121	-	-	-1.2752	-2.81795	-	-	-	-	-	-	-	-	-4.21561
Jun-97								-16.9039	-0.65906	-3.24381	-0.21824	-	-11.6139	-2.39677	-	-2.7889	-	-	-3.55395	-	-	-41.37855
Jul-97									-6.06469	-0.7735	-6.15125	-0.47941	-0.2783	-23.7697	-0.28103	-	-	-	-	-1.22822	-	-39.02604
Aug-97										-2.32722	-0.04661	-2.21787	-0.84516	-	-1.09311	-0.21802	-	-	-	-	-0.0701	-6.81810
Sep-97											-1.11091	-0.3952	-3.9965	-0.16178	-	-0.88015	-0.01296	-	-	-	-	-6.55750
Oct-97												-3.99203	-	-17.0951	-	-	-0.37033	-	-	-0.10649	-	-21.56399
Nov-97													-3.00614	-0.84075	-5.19358	-0.10595	-	1.133137	-0.25779	-	-0.00753	-8.27960
Dec-97														-5.63557	0.00081	3.546273	0.340262	-	3.144962	0.285264	-	1.68200
Jan-98															12.51377	1.19648	16.6348	1.414208	0.651046	9.176846	1.687345	43.27450
Feb-98																7.387861	1.187658	5.414892	0.343131	-	1.348481	15.68202
Mar-98																	2.422475	0.21802	-0.42791	0.369967	-	2.58245
Apr-98																		-0.01089	-0.36637	-2.17055	-0.42546	-2.97327
May-98																			-1.25492	-0.05113	-2.69556	-4.00160
Jun-98																				0.498975	0.31857	0.81754
Jul-98																					-0.17224	-0.17224
sum	-0.00357	-0.03587	-0.21782	-0.21018	0.024687	0.190003	0.689332	-19.1292	-12.0267	-13.414	-7.52701	-10.2858	-33.4653	-61.4976	-1.26034	5.6219	20.20191	8.169363	-1.7218	6.774576	-0.01649	-119.13992

Note: 1. Estimates from Table 1 and Table 2.

2. Plus sign means profit or gain for BoT while minus sign refer to a loss for BoT.

Table 4. Bank of Thailand's Forward Transactions (Off-Shore)

(Unit: Billion U.S.dollar)

Time	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97	Jan-98	Feb-98	Mar-98	Apr-98	May-98	Jun-98	Jul-98	Aug-98	Sum
Dec-96	-0.14	-0.4	-0.1	-	-	-0.05	-	-	-0.1	-	-	-0.2	-	-	-						-0.99
Jan-97		1.49	-0.65	-0.1	-0.95	-	-0.2	-1.05	-	-	-	-	-	-0.65	-	-					-2.11
Feb-97			1.1	-0.1	-0.39	-0.1	-	-1.04	-0.19	-	-0.06	-	-	-0.65	-1.11	-					-2.54
Mar-97				-1.09	0.25	-0.2	-	-	-0.5	-	-	-	-	-	0.01						-1.53
Apr-97					-0.04	-0.05	-0.2	-	-	-0.69	-	-	-	-	-0.01	-0.4					-1.39
May-97						-1.6	-0.2	-1.56	-	-0.1	-6.24	0.05	-	0.1	-	-	-3.84				-13.39
Jun-97							-1.34	0.28	0.01	-0.1	-	0.09	-	-	-	-	-	0.1			-0.96
Jul-97								-0.49	0.02	-0.07	-	-0.03	-0.12	-	-	-0.07	-	-	-0.52	-0.05	-1.33
Aug-97									0.22	-	-	-	-	-	-					-0.53	-0.31
Sep-97										-	-	-	-	-	-0.03						-0.03
Oct-97											1	-	-	-0.25	-	-	-0.32	-	-	-0.21	0.22
Nov-97												-	-	-	-						0
Dec-97													-	-	-						0
Jan-98														0.57	-	-	-0.01				0.56
Feb-98															0.02	-					0.02
Mar-98																0.2	0.06				0.26
Apr-98																	0.53				0.53
May-98																					0
Jun-98																					0
Jul-98																				0.09	0.09
sum	-0.14	1.09	0.35	-1.29	-1.13	-2	-1.94	-3.86	-0.54	-0.96	-5.3	-0.09	-0.12	-0.88	-1.12	-0.27	-3.58	0.1	-0.52	-0.7	-22.9

Note:
1. Time period by column refers to the period that the BoT enters into the out-right forward and swap transactions while time on the row basis refers to obligation under different maturity structures in out-right forward and swap transactions taken by the BoT.
2. Minus sign refers to BoT's Buy-Sell swap and out-right forward obligations while plus sign is the opposite situation for the BoT, i.e. Sell-Buy swap and out-right forward purchase of dollar.
3. The data used in the above calculation is based on the Bank of Thailand's outstanding forward obligations.

Table 5. Spread between Actual Spot Rate and Swap or Forward Rate under the Forward Obligations (Off-Shore)

(Unit: Baht per U.S.dollar)

Time	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97	Jan-98	Feb-98	Mar-98	Apr-98	May-98	Jun-98	Jul-98	Aug-98
Dec-96	0.041695	0.192105	0.118029	0.153149	-0.22511	-1.52695	4.001168	6.05836	8.869108	10.88276	12.55213	17.98839	-26.4915	-	-	-	-	-	-	-
Jan-97		0.133539	0.060645	0.089719	-0.29007	-1.59345	3.926895	5.980125	8.786912	10.80011	12.46729	17.90136	26.1505	19.08469	-	-	-	-	-	-
Feb-97			-0.1492	-0.16827	-0.60072	-1.93419	3.556071	5.5754	8.361163	10.35333	12.00123	17.42307	25.65998	18.58194	13.78719	-	-	-	-	-
Mar-97				-0.11255	-0.59089	-1.99282	3.510085	5.542058	8.327587	10.34145	12.01105	17.44752	25.6943	18.62612	13.84122	-	-	-	-	-
Apr-97					-0.37048	-1.67035	3.853511	5.900985	8.702015	10.70945	12.37002	17.79747	26.04	18.9773	14.19789	12.51288	-	-	-	-
May-97						-1.65403	3.76777	5.71864	8.50417	10.49610	12.14377	17.58024	25.83180	18.7684	13.9835	12.29302	12.02855	-	-	-
Jun-97							4.09576	5.62150	7.90079	9.77428	11.30348	16.59957	24.76511	17.61569	12.74955	10.99624	10.66894	13.48628	-	-
Jul-97								1.61697	4.15773	5.90490	7.42697	12.71591	20.81994	13.66966	8.802662	7.030078	6.720078	9.554724	8.378967	-
Aug-97									2.53532	4.37730	5.87500	11.16492	19.26992	12.05996	7.168288	5.371028	4.999778	7.742174	6.474167	6.76175
Sep-97										1.75411	3.18552	8.38381	16.40718	9.115592	4.107291	2.204084	1.726887	4.394336	3.027291	3.215836
Oct-97											1.55395	6.79349	14.84811	7.571907	2.578985	0.680475	0.202899	2.86997	1.526636	1.702682
Nov-97												5.19494	13.24351	5.977132	1.008376	-0.86597	-1.3143	1.339994	-0.01611	0.183368
Dec-97													7.815905	0.418638	-4.69535	-6.65658	-7.19181	-4.58239	-5.91428	-5.69059
Jan-98														-7.5359	-12.7863	-14.9423	-15.8606	-13.6342	-15.4182	-15.4781
Feb-98															-4.79175	-6.53621	-6.85467	-4.56986	-6.29545	-6.46545
Mar-98																-1.69875	-2.03729	0.768818	-0.83906	-0.89135
Apr-98																	-0.41107	2.328093	1.056855	1.056461
May-98																		1.881053	0.205652	0.085843
Jun-98																			-2.1341	-2.51771
Jul-98																				-0.13915

Note: 1. See note 1 in Table 3 for the interpretation of time in terms of columns and rows.

2. The spread is the difference between the actual (future) spot rate at time t and the swap or forward rate under the obligation due at the same t period.

Table 6. Estimates of Gross Profit and Loss on official Forward Operations (Off-Shore)

(Unit: Billion Baht)

Time	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97	Jan-98	Feb-98	Mar-98	Apr-98	May-98	Jun-98	Jul-98	Aug-98	Sum
Dec-96	-0.00584	-0.07664	-0.0118	-	-	0.076348	-	-	-0.88691	-	-	-3.59768	-	-	-	-	-	-	-	-	-4.50272
Jan-97	-	0.198973	-0.03942	-0.00897	0.27557	-	-0.78538	-6.27913	-	-	-	-	-	-12.4051	-	-	-	-	-	-	-19.0434
Feb-97	-	-	-0.16413	0.016827	0.234281	0.193419	-	-5.79842	-1.58862	-	-0.72007	-	-	-12.0783	-15.3038	-	-	-	-	-	-35.2088
Mar-97	-	-	-	0.122677	-0.14772	0.398563	-	-	-4.16379	-	-	-	-	-	0.138412	-	-	-	-	-	-3.65186
Apr-97	-	-	-	-	0.014819	0.083517	-0.7707	-	-	-7.38952	-	-	-	-	-0.14198	-5.00515	-	-	-	-	-13.209
May-97	-	-	-	-	-	2.646442	-0.75355	-8.92107	-	-1.04961	-75.7771	0.879012	-	1.87684	-	-	-46.1896	-	-	-	-127.289
Jun-97	-	-	-	-	-	-	-5.48832	1.57402	0.079008	-0.97743	-	1.493961	-	-	-	-	-	1.348628	-	-	-1.97013
Jul-97	-	-	-	-	-	-	-	-0.79231	0.083155	-0.41334	-	-0.38148	-2.49839	-	-	-0.49211	-	-	-4.35706	-	-8.85154
Aug-97	-	-	-	-	-	-	-	-	0.55777	-	-	-	-	-	-	-	-	-	-	-3.58373	-3.02596
Sep-97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.12322	-	-	-	-	-	-0.12322
Oct-97	-	-	-	-	-	-	-	-	-	-	1.553955	-	-	-1.89298	-	-	-0.06493	-	-	-0.35756	-0.76151
Nov-97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Dec-97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Jan-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-4.29546	-	-	0.158606	-	-	-	-4.13686
Feb-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.09583	-	-	-	-	-	-0.09583
Mar-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.33975	-0.12224	-	-	-	-0.46199
Apr-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.21787	-	-	-	-0.21787
May-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Jun-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Jul-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.01252	-0.01252
sum	-0.00584	0.122131	-0.21535	0.130532	0.376948	3.398288	-7.79796	-20.2169	-5.91939	-9.8299	-74.9432	-1.60618	-2.49839	-28.7949	-15.5264	-5.83701	-46.436	1.348628	-4.35706	-3.95381	-222.562

Note:
1. Estimates from Table 4 and Table 5.
2. Plus sign means profit or gain for BoT while minus sign refer to a loss for BoT.

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