CHAPTER 4[1]
THAI BAHT AND DEVALUATIONS

Empirical Regularities of Devaluations

In a country with free-floating exchange rate regime the disequilibrium in balance of payments will be eliminated by the shift in exchange rate. For example, the deficit external balance will demand for foreign currency to pay off the debts. Due to an increase in demand for foreign exchange reserves, the price of foreign currency will go up. The depreciation of domestic currency will encourage exports while imports will be discourages, which bring external account to the equilibrium. With the fixed exchange rate policy, the central bank has to supply internation reserves, stabilizing the price of curries. Under the fixed exchange rate, monetary authorities, therefore, avoid to sustain the balance of payments deficits because they can not be financed for a long time without running out of the foreign exchange reserves or approaching limited borrowing.

Many developing countries, including Thailand, have undergone the experience of devaluations. Most of devaluations occurred when the government attempted to maintain exchange rate at some level. But there was not enough international reserves to intervene through the foreign exchange market while the price of domestic currency tended to decrease sharply because of both profitable expectation and domestic currency distrust. To prevent increasing in foreign currency demand which caused more domestic currency depreciation, the government will set up the new exchange rate. This exchange rate had to be higher than the actual rate, prevailing at the time of collapse in order to detoriorate the demand for the foreign currency. That was the collapse of fixed exchange rate or the occurrence of BoP crisis.

Although the BoP crisis has not received much theoritical attention, there are obviously common features which recurring happen in many crises. The process leading to BoP crisis can be analysed by a log-linear

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[1] All variables in this chapter are in the log form except interest rate (i).

formulation model, established by Garber-Blanco, that allows an explicit calculation of the time of occurrence of the crisis and the new exchange rate by assuming that the exchange rate in the post-collapse regime is setted by the central bank.

As it was stressed earlier, with perfect capital mobility, the domestic economy can always finance a trade deficit by means of capital inflows at the given world interest rate. On the other words, an economy's adjustment process is not only in short-run equilibrium but payment disequilibrium is also adjusted perhaps instantaneously. Simple interchanges of bonds and money can alter the domestic money supply and fit it into the full equilibrium while the economy moves simultaneously to balanced payments.

In a country with imperfect capital mobility, prefering to fulfil the goal of economic growth, the external balance, however, can not be attained through the private international capital markets. Suppose trade account is deficit, the reserves will be required to pay out external debts, money supply will decline. As a result, the deflation will raise interest rate and bring money back. Ultimately, the payment disequilibrium will be better but too high interest rate will reduce investment and lower aggregate demand.

The government, thus, have to intervene to defend the operation of the automatic adjustment mechanism which sometimes leads to a protracted recession of economy. The economy has been, therefore, kept out of a payments equilibrium which may be impossible to permanently sustain in this position over the extended periods of time since it requests unlimited level of international reserves, pushing in the system to maintain money supply at steady state.

Once the government's reserves gradually decline, at some point, generally before the reserves will be exhausted, there is a sudden speculative attack that will rapidly takes out the last of the reserves. Whenever the central bank does not have sufficiently held securities or foreign reserves, there are two alternative choices which are to stop intervention, so called sterilizing, or to stop fixing exchange rate.

Empirically, the government mostly preserves the internal balance by ending the fixed rate.

Thai Baht and Devaluations

Take the history of Thai economy into account, it is similar to most developing countries in the world. Thai government attempts to stabilize exchange rate while the efforts to solve current account deficit must have been accomplished.

Since an exchange rate stabilizing involves the control of nominal price, a government can maintain a given exchange rate by controlling money supply. While controlling money supply-sterilization keeps the economy from the external balance, the devaluation can assist in attaining the goals of current account deficit improvement and balanced payments in the long run.

As a dilemma, there are two objects, requiring different policies applications which are contradict and rather hard to harmonize. By experience, if the current account deficit was in severe stage, the exchange rate policies have always been used to utilize other economic achievments which implies that the exchange rate stabilizing has never been a primary goal.The Baht devaluations in 1972, 1973, 1981 and 1984 had also been the announcements in order to solve BoP crisis, motivate rising in international reserves and increase competitiveness of Thailand.

Typically, most developing countries undergo currency devaluations because of three main reasons. First is the exhaust of reserves. Second is high inflation and third is severe current account deficit.

1) Low international reserves

While the government intends to maintain the fixed exchange rate in the country which perfect capital mobility is not available, it prevents the economy from balanced external payments. The gradual decreased international reserves will deplete the government's effort available in sustaining the fixed rate. If there is not enough international reserves when

the domestic currency price is continuously going down, the government is unable to supply foreign currency. Then, according to the law of demand, to stop the rise in foreign currency demand, the central bank will rise the foreign currency price by announcing devaluation of domestic currency.

International reserves in Thailand was accumulated 2.4 billion US$ in 1981, 7.1 billion US$ in 1988, 25.4 billion US$ in 1993, 30.4 billion US$ in 1994 and 35.0 billion US$ in 1995, increases by an average of 400 million US$ per month. Presently, international reserves at Bank of Thailand had increased nearly ten-fold from 3.8 billion US$ in 1986 to 35 billion US$ in 1995, which is able to finance 7 months worth of imports. It is also 3.5 times the current account deficit and more than the double of size of net capital inflows in 1994.

Mexico had high international reserves in February 1994, about 29 billion US$, but the turmoil from the guerlia band "Patista" and the assassination of two important persons in the previous cabinet caused capital outflows by foreign investors. Thus, at the end of 1994, Mexico had only 6 billion US$, led to the Peso devaluation on December 19, 1994 by President Zedillo.

2) **High inflation rate comparison to counter party implied low comparative advantage**

As known that high inflation rate will destroy the competitiveness of export products. If the inflation rate increases, to sustain competitiveness, the government has to devalue domestic currency to offset the increase in the price of exported products.

Compare to Mexico, Thailand has smaller inflation gaps between Thailand-US. and also between Thailand and other counter partner countries because Thailand has stable inflation rate at a rather low level which is being well under control by government.

Inflation in Mexico was instable and it used to rise up to triple digits in some years. The government solved this problem by using applicable policy to control such as restricted monetary policy by setting a high

interest rate, which succeed in controlling inflation rate at some level. Since Mexico determined the fixed exchange rate from the different inflation rate between its country and US. who is the major trade partner. To maintain the competitiveness, Mexico had devalued the Peso by 3.7 percent annually.

3) **Severe current account deficit**

The hugh current account deficit that is insufficiently financed by capital account surplus will cause the BoP deficit. The BoP deficit which happened continuously leads to the decline in international reserves and reaches the lower level. Then, the government can not supply foreign exchange rate to maintain the fixed rate, the devaluation will occur.

In some countries, the current account deficit is financed by large amount of capital inflows. However, this capital surplus is concerned as short-term capital inflows, fluctuating as the movement of domestic interest rate and the yields from stock market. The kind of capital is very sensitive and can flow out easily. This implied that the movement of international reserves, are being concerned uncertainty.

Moreover, the devaluation also has been used, aiming to improve BoP deficit since there is an expectation that exchange rate devaluations can switch demand away from foreign and towards domestic goods. A domestic currency devaluation will increase domestic output while improving the trade balance but, as known, it will be possible if Marshall-Lerner condition is satisfied. This condition states that a domestic currency devaluation, implying an increase in the relative price of imports and a reduction in price of exports, will result in improvement of the trade balance, only if the sum of the price elasticities of exports and imports is larger than one. Experience, however, has stated that over the short period, both exports and imports are rather unresponsive to changes in the value of exchange rate because consumers and producers generally adjust slowly to devaluation, then, the devalution will initially worsen the trade account. On the other word, it is because the price elasticity of both imports and

exports are small. But, eventually in the long run, it will improve trade balance in response to a devaluation, which is known as J-Curve effect[2] .

Over the last ten years, Thailand has experienced a steady appreciation in its real exchange rate which affects export-import values. Moreover, the acceleration of private investment which has been forced by expanding production capacity upgrading industries, investing in infrastructure and over promoting of new BOI projects, caused huge trade deficit continually. The large deficit has been induced by the dramatic increment the in raw materials, government imports and also the impacts of a terms of trade shock during year 1995, although exports, on the other hand, continued to perform very strongly. Since the market expansion in the Asia-Pacific and Indochina causes an increased export value. Exports play an important role in leading the economy.

Trade account deficit in Thailand is increasing alarmingly, causes the current account deficit. The current account deficit implies that the gap between saving and investment is high or there is unbalance in saving-investment gap. Although average Thai saving rate is about 35 percent to GDP in 1994/95 which is much higher than Mexico, its investment to GDP has been running at about 40 percent.

Thus, Thailand has been running an average current account deficit equivalent to about 5 percent of GDP, which tends to rise because of an increase in trade account deficit whereas services account surplus tends to decrease. Since the hugh debts are steadily supported by a strong economy with a sound export sector, high national saving ratios and continued fiscal surpluses.

Although, the capital inflows is more than financing the debts, the deficit is greatly than financing by quality capital inflows. Around one-third of capital inflows have been concerned as short term capital with high uncertainty. Eventhough the financial position of Thailand seems to be sound, with a level of external debt backed up by international reserves,

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[2] There are two principle reasons to express J-Curve effect. First is a consumer-response lag and second is production-response lag because both consumer and producer have to take time to response for a devaluation.

equivalents to almost 7 months of import cover, the high international reserves may be considered to be uncertainty too.

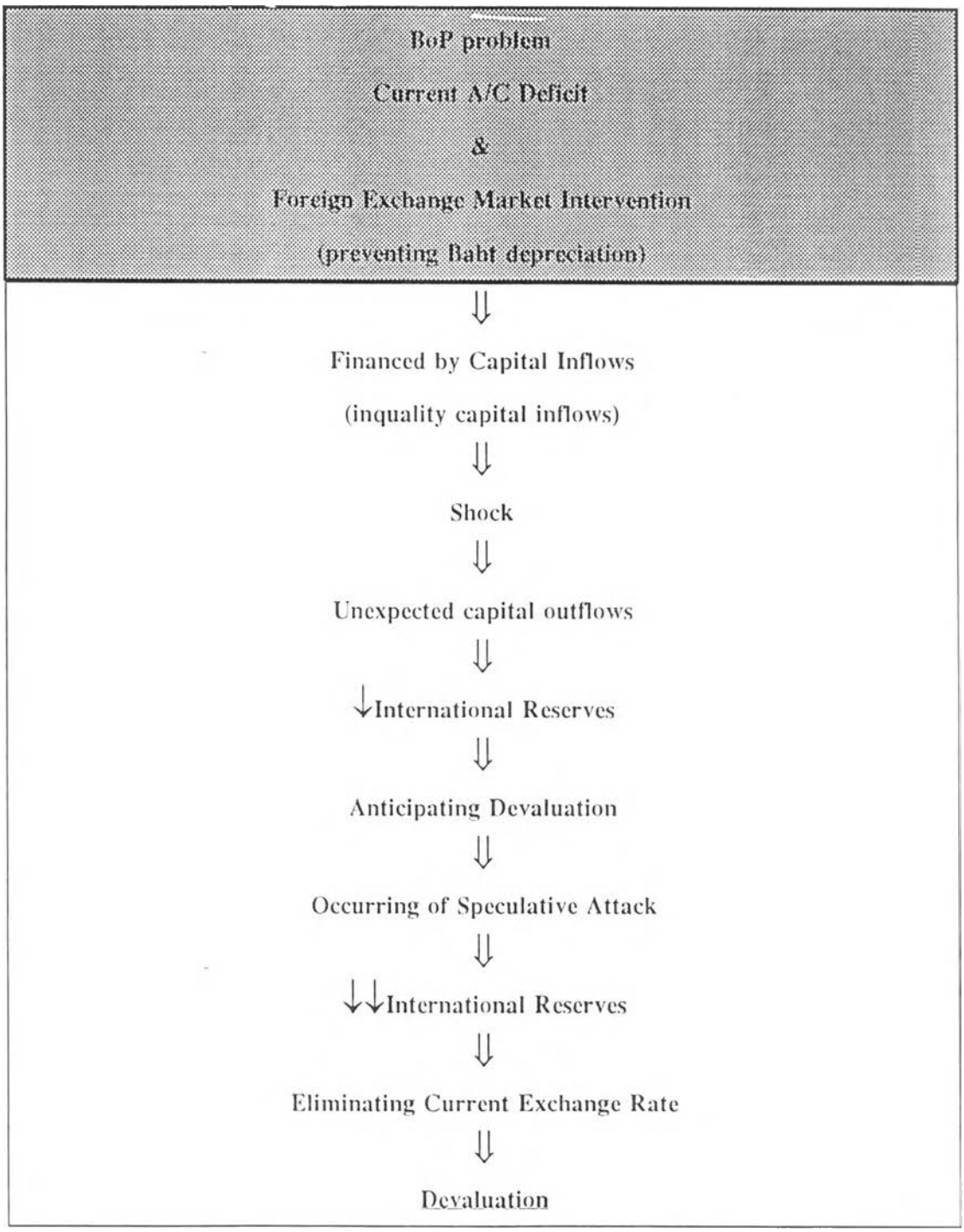
Thus, in the case of Thailand, there is a possibility that BoP problem will become crisis in which international reserves reach some critical lower level, e.g. from 29 to 7 billion US$ in Mexico before the collapse of Peso, the international reserves of Mexico was 29 billion US$ in 1994 but it jumped down to 7 billion US$ in the late of 1994 since the occurrence of unpredictable disturbances, caused the January crisis. For instance, shown in Chart 4.1 if there is something destroys the confidence in Baht--e.g. political reasons or unpredictable disaster etc., BoP problem may become more serious because the unexpected movement of short term capital out of economy will immediatly deplete international reserves as freely capital mobilization.

During the going down of reserves, speculators will occur to acquire the last portion of international reserves and speed up the collapse of economy, since people know that the government reserves are gradually exhausted and may not be sufficient to intervene current exchange rate. As rational agents, they can anticipate that there will be devaluation if international reserves reach some critical level where the government is no longer able to maintain exchange rate.

The distrust in domestic currency as well as profitable expectation they try to change domestic currency and acquire the last amount of foreign currencies. At the moment of collapse, the speculators will gain the profit by margin between pre-collapse exchange rate and post-collapse exchange rate as they convert back to domestic currency.

Therefore, there is a suspect that regarding to serious current account deficit, seeming more grave, in Thailand, whether Baht will be forced to devalue.The next section intends to generate an empirical model which is accurate and appropriate to predict when and how much of devaluations. If the model is able to show timing and magnitude of devaluations that occurred in the past, it can be used to forecast whether the devaluation will occur, if the other exogeneous variables change.

Chart 4.1 : Possibility of Devaluation of Thai Baht



The Modified Devaluation Model

As it was mentioned in the original Garber-Blanco model, there is an equivalence between the new exchange rate($\hat{e}$) exceeding the current exchange rate($\bar{e}$) and the reserves level attaining its lower bound. Since, if the first event occurs, agents will be able to participate profit from attacking the currency. According to its policy, the central bank will sell the international reserves until they reach the lower bound ($\bar{R}$). At that point the central bank will established the new exchange rate which will provide an instantaneous capital gain to the speculators who attacked the reserves. Conversely, if the international reserves have reached to their lower bound but an excess money supply of the domestic currency still remains at the current exchange rate, it is a must that the policy maker has to set the new exchange rate more (depreciated) than the current rate. If not, the excess supply will be worsened.

Under Garber-Blanco framework, the model emphasises on the lower limit of the international reserves that trigger the crisis. On the other hand, this modified model concentrates on the assumption that the devaluation will occur whenever the new exchange rate, set by central bank, is more depreciated than the current rate. Hence, this model will predict probability of devaluations and series of new exchange rates, based on information available at the previous period, including the amount of international reserves.

The original model, applying to Mexican experience, fixed the international reserves at the lower bound because of the assumption that the central bank's domestic credit creation policy is an exogeneous force in the exchange rate market. If the reserves are supposed to be at lower bound, changes in domestic credit overtime will directly affect changes in money supply, nominal price and shadow exchange rate, respectively. For sample, in case of Mexico, priority public finance requirements dictated rapid domestic credit creation that will eventually collapse the current fixed rate.

The domestic credit creation was not a major concern in Thailand, thus, the current variables will be applied to estimate the one-period-ahead

probability of devaluation, a time series of the expected next-period exchange rate conditional on the occurrence of a devaluation.

The model first derives from the simple money market equilibrium concept that occurs when :

Money Supply = Money Demand

that is, when the demand for money is equal to its supply. The real money demand is defined to be a decreasing function of the interest rate, i, and increasing function of real income in the economy, Y.

$$M_t - P_t = \beta + \Omega Y_t - \alpha i_t + \varpi_t \qquad \text{----------4.1}$$

where M_t, P_t and Y_t are the logarithms of money stock, the domestic price level and the aggregate output level, respectively: i_t is the domestic interest rate and ϖ_t is a stochastic disturbance to money demand. The model further assumes that the interest rate and the price level are assumed by

$$i_t = i_t^* + Ee_{t+1} - e_t \qquad \text{----------4.2}$$

According to uncovered interest rate parity condition, the interest rate differential between domestic and foreign assets is equal to the expected rate of depreciation of domestic currency, $i_t - i_t^* = Ee_{t+1} - e_t$

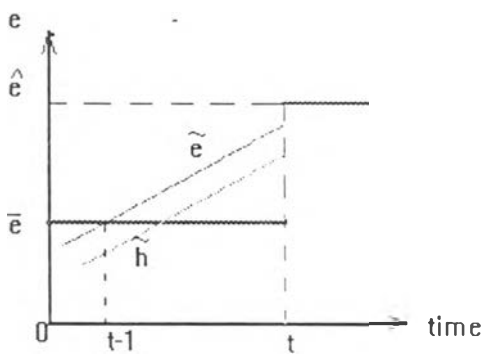
$$P_t = P_t^* + e_t + u_t \qquad \text{----------4.3}$$

Deviations from purphasing power parity imply that equation $e_t = P_t - P_t^*$ does not hold exactly, but rather that $e_t = P_t - P_t^* + u_t$ where u_t represents real exchange rate which is proportional changes in the exchange rate.

Where an asterisk denotes an exogeneous foreign variable and e_t and u_t are logarithms of the nominal and the real exchange rate, respectively. The operator E represents expectations conditional on the information of the previous period.

The devaluation policy is the policy that will be applied when the current exchange rate can not be sustained any longer. Generally, the process of collapse begins at the point where the shadow floating rate, which reflects market fundamentals, is equal to the prevailing rate (assuming up-ward slope of shadow rate).The shadow floating rate is the exchange rate that will dominate when the reserves had reached at lower level. Changes in the variables of equations 4.1-4.3 as well as evolutions of domestic credit and international reserves determine the movement of shadow floating exchange rate.

Figure 4.1: Pre-Collapse Exchange Rate($\bar{e}$), Shadow Floating Exchange Rate($\tilde{e}$) and New Exchange Rate ($\hat{e}$)



In figure 4.1, the exchange rate remains constant at $\bar{e}$ until the collapse occurs at period t, when the new exchange rate ($\hat{e}$) is established at period t+1

Changes in economic variables will reflect in the movement of shadow exchange rate. Once the shadow rate overwhelms the official rate, it implies that the demand for foreign money exceeds its supply. To stabilize the exchange rate, the central bank will have to supply foreign money to economy. Then it will extend to point that the central bank stops intervening in the foreign exchange market since there is not enough international reserves, reach a critical level at period t. The considerable main factor is the speculation attack. Since period t-1, the shadow exchange rate exceeds the fixed rate. By studying agents' rational speculative behavior, agents try to alter domestic currency, toward foreign currency because they expect yields from the margin as they convert back after devaluation announcement.

Formally, the shadow exchange rate remain in the background, unobservable to the researcher. This process will end at period t when the reserves is at the lower bound. If such an event materializes at time t, the central bank establishes a new exchange rate. This exchange rate will be a function of the model's stochastic state variable. It attains viability only at the moment of a devaluation. The viability of the current exchange rate depends on the relation between the fixed exchange rate and the shadow exchange rate.

Not only the reason that shadow exchange rate is unobservable, but also because of the new exchange rate is highly related to the shadow exchange rate, the relation between the current rate and the expected of new fixed exchange rate will influence the viability of current exchange rate. If new fixed exchange rate, expected for one period ahead ($\hat{e}_{t+1}$), is more depreciate than current fixed rate, $\bar{e}_t$,it will cause speculative attack, exhausted reserves and collapse of exchange rate, respectively.

The viable new exchange rate policy must prescribe an exchange rate greater than or equal to the shadow exchange rate, may be called permanent flexible exchange rate. The process, deriving flexible exchange rate, can be done through the money-market clearing condition. Substituting 4.2 and 4.3 into 4.1, then obtaining,

$$\tilde{h}_t = -\alpha E\tilde{e}_{t+1} + (1+\alpha)\tilde{e}_t \qquad \text{----------4.4}$$

where $\tilde{h}_t \equiv \log(D_t + R_t - \bar{e}_t) - \beta - \Omega Y_t + \alpha i_t^* - P_t^* - u_t - \varpi_t$, h_t can be roughly explained as the difference between expected floating exchange rate in next period and the floating exchange rate. $\tilde{h}_t$ is used to duplicate the pattern of movement of floating exchange rate. D_t is the domestic credit which is one of the component of monetary base at time t and e_t represents the permanently floating exchange rate. R_t is the current international reserves level, $\bar{e}_t$ is the current exchange rate.

h_t is denoted as the initial value of $\tilde{h}_t$ that will appear at time t if the exchange rate starts to float at time t. Due to that the $\tilde{h}_t$ process is unobservable by the researcher, h_t and $\tilde{h}_t$ process, then, are assumed to be identical. The stochastic process that drives the h_t variable is supposed to

be first-order autoregressive process, exogeneous to the exchange rate which is,

$$h_t=\theta_1-\theta_2 h_{t-1}+v_t \qquad \text{----------4.5}$$

v_t is a white noise process, a normal density function g(v), with zero mean and standard deviation σ .v_t, the disturbance term, represents other factors which do not appear in model, but force the current exchange rate deviate from the previous rate.

By solving the difference equations 4.4 and 4.5, the solution of flexible exchange rate $\bar{e}_t$ is

$$\bar{e}_t=\mu\alpha\theta_1+\mu h_t \qquad \text{----------4.6}$$

where $\mu=1/[(1+\alpha)-\alpha\theta_2]$, assuming that $\alpha\theta_2/(1+\alpha)<1$ and ruling out the existence of bubbles.

The new exchange rate ($\hat{e}$) will be established when the reserves attain the lower level. According to the devaluation policy, it states that after an attack the central bank will select the new rate equal to minimum viable rate plus a nonnegative quantity dependent on the magnitude of disturbance (v_t) that forced the collapse. So the new established rate is

$$\hat{e} = \bar{e}_t+\delta v_t \qquad \text{----------4.7}$$

The new exchange rate is supposed to be a simple linear function, according to the central bank's determination of policy rule for the new exchange rate. δ is nonnegative parameter, then, $\hat{e}_t$ always exceeds the minimum viable value for a new exchange rate when reserves run out.

The probability of devaluation at time t+1, based on information available at t, means the probability that e_{t+1} exceeds the current rate at period t. The procedure sets the probability of devaluation, pr, equal to

$$\begin{aligned} pr(\hat{e}_{t+1} > \bar{e}_t) &= pr\,(\bar{e}_{t+1}+\delta v_{t+1} > \bar{e}_t) \\ &= pr\,(\mu\alpha\theta_1+\mu h_{t+1}+\delta v_{t+1} > \bar{e}_t) \end{aligned}$$

where $\bar{e}_t$ is value of the fixed rate at time t. The devaluation probability can be alternatively formulated as

$$1-F(k_t) \equiv pr(v_{t+1} > k_t) \qquad \text{----------4.8}$$

$k_t \equiv [1/(\mu+\delta)][\ \bar{e}_t-\mu\alpha\theta_1-\mu(\theta_1+\theta_2 h_t)]$ and $F(k_t)$ represents the cumulative distribution function associated with g (v)

To clearify the steps involved in transforming into k_t , consider

$$\begin{aligned} \mu\alpha\theta_1+\mu h_{t+1}+\delta v_{t+1} &> \bar{e}_t \\ \mu\alpha\theta_1+\mu(\theta_1+\theta_2 h_t+v_{t+1})+\alpha v_{t+1} &> \bar{e}_t \\ (\mu+\alpha)v_{t+1} &> \bar{e}_t-\mu\alpha\theta_1-\mu(\theta_1+\theta_2 h_t) \\ v_{t+1} &> [1/(\mu+\alpha)][\ \bar{e}_t-\mu\alpha\theta_1-\mu(\theta_1+\theta_2 h_t)] \end{aligned}$$

which is defined as k_t

The expectations of future exchange rate can be derived from the average of current fixed exchange rate and the expected rate materializing conditional on a devaluation, weighted by the respective probabilities of occurrence.

$$Ee_{t+1} = F(k_t)\ \bar{e}_t+[1-F(k_t)]E(\tilde{e}_{t+1}/v_{t+1} > k_t) \qquad \text{----------4.9}$$

So the expectation of new exchange rate, set by central bank conditional on the occurrence of devaluation, so called the condition expectation, can be expressed as

$$E(\tilde{e}_{t+1}/v_{t+1} > k_t) = \mu\theta_1(1+\alpha)+\mu\theta_2 h_t+(\mu+\delta)E(v_{t+1}/v_{t+1}>k)$$

where

$$E(v_{t+1}/v_{t+1} > k_t) = {}_{kt}f^{\infty}\, vg(v)/(\ 1-F(k_t)\ )\ dv$$

The unconditional expectation of exchange rate for t−1 is

$$Ee_{t+1}=F(k_t)\ \bar{e}_t+[1-F(k_t)][\ \mu\theta_1(1+\alpha)+\mu\theta_2 h_t]+(\sigma(\mu+\delta)\exp(-0.5(k_t/\sigma)^2))/\sqrt{2\prod}$$
$$\text{----4.10}$$

Up to this point, the one-step-ahead probability of devaluation (4.8) and the conditional and unconditional exchange rate (4.9 and 4.10) are the main solutions. To monitor precision of the model, there are three conditions which ought to be satisfied. First, expected probability should peak immediately before on actual devaluation. Second, the uncondition forecast exchange rate should be closely corresponding with appropriate forward or future rates. Finally, the conditional forecast should approximate the exchange rate set when a devaluation occurs.

Thai Baht Devaluations Model

Among many models relating to BoP crisis, speculative attack and collapsing of the exchange rate regime, the model established by Herminio Blanco and Peter M. Garber, was selected to predict timing and magnitude of Thai baht devaluations. The reasons are, first, applying the shadow exchange rate concept makes the model to be more realistic since the shadow rate prevails according to market fundamental. Second, this model includes other factors that do not appear but share parts of role influence the collapse of regime. The disturbance, ϖ_t, is the measurement error that appears from the researcher's inability to observe while v_t is the disturbance that collects factors leading to change in exchange rate one period ahead. These assist to extend the model to the stochastic environment.

Furthermore, this model was applied to study Mexican crisis and the results are rather satisfied.

Model Establishment

However, there are some differences in the process causing speculative attack and collapse of the regime between Thailand and Mexico, see Chart 3.1 and Chart1 in Appendix I. The original model was slightly modified to be appropriate for Thai economy but the central components still exist as in origin. In equation 4.4 the original model defines the components of money base as the domestic credit and lower level of international reserves convert into domestic currency by using the fixed exchange rate prevailing at the time of switching to floating rate.

In Mexico, there has been a major problem with domestic credit creation. The increased government budget deficit has rapidly risen domestic credit creation and depleted reserves. The original model attempts to observe changes in the domestic credit creation in determining the value of domestic currency. Considering that if international reserves is fixed at the lower bound (by estimation), the excessive domestic credit growth over money demand growth will lead to a sudden speculative attack against the currency. According to price mechanism, the excess

supply will lower the price which means local currency depreciation and triggering the BoP crisis.

The modified version defines the components of money base as the current domestic credit and the current level of reserves convert into domestic currency by using the current exchange rate. Unlike Mexico, Thailand government budget is surplus so there is not much concern about the domestic credit creation. The modified model trys to observe the shadow exchange rate, represented by new exchange rate that will be set by Bank of Thailand if devaluation occurs.

This new exchange rate depends on all exogeneous variables, mentioned in the model, as well as disturbance terms, ϖ_t and v_t. If expected exchange rate for the next period is more depreciated than the current rate, sparking speculative attack and collapse of regime are expected in the next period.

Estimation Procedure

After generating the empirical model, extending speculative attack to the recurrent devaluation problem, the model will be used to estimate the conditional expected exchange rates and a time series of the one-step-ahead devaluation probabilities $[1-F(k_t)]$ for Thai Baht experience.

The estimation procedure begins by searching for the best equation that represents the best relation between real money supply and exogeneous variables, determining real money demand. Then the efficient exogeneous lagged variables will be used.

The next step is interpreting the forward exchange rate as the unconditional expected rates. Suppose that the three-months forward rates for Thai baht, f_t ,are generated by

$$f_t = Ee_{t+1} + \varepsilon_t \qquad \text{----------4.11}$$

where Ee_{t+1} is the unconditional expectation of next period (one quarter)'s exchange rate and ε_t is a disturbance which will be impacted

only from specification error. Assuming, investors are risk neutral, there is no risk premium.

If the result of Ee_{t+1} is good enough to predict the forward exchange rate, means it can capture well on the movement of f_t, the model will be able to estimate other unknown parameters. The process has been done as:

The first step is estimating equation 4.1 - money market clearing condition - by OLS technique. The output are β, Ω, α and the series of ϖ_t. Then, using the estimated money demand parameters to calculate h_t series.

From time series of h_t, the equation 4.5 was regressed by the assumption of a first-order autoregressive process AR(1) , yields θ_1,θ_2 and v_t. Then, calculating variance of h_t and μ.

Then setting initial value of δ, equals to 1.965, following from δ that received from the Mexican empirical model, after that computing k_t, μ_k and σ_k^2, respectively.

$$k_t \equiv [1/(\mu+\delta)][\ \bar{e}_t - \mu\alpha\theta_1 - \mu(\theta_1+\theta_2 h_t)]$$

$$\mu_k = (\sum k_t)/N$$

$$\sigma^2_k = (\sum (k_t-\mu_k)^2)/(N-1)$$

Up to this step, the density function of k_t is generated, thus, it is possible to integrate density function of k_t to establish cumulative distribution function.

Substituting all variables into 4.10 to calculate the unconditional expectation of the next period's exchange rate. After that, the model can reestimate δ by minimizing sum of square residuals of the linear equation 4.11.

The procedure will be iterated until the change of sum square residuals is less than 0.1% converging to some constant level, by applying MATLAB program.

When the result is satisfied, shown in Figure 4.4, the unconditional expected exchange rate line is able to capture the movement of forward exchange rate in both up-turn and down-turn. The parameters can be used to calculate the new fixed exchange rate by anti-log of equation 4.7 and probability of devaluation by calculating $1-F(k_t)$.

Data

The parameters in the model have been estimated by applying, the quarterly data from the first quarter of 1977 to the forth quarter of 1995. For the money supply variable, among alternative monetary concepts, M3 has been choosen because it appears suitable to concern about the movement of short-term capital flows as the M3 is high liquidity and can immediately reflect changes in capital flows.

The logarithms of level of domestic credit, D_t, represents loans to the federal government and commercial banks. Y_t and P_t are the quarterly series of logarithms of the real gross domestic product and the gross domestic product deflator, respectively.

Y_t is decomposed from annual data to quarterly data by the formular , formulated by Mr. Kittipong Chunpongtong[3] .

$$Y_a = X/4 + 0.6125\,(Y/4 - X/4)$$
$$Y_b = -(2Y_d + Y_a)/3 + Y/2$$
$$Y_c = -(Y_d + 2Y_a)/3 + Y/2$$
$$Y_d = Y/4 + 0.375\,(Z/4 - Y/4)$$

where Y is real GDP in period t
X is real GDP in period t-1
Z is real GDP in period t+1

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[3] กิตติพงษ์ ชุนพงษ์ทอง, วิทยานิพนธ์ "อุปสงค์การนำเข้าสินค้าของไทย" คณะเศรษฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย, 2538

and subscript a,b,c and d are the first, second, third and forth quarter, respectively

The average quarterly interbank rate of Thailand was used as a measure of i_t whereas i_t^* was used as the US. fed fund rate. R_t is logarithms of international reserves at Bank of Thailand. P_t^* is logarithms of US. GDP deflator and $\bar{e}_t$ is logarithms of the official exchange rate.

Forward premium rates were from Siam Commercial Bank. There is a limitation to forward premium rate variable since the data are available only from 1982.1 to 1995.4 and the condition of computer program that requires the same range of observations, forward rate data from 1977.1 to 1981.4, was estimated by random walk procedure.

Then, it comes up to the most crucial part which is the results. The results can be devided into three parts . First is about the estimation of the results, the results that represent the satisfaction of econometric aspect. Second is the conditional expected exchange rate, one of outputs in this model. Another output is contained in the third part which is the probability of devaluation.

Estimation Results

According to the estimation procedure, the first step is to seek for equation that represents the best relation between real money supply and real money demand. There are many alternative sets of instrumental variables. The best set contained three lags of income and four lags of interest rate, which can be shown as:

$$\log M_t - \log P_t = \underset{(-2.8862)}{-6.9327} + \underset{(5.6022)}{1.27}\log Y_{t-3} + \underset{(-0.2780)}{0.0133}\, i_{t-4} \qquad \text{----------4.12}$$

Equation 4.12 states that an increment in national income with three period lags by one percent will induce a rise in real money supply by 1.27 percent while one percent increased interest rate in four period lags will lead real money supply to go in the same direction by 0.0133 percent. The estimated parameters, Ω and α, can be interpreted as elasticity of money

demand with respect to income and interest rate, respectively. t-test on the individual coefficients shows that β and Ω are significant but the third, α, is insignificance at the 5 percent level of significant. Although the coefficient of variable i is not significant, the result is still satisfied because the result yields right signs for all three variables and the equation passes F-test by F statistic which is equal to 26.25. To see figure 4.2, it is obviously found that fitted line is able to move along with actual line very well. This set was ,therefore, chosen to represent the relationship between real money supply and real money demand.

After seeking efficient lagged variables of Y and i to explain real money supply, log-linear model was regressed and estimated by MATLAB program. The indicator, pointing out the goodness of model, is the unconditional expected rate which means that if this model is good enough, it should produce unconditional expected rate that is closed to the forward rate. How similar they are implies how good the model is.

The results from regressing equation 4.11 are R^2 which is equal to 0.8286, F statistic is 329.4468 which are quite satisfied and perfect enough for estimating parameter, as shown in Figure 4.4 .

From utilizing a multistep, iterative estimation procedure to estimate δ, the results are stated in Table 4.1 The positive δ estimate informs that the new exchange rate, materializing after the collapse of fixed rate, will alway exceed the shadow floating rate.

Equation 4.5 was applied to regress again by TSP program. The result were :

$$h_t = \underset{(2.2184)}{0.2609} + \underset{(23.8036)}{0.971}\, h_{t-1} \quad \text{----------4.13}$$

As defined in equation 4.4, h_t is the gap between money supply and money demand, therefore equation 4.13 can be interpreted that the excessive money supply in this period positively relates to the excessive money supply in the previous period by increasing rate. An increased h_{t-1} by one unit will cause h_t to rise up by 0.971 unit. For econometric results,

R^2 is 0.89, F statistic is 566.61 and the estimated parameters were exactly the same as the answers that were obtained from MATLAB, shown in table 4.2. Graphically, the results can be demonstrated in figure 4.3.

Figure 4.2 : The Results of Regression

$$\log M_t - \log P_t = \beta + \Omega \log Y_{t-3} + \alpha i_{t-4}$$

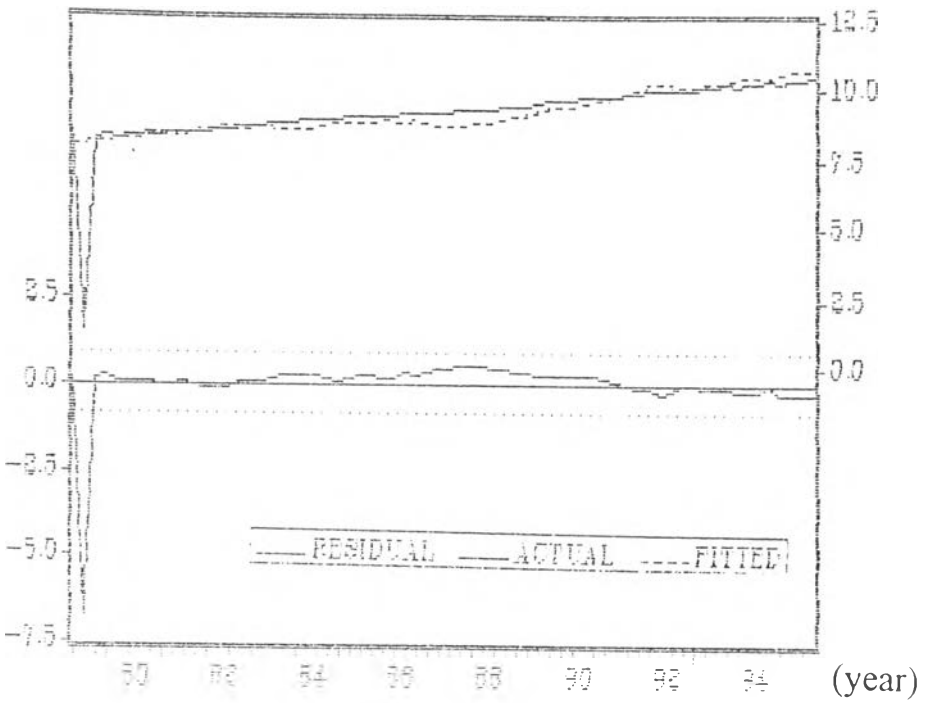


Figure 4.3 . The Results of Regression

$$h_t = \theta_1 + \theta_2 h_{t-1} + v_t$$

Figure 4.4 : Forward Exchange Rate and Unconditional Expected Exchange Rate

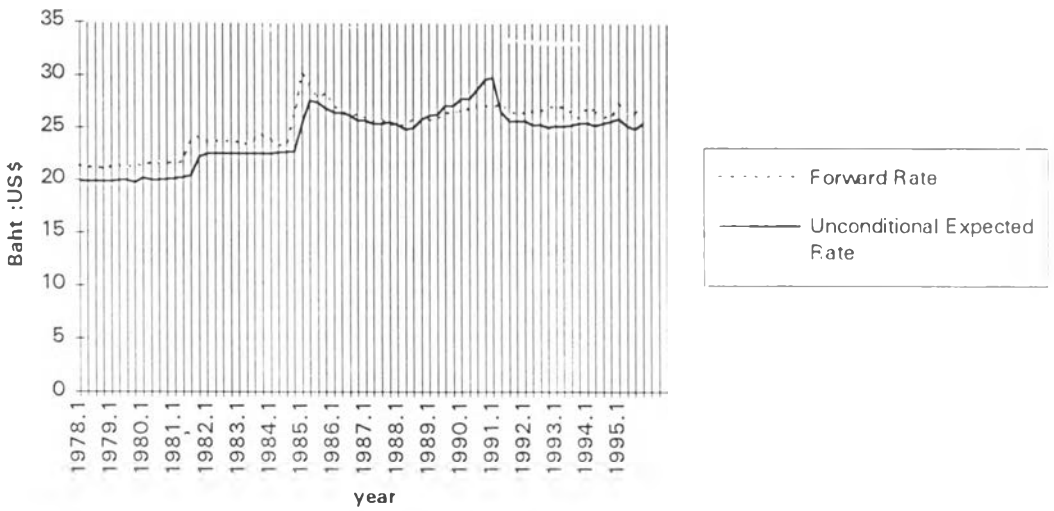


Table 4.1: Estimates of Parameters From the Model

Parameter	Estimate
μ	0.9989
δ	2.0099
β	-6.9327
	(-2.88620)
Ω	1.27
	(5.60219)
α	0.0133
	(-0.27795)
θ_1	0.2609
	(2.21835)
θ_2	0.971
	(23.80359)
σ	0.0618

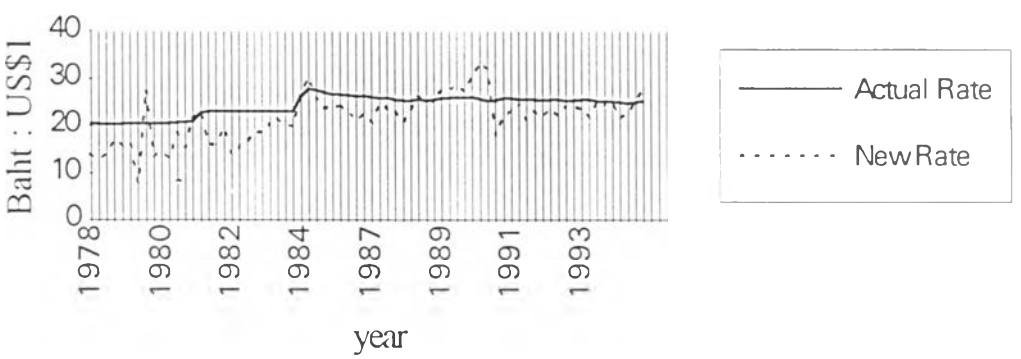
Table 4.2 : The Estimation Results of Equation 4.5

	TSP	MATLAB
θ_1	0.2609	0.2609
θ_2	0.9170	0.9170

Take a look into Figure 4.3, it is easy to observe that v_t almost moves within the band.

The Conditional Exchange Rate on Devaluations

Figure 4.5 : Actual Exchange Rate and New Exchange Rate



Before interpreting such empirical results, the same understanding is required. If current exchange rate is at period t, new exchange rate at period t, appearing in figure 4.5 as well as in table 4.3, is the rate people expected at period t-1 that if there is a devaluation in the next period (t),the government will annouce some rate which is close to their expected rate.

Like Mexican original model's results, it is interesting to notice that three times of Baht devaluations in the past occurred at period t when a new exchange rate at period t exceeded an actual rate at period t-1. Moreover, there is another considerable point that expected exchange rate which is computed by this modified model is similar to that realized during devaluations. For the May 1981 devaluation the exchange rate set by Bank of Thailand (BOT) was 21 which was lower than expected rate, 21.7. For July 1981, the expected rate is 22.9, lower than rate set by BOT, 23.0. For

the last devaluation, November 1984, the expected rate was 27.0007 whereas the rate set by BOT was 27.0.

It is remarkable that, in the same time interval, the movement of probability is consistent with of the new exchange rate. If the new rate goes up, the probability tends to rise up and so on reverse. It implies that if people expect the higher (more depreciated) exchange rate in the next period, the probability that exchange rate will be devalued in the next period will increase. In realistic, it is easy to observe that if people expect the higher exchange rate in the next period, the forward premium will increase.

However, there were sometimes that the new exchange rate was higher than the actual rate in the previous period, the devaluation did not occur, although the probability was locally high.

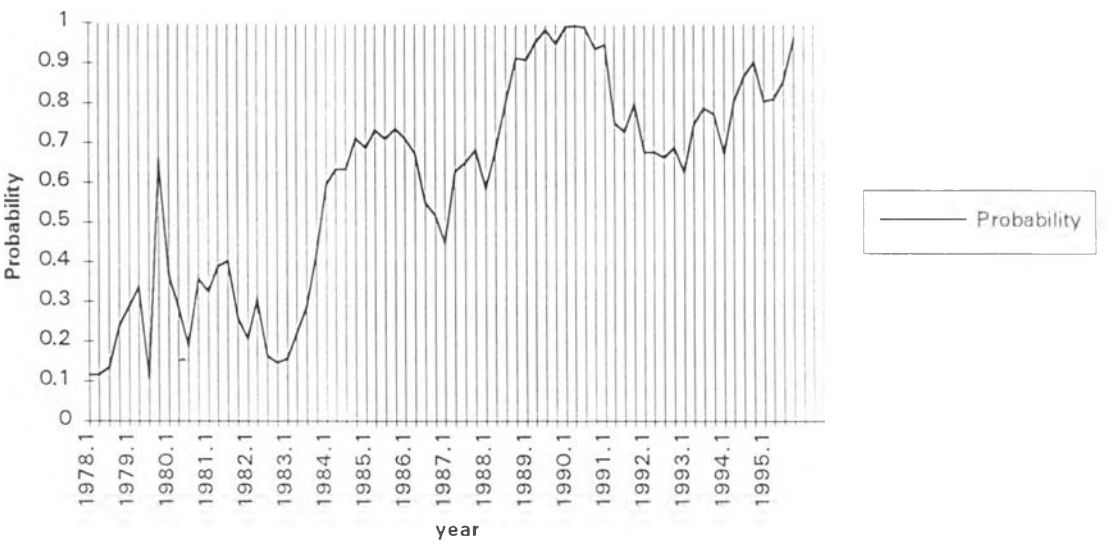
Table 4.3 : Probability , Actual Rate and New Rate

Year	Probability	Actual Rate	New Rate
1978.1	0.116	20.4	13.9723
1978.2	0.1168	20.4	12.9256
1978.3	0.1346	20.28	14.1569
1978.4	0.2403	20.2667	17.0215
1979.1	0.2896	20.4097	15.9963
1979.2	0.3385	20.4207	16.0266
1979.3	0.1062	20.4237	7.8497
1979.4	0.6582	20.4227	17.8757
1980.1	0.3641	20.4233	13.4493
1980.2	0.287	20.4157	14.3889
1980.3	0.1891	20.4787	13.2002
1980.4	0.3583	20.5873	18.3012
1981.1	0.3246	20.6743	15.4496
1981.2	0.3889	20.8927	21.7053
1981.3	0.4029	22.7143	22.9
1981.4	0.2599	23	16.2505
1982.1	0.2067	23	16.057
1982.2	0.3071	23	19.3629
1982.3	0.1642	23	14.1571
1982.4	0.1471	23	15.4729
1983.1	0.1575	23	16.5088
1983.2	0.2206	23	18.4734
1983.3	0.2882	23	18.6742
1983.4	0.4242	23	20.226
1984.1	0.5969	23	21.4314
1984.2	0.6336	23	20.2216
1984.3	0.6333	23	19.8584
1984.4	0.7126	26.096	27.0007
1985.1	0.6875	27.7783	30.0498
1985.2	0.7333	27.4433	25.6242
1985.3	0.7106	26.946	23.7086
1985.4	0.7367	26.47	23.9806
1986.1	0.7116	26.504	24.1339
1986.2	0.6743	26.3643	23.2417
1986.3	0.55	26.1277	21.047
1986.4	0.5173	26.2007	22.3931
1987.1	0.4483	25.9163	20.6081
1987.2	0.629	25.683	24.5246
1987.3	0.6509	25.8543	23.7468
1987.4	0.6836	25.4877	22.6984
1988.1	0.5856	25.2538	20.6281
1988.2	0.6842	25.1862	23.6411
1988.3	0.8028	25.526	26.1815
1988.4	0.9145	25.2099	25.7426
1989.1	0.9089	25.3818	25.0239
1989.2	0.9544	25.7304	27.4281
1989.3	0.9841	25.879	27.4289
1989.4	0.9501	25.8169	28.6578
1990.1	0.9916	25.7826	27.2565
1990.2	0.9954	25.9084	30.5088
1990.3	0.99	25.5361	33.2244
1990.4	0.9368	25.1143	31.9025
1991.1	0.9479	25.2618	18.0378
1991.2	0.7534	25.6523	21.6517
1991.3	0.729	25.6867	23.3241
1991.4	0.7998	25.4655	24.3368
1992.1	0.6768	25.4577	21.479
1992.2	0.679	25.5156	23.1226
1992.3	0.6638	25.2391	21.9093
1992.4	0.6899	25.3872	23.4981
1993.1	0.6265	25.4781	22.0467
1993.2	0.7472	25.2181	24.0768
1993.3	0.7901	25.2276	24.0545
1993.4	0.7741	25.3546	23.5508
1994.1	0.6742	25.4001	21.7665
1994.2	0.8037	25.1968	24.7978
1994.3	0.8681	24.9911	24.3997
1994.4	0.9043	25.0113	24.8977
1995.1	0.8055	24.9512	21.8049
1995.2	0.8117	24.60467	22.3616
1995.3	0.8569	24.91233	24.945
1995.4	0.9617	25.11733	27.4927

Probability of Devaluations

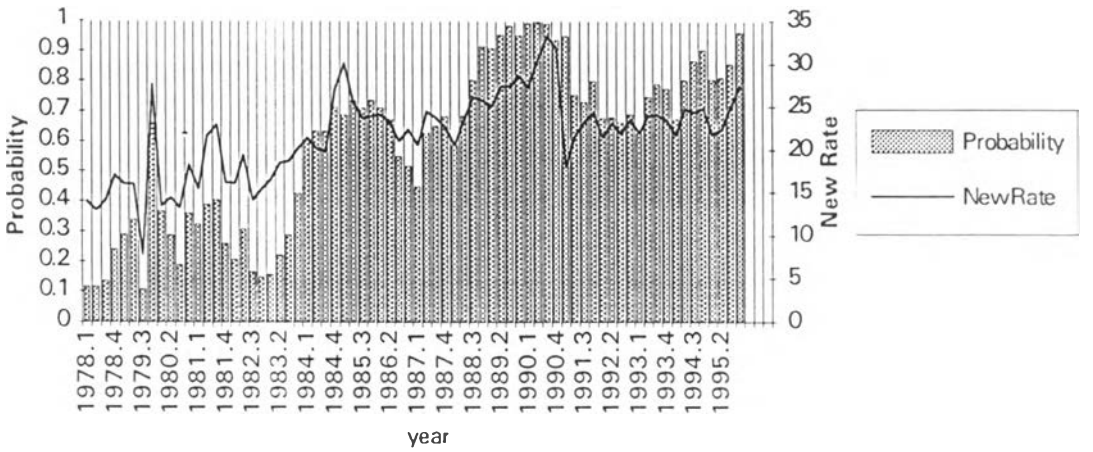
From equation (4.8), the series of one-step-ahead devaluation probabilities is computed. The series, presented in figure 4.6, indicates that the probability of devaluation fluctuated on the increasing trend over a period of time, as shown below.

Figure 4.6 : Probability of Devaluations



Baht devaluations in the past did occur when predicted by the model. Eventhough they did not obviously jump, the probability reached a local peak in all three times of Baht devaluation annoucements. Furthermore, devaluations (at period t) occurred when new (conditional) exchange rate at period t exceeded the actual exchange rate in period t-1 as same as the devaluation policy rule.

Figure 4.7 : Probability and New rate

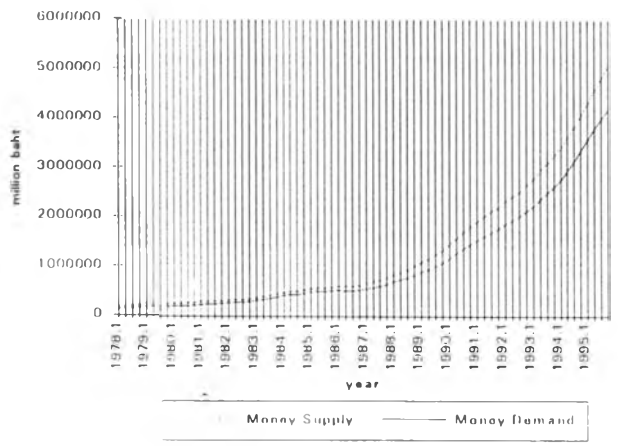


Graphically, it is obviously seen that the probability moves up and down according to the fluctuation of the conditional exchange rate. It can be explained by the sense that if people expect Baht to be more depreciated, to prevent their loss, people will convert Baht to other currencies. Speculators attack. Higher expected exchange rate implies more inspiration that people will refuse to hold Baht because they foresee more profits.

Therefore, it can be concluded that factors, influencing the change in new exchange rate expectation, are the factors that determine the movement of the probability of devaluation.

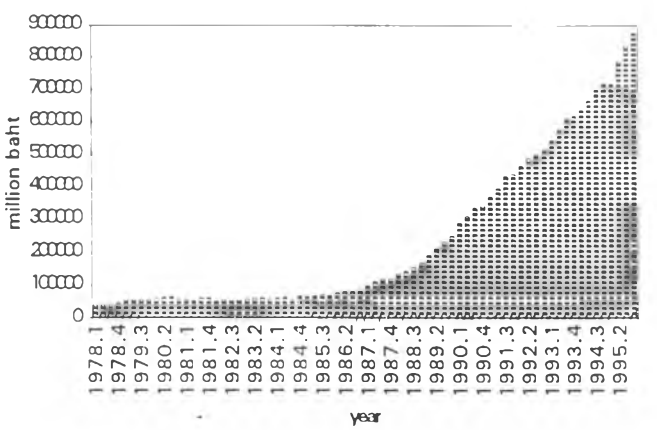
There are many factors that terminate the expectation of the new exchange rate. However, in this model, it has been controlled by demand and supply of the domestic currency, Baht. If demand for domestic currency is larger than its supply, it will cause Baht to appreciate, lowering probability of devaluation. On the other hand, if supply exceeds its demand, Baht will depreciate, then the probability of devaluation, computed from this model, ought to increase.

Figure 4.8: Domestic Money Supply and Demand



Source : International Financial Statistics Yearbook 1995, IMF.

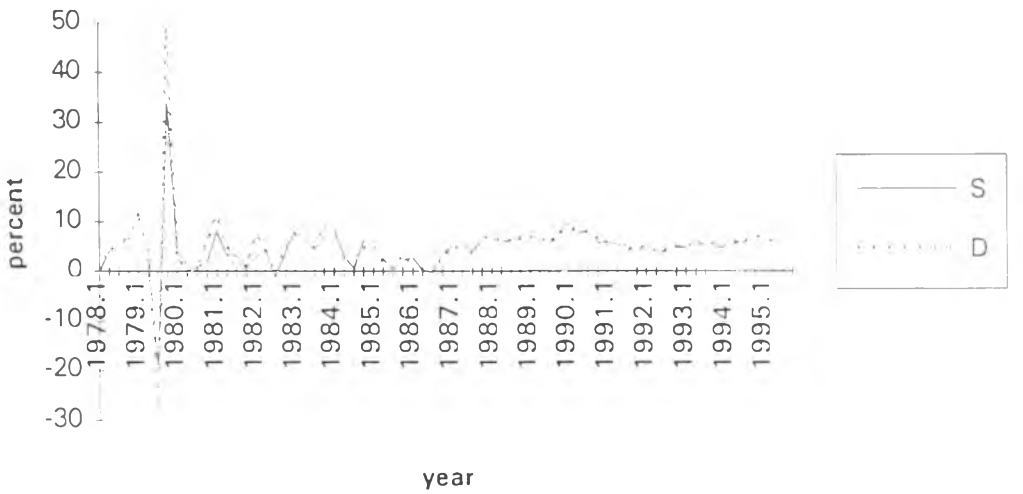
Figure 4.9: The Gap Between Domestic Money Supply and Demand



Source : International Financial Statistics Yearbook 1995, IMF.

Take a look into figure 4.8, domestic money supply is always larger than domestic money demand and its gap tends to increase as shown on figure 4.9. Because while money supply of domestic currency rises, demand also grows at almost the same rate (smaller base), shown in figure 4.10. When S denotes growth of money supply and D denotes growth of money demand. This means that money market regularly diverges from equilibrium.

Figure 4.10 : Growth of Domestic Money Supply & Demand



Source : International Financial Statistics Yearbook 1995, IMF.

It is unquestionable that conditional (new) exchange rate tends to depreciate since there is a continual increase in excessive money supply which leads to a rise trend in the probability of devaluation.

Figure 4.11: Increasing Trends of New Rate and Probability

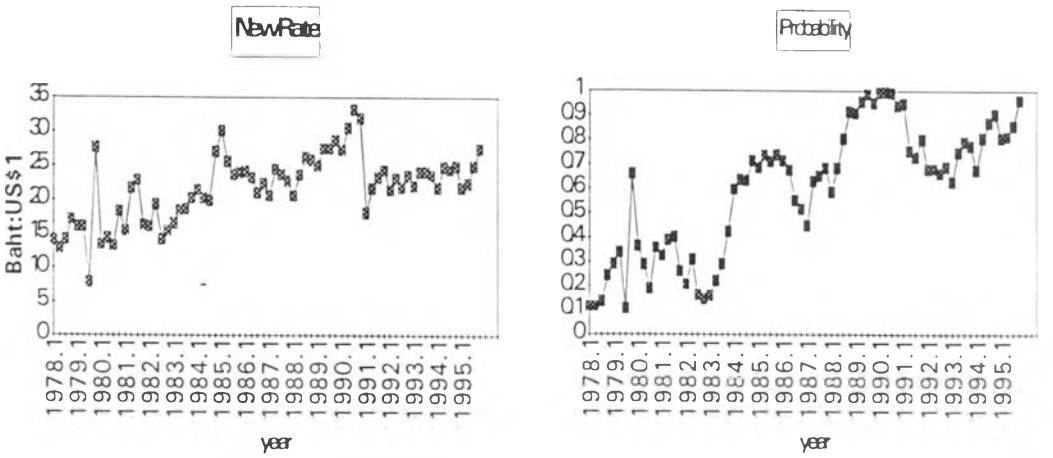
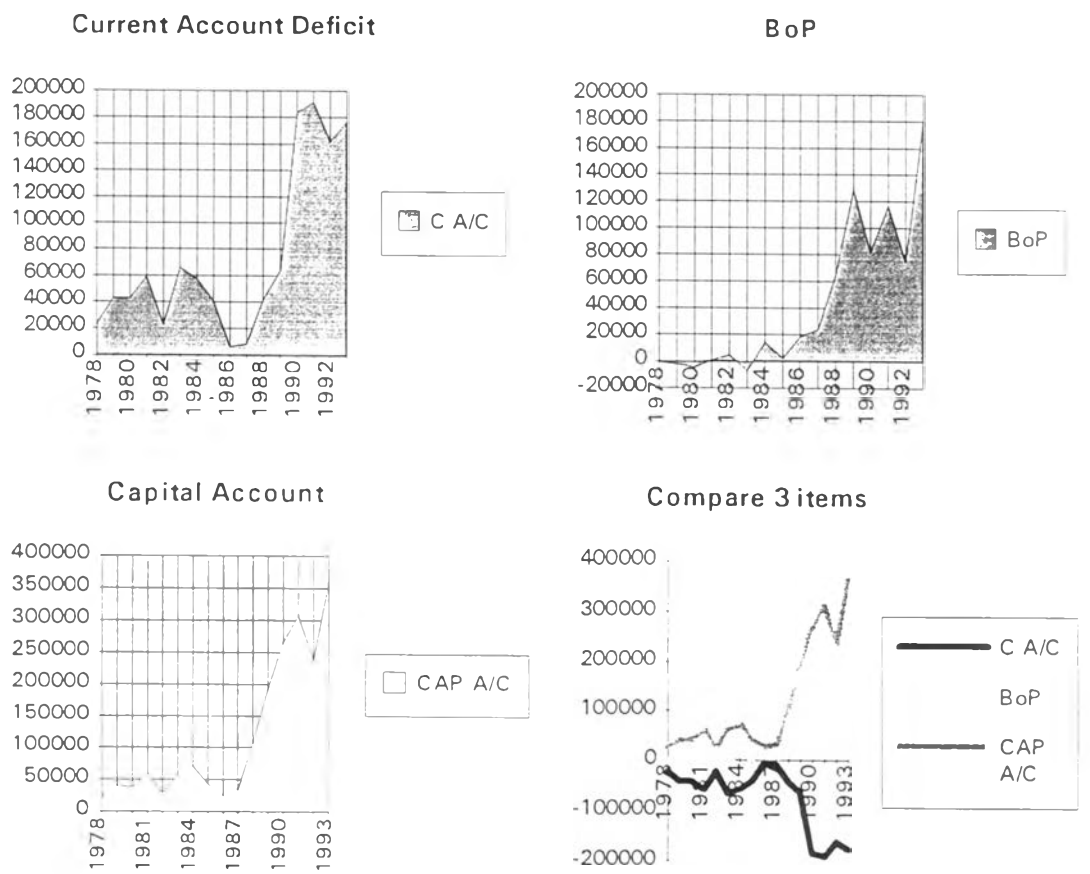


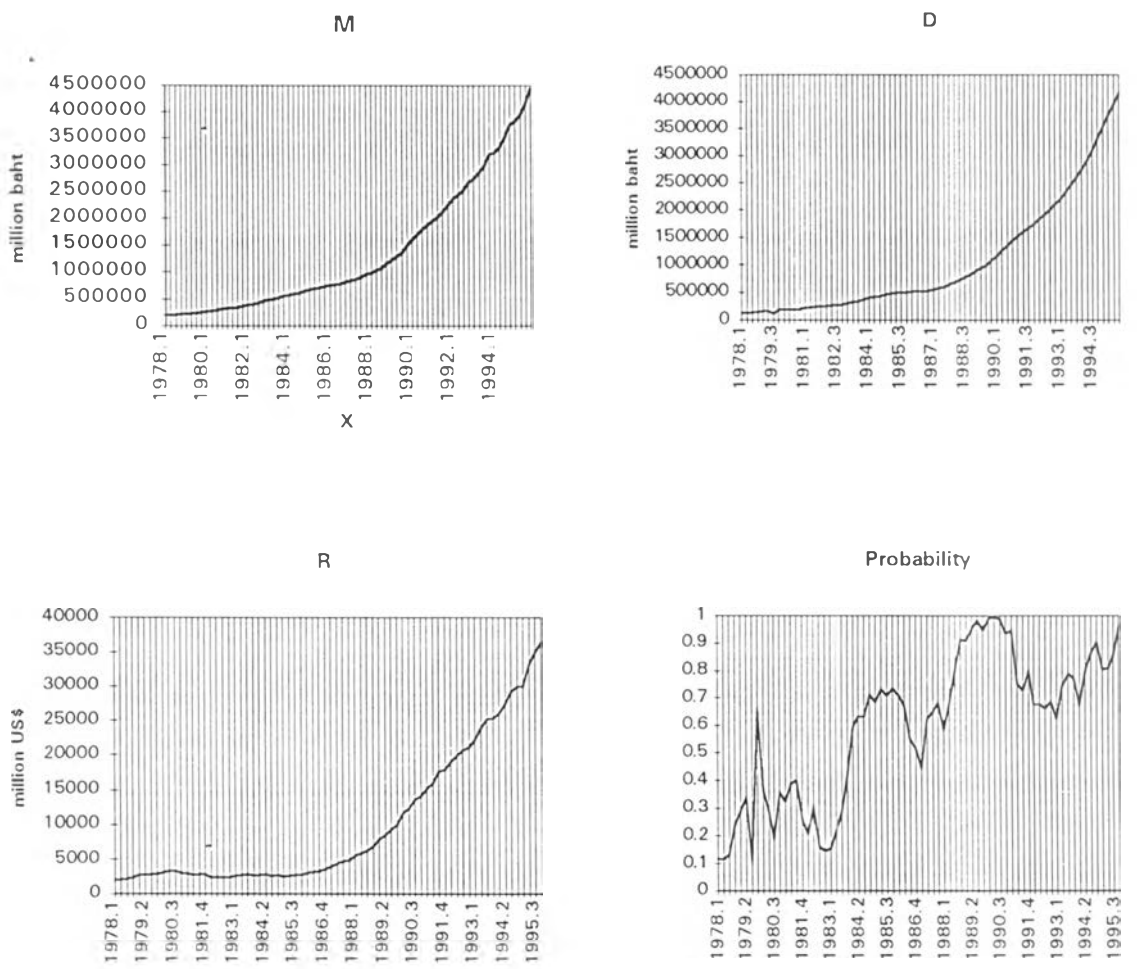
Figure 4.12 : Current Account Deficit, BoP and Capital Account



Source:International Financial Statistics Yearbook 1995, IMF. Unit:million Baht

Where does the large excessive money supply come from? Since 1985, after the late Baht devaluation, Thailand has undergone BoP surplus and its trend dramatically increases. Whereas current account has been deficit and its deficit increases sharply, the current account deficit has been financed by capital surplus and the capital inflows have been greater than what needs to pay off the deficit, then it leads to BoP surplus.

Figure 4.13 : The Movement of Exogeneous Variables



Source : Bank of Thailand
M and D are measured in million Baht and R is in million US$

When BoP is positive, foreign currency will be collected by the central bank to prevent domestic currency from appreciation since it perhaps discourage exports. This leads to an increase in international reserves. Preserving internal balance, the government the originally has to maintain money supply in economy, sterilizing the effect of BoP surplus, the government will reduce the level of domestic credit by selling bonds. On the contradiction, in Thailand, while the international reserves rises, the domestic credit always rises. It, therefore, causes a sharp increase in excess money supply, as shown in figure 4.13 .

In 1994, this capital inflows was twice current account deficit. Huge capital continuously flew into Thailand since 1988/89 because of the effective policies towards investment promotion, particular active export promotion. Private investment had risen by over 15 percent a year during 1988-91. Furthermore, financial liberalization has begun in the early 1990's by freeding deposit rate including trade liberalization which motivate the investment in Thailand; direct investment and portfolio investment. Moreover, the low wage of unskill labours in Thailand used to be an attractive point for foreign investors.

When the capital flows into economy, it will lead to too much supply of foreign currency. In order to stabilize an exchange rate (preventing from Baht appreciation), the government has to collect the foreign currency and supply Baht through the foreign exchange market. Large capital inflows is a large amount of domestic currency supplied in the economy. Then if there is excessive domestic currency supply, according to market machanism, Baht's value will decline. The expected rate of Baht in the next period will be higher (more depreciated), and the probability of devaluation in that next period should be higher. If the expected rate is higher than the actual rate, speculators will occur and the probability will be relatively high.

Result Interpretations

In the original paper, Blanco and Garber did not explain the economic fundamental of Mexico, accompanied with the model estimation

results. This study provides such details of the economic fundamental of Thailand, to see whether it is corresponding to the estimation results.

However, there are various details that happen period by period or year by year. To interpret the results, generated by this modified model for Thai economy, the explanation will be devided into two parts, according to the exchange rate regimes although by proving the exchange rate regime does not influence the accuracy of the model[3]:

The former part consists of time interval from the first quater of 1978 to the fourth quarter of 1984 when the economy still operated under the fixed exchange rate regime. At that time Thailand still suffered with the lagged effects of two times of oil crisis, occurred in 1973 and 1979 since Thailand strongly depended on imported oil. The crises caused imbalance and painful adjustment. An expansionary fiscal policy combined with delays in taking appropriate action to correct the imbalance contributed to a sharp deterioration in the fiscal and external accounts. The later part is from the first quarter of 1985 to the last quarter of 1995, under basket system. When the country was stimulated by the policies that applied to solve oil crisis problem in the first half of the 1980's. Two digits growth rate occurred, accompanied with more trade and financial liberalization over time. So, the discussion is provided in more detail as:

For the former part, in March 8, 1978, the government gave up setting par value and started to peg Baht with basket of currencies. This policy caused Baht to be more flexible and more reflected market fundamental. Baht tended to depreciate gradually by following US dollar.

The probability jumped in 1978.3 since Baht was revalued by about 1 percent to prevent depreciation. The probability speeded up sharply because new exchange rate which was set by BOT did not mirror the current situation. Domestic interest rate which was higher than foreign interest rate, as shown in figure 4.16 (represented by Fed Fun rate), caused the excessive money supply in economy (S-D; when S is domestic money

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[3] If the change in exchange rate regime impacts the accuracy of the model estimation results is proved in AppendixB

supply and D is domestic money demand), shown in figure 4.15. Instead of reducing domestic currency price because of excessive supply, government increased price of domestic currency. This increased more excessive money supply since high price of Baht. To lower the pressure of devaluation, in November 1978, daily fixing exchange rate was employed, introducing Baht to move according to current market situation.

Figure4.14: Excess Money Supply

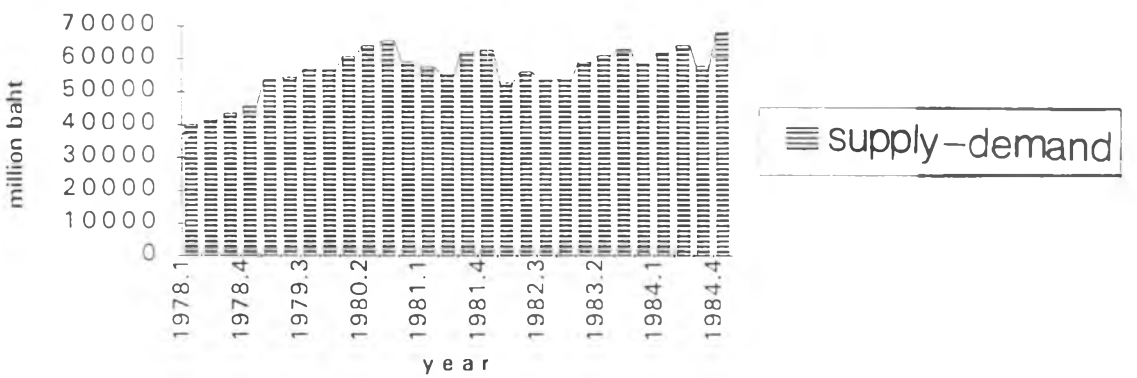
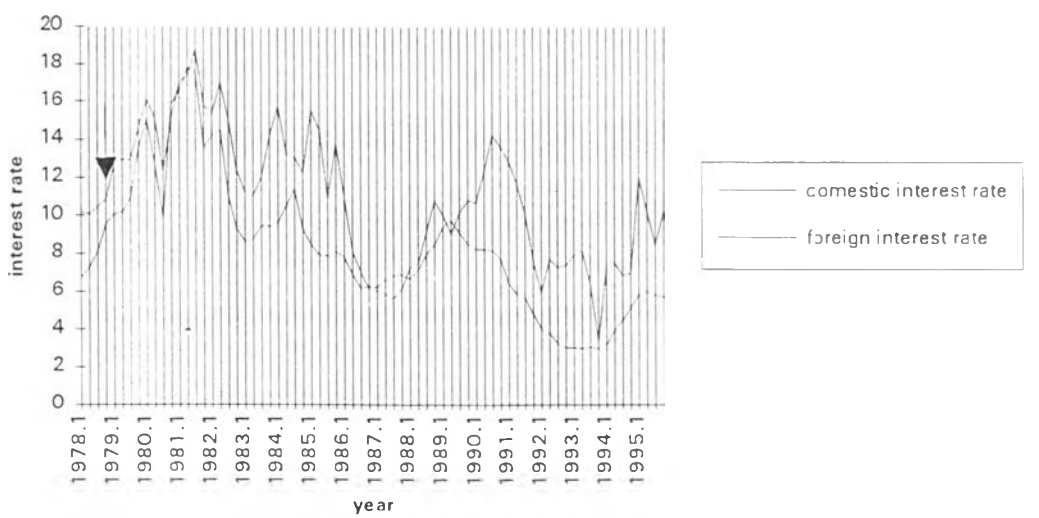


Figure4.15: The Domestic and Foreign Interest Rates



In the early 1980's, Thailand faced the serious effects of both the 1973 and 1979 oil price shocks. It was a period of serious imbalance and painful adjustment because of its heavy dependence on imported oil. In 1979, the second oil shock hit, the relatively expansionary fiscal stance combined with delays in taking appropriate action to correct the

fundamental imbalance contributed to a sharp deterioration in the fiscal and external accounts, illustrated in figure 3.1-3.2.

It led to high probability of devaluation in the late of 1979 since there was an abnormal increase in money growth rate. Reserves also went down to 2955.4 million US$ in November, 1979 from 3488.9 in the middle of the same year. Inflation dramatically rose Baht was expected to depreciate.

The exchange rate tended to depreciate again during 1980/81. Although Baht was pegged with basket of currencies, in practice, Baht was heavily pegged with US dollar (around 80% weighted in basket of currencies) which was a currency of the most important trade partner of Thailand. While value of US. dollar continuously increased, Thai government tried to intervene through the foreign exchange market to keep the stability between Baht and other currencies in basket.

Baht depreciated continuously against US dollar because of two major reasons. Firstly while US dollar kept appreciating, Baht had to be adjusted in order to stabilize baht with other major currencies, government had to intervene by supplying US dollar continuously. Secondly, there was BoP problem because of slowing down of exports and capital outflows (domestic interest rate dropped, shown in figure 4.16). International reserves declined.

The government could not avoid to intervene exchange market but the intervention operation did not work. Baht dramatically depreciated against US$, people lost confidence in baht. Speculators attacked while external payments caused an increase in demand for US dollar and less demand for Baht. Probability of devaluation went up from previous period.

In May 12, 1981, Baht was devalued by 1.07 percent, however, it was not better: US$ value still rose. There was not any improvement in BoP situation. Baht denomination policy pegged with US. dollar at 21 Baht:US$1. Baht value did not reflect real economic situation of Thailand, so businessmen and commercial banks lost confidence in Baht.

Commercial bank accumulated foreign assets whereas they reduced foreign liabilities to 204 million US$. This caused international reserves to decline. Inflation rate in 1981 increased by 12.8 percent from 19.7 percent in 1980. Export capability decreased as commodities price increased in comparison to Thai counter party countries. People expected devaluation again since they could foresee the rapid depletion of reserves.

Table 4.3 shows that conditional (new) exchange rate was 21.7 while the government annouced at 21 Baht: US$1. There was still an excess supply in domestic currency which was higher than before devaluation announcement. Forward premium largely increased, figure 4.4. Probability slightly rose from the previous period. Baht was stronger than actual. Thus, in July 15, 1981, Baht was devalued again by 8.7 percent to reflect the real economic situation and to stimulate Thai exports since high price of Baht worsened trade deficit and caused speculative and sharply decline in reserves. The Exchange Equalization Fund had to sell US dollar continuously for 14 working days.

However, this devaluation led to an increase of leading indicators at the end of 1981. Current account deficit to GDP declined sharply in the year 1982. The daily fixing was also given up. The government recurrently fixed exchange rate at 23 Baht:US$1 (the conditional exchange rate calculated by the model is 22.9) until late 1984 in order to revive the confidence in the stability of Thai Baht.

During the period of 1979-1983, the current account deficit was about 7 percent of GDP and the fiscal budget deficit hovered around 5 percent of GDP for an even longer period. Long-term external debt rose dramatically from 2.7 billion US$ in 1978 to 13.2 billion US$ in 1985.

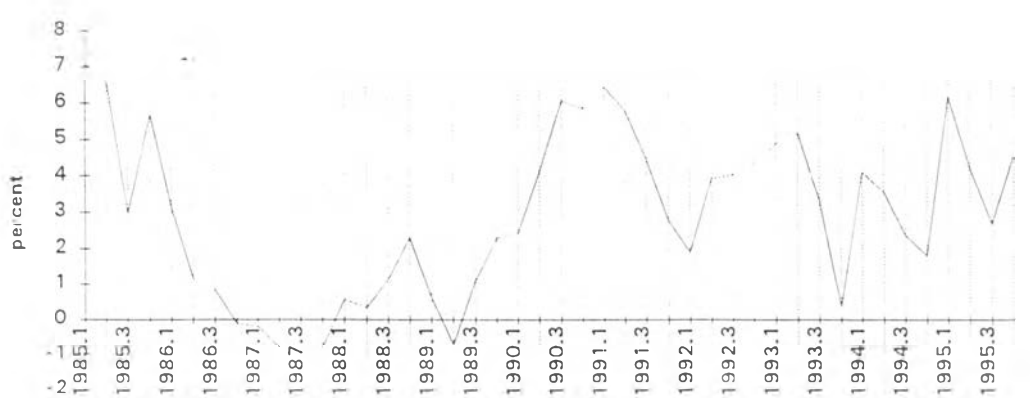
In the late 1984, the fixed Baht was strengthen by 51%, 37.18% and 22.51% against Pound Sterling, Hong Kong Dollar and Deutsche Mark respectively. Thai government realized that fixed system was not appropriate to Baht. Export prices were high, Thailand could not compete with other countries, and import prices were relatively low. The fact that the government had to borrow money from abroad led to an increase in external debts burden. Capital surplus increased and induced more excess supply, then the probability of devaluation made a big jump.

Due to the negative effect of BoP as well as prices of agricultural products, in November 5, 1984, Baht returned to peg with basket again, accompanied by Baht devaluation by 14.8% to 27.0 while the expected rate, computed by model identified at 27.0007. The fixed exchange rate was abandoned.

The later part is concerned about the economy with managed floating system. Considering Figure 4.7, the probability fluctuated at the high level and peaked in the early of 1990's. Since the financial liberalization began in 1990, huge capital inflows led to more excessive domestic money supply while aggregate demand could not catch up because it was stagnated due to the effects of tightening policies applications.

Moreover, the capital flew in Thailand, most of it has purposed for gaining from the interest rate differential and the returns in stock market. The probability of devaluation, therefore, moved according to the movement of interest rate differential (figure 4.17). The domestic interest rate was greater than foreign rate, means positive gap in the interest rate differential. If the interest rate differential increases, there has been a rise in capital inflows. Increasing in domestic money supply, according to market mechanism, implies the expected lower price in the local currency, pressured the probability of devaluation.

Figure4.16 : Interest Rate Differential



Continuing from the former period, the Thai government took a number of actions in the first half of 1980's to stabilize and reform the economic structural. Such as fiscal retrenchment, stronger tax collection, competitive exchange rate management, active export promotion, and reduced external borrowing. Initially, the economy responded slowly to these policy changes, in part because of the unfavourable global economic situation, and in part because the adjustment was relatively gradual.

Since 1985, however, the cumulative effects of policy measures, including a 14 percent devaluation of the Baht in late 1984 combined with more favourable external economic conditions had stimulated a rapid turnaround and recovery. This turnaround was sustained by effective exchange rate management and an increasingly attractive market for Thai exports. Accompanied by improvements in terms of trade, the economy grew faster and the fiscal and external deficits both fell rapidly.

These sound economic base should prevent economy from devaluation. The revived confidence of economy as well as domestic currency led to respective decline in the probability of devaluation. However, the interest rate differential which was rather large, led to excessive domestic money supply and made the probability attain at high level since 1986.

During 1986 and 1987, domestic interest rate as well as foreign interest rate declined and interest rate differential was also low. Forward premium easily decline during this period. Thus the probability of devaluation relatively decline since capital surplus had gone down.

Between 1987 and 1990, real GDP growth was among the highest in the world, average almost 12 percent, reaching 13.2 percent in 1988. While the economic rebound in the latter half of 1980's was directly attributable to a more favourable international environment including the depreciation of the dollar against the yen, rising cost in East Asia and Japan and lower oil prices, it was reinforced by causion macroeconomic and structural policies. Conservative fiscal management, competitive exchange rate policy, and a general shift from import substitution towards

export promotion have strengthened investor confidence in the Thai economy and significantly boosted exports.

However, on the other hand, imports which emphasized on raw material and mechanisms as the expansion of the investment sector also sharply increased. The external current account deficit was dramatically rising over time and peaked at 9.2 percent (current account deficit to GDP) in 1990, which is consistent with the peak of probability. At that time there was a huge excessive money supply caused by enormous capital surplus. This capital inflows was induced by large interest rate differential as well as the beginning of financial liberalization.

During the Gulf War Crisis, oil price rose and a significant decline in visitor arrivals, the deficit for 1991 was expected to be even higher, but fell to 7.7 percent. Monetary arrangements have also been liberalized, and the regulatory and supervisory framework of financial transactions strengthened. Thai government imposes many regulations and measures to liberalize Thai financial market in order to be the financial centre in this region, for example, the relaxation on current restriction in 1990, freeding domestic interest rate.The net result has been to make the system more open and to integrate Thailand more fully into the international financial market.

The increasing current account deficit was financed by the capital account. Then, at this economic boom period, the large amount of capital inflows, observing from sharply increase in international reserves, R, in figure 4.13 accompanied with rising in credit that the central bank gave to the government and commercial bank, D, led to excessive domestic money supply over its demand.

In 1991/92, despite the deepening recession in the world economy, Thai GDP growth rate was 8 percent. While this was lower than the double-digit growth rates during the latter part of the 1980's, this performance is more sustainable. Lower domestic demand due in part to monetary and fiscal tightening has been the main factor in slowing GDP growth. Private fixed investment in particular, was almost stagnanted in 1992 after having risen by over 15 percent during

the year 1988-91. Even with rapid economic growth, consumer price index inflation has remained below 6 percent. While the public sector maintained a current budget surplus for eight consecutive years, the deficit fell slightly to 5.7 percent in 1992. This stagnanted investment which is consistent with the decreasing capital surplus reduced the probability of devaluation because of its excessive money supply reduction.

Since 1993, more financial liberalization and trade liberalization have motivated foreign capital inflow at high level continuously. Commercial banks have received licence to do International Banking Facilities (IBFs) since 1993. The lower interest rate, though IBFs bring about a lot of fund to commercial banks, enhances their liquidity management by providing loan both in terms of Baht and other currencies.

Therefore, commercial banks' liabilities in terms of foreign currencies increase rapidly from 6 billion US$ in 1992 to 17 billion US$ in early 1994. Furthermore, the relaxation on current restriction also benefit business sector to accumulate fund directly by issuing treasury bills from both domestic and international market. In 1994, business sector borrowed money from aboard about 3.2 billion US$, by the way, external debts increased from both commercial bank and business sector in order to expand their business in Thailand. This huge capital inflows, with high liquidity, have led to increasing domestic money supply in economy. Consequently, it leads to increasing trend of probability of devaluation.

Comparison the devaluation probabilities between the former and later parts in figure 4.6, the probability in the later period is apparently higher than the probability during 1978-1984. It is because of a continual, dramatic increment in money supply in Thai economy. Observing figure 4.13, since 1985 after the last time Baht devaluation, Thailand has undergone BoP surplus with its sharp increasing trend. While current account has been deficit and its deficit has increased dramatically, the current account deficit has been financed by capital surplus. But the capital inflows have been greater than the amount, required to pay off the debts, then, it has caused BoP surplus, means

the excessive money supply. By the concept of this model, higher devaluation probability is responsed by the more excessive money supply. In addition, financial liberalization and trade liberalization[4], beginning in the early of 1990's, which continually perform with higher degree of liberalization, also results in more excessive money supply, causing higher probability . However the devaluation probability does not increase steadily but it slightly fluctuates, following the movement of the interest rate differential.

Policy Implication

In this section, there are some suggestions to prevent and lower the pressure of devaluation. Such these policies emphasize on the causes of currency devaluation. The first is to head off serious current account deficit. As a matter of fact, this can be done in many ways. For the case of Thailand, to eliminate the trade account deficit, the government should motivate the domestic saving for the benefit in long run. Besides, the service sector should be monitored closely as well as promoting and increasing its value added in order to slice current acccount deficit. The government authorities should keep eyes on the capital inflows, particularly its types. Moreover, the inflation should be controled at lower rate to prevent the depreciation of real value of domestic currency. The government also needs to restore investor confidence and to discourage the speculative efforts in both currency market and stock market.

In addition, according to the center concept of this model, to defend against domestic currency devaluation, the controling money supply should be emphasized. Threr are several approach to cut out the excessive money supply. Firstly, domestic interest rate should be lowered in order to transform short-term capital to longer term. Nowaday the huge amount of short-term capital flows into Thai economy because the foreign investors recognize that in Thailand they can yield more for higher interest rate, relatively to world interest rate without currency risk as Baht is almost completely fixed. These short-

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[4] If the liberalizations both in trade and finance impacts the accuracy of the model estimation results is proved in AppendixB

term money does not contribute to national income. Then, Thai economy perhaps not ready for completely financial liberalization. Secondly, an accordance with sterilization approach, the selling bond can be used to absorb the excessive money supply. Ultimately the central bank can eliminate the excessive money supply by depositing Baht, in term of foreign currency, outside the country.

Remarks

Due to Vanitchareontham's suggestion, constant level of international reserves, according to the original model, should be changed to an exogeneous variable at current period as the reasons were mentioned before. Then the results, concentrating on time interval 1980-1984 are rather difffent from the previous studyin the better way.

In Vanitchareontham's study, the new exchange rate did exceed the fixed rate at the times of devaluation except for May 1981. The calculated flexible exchange rate are equal to 20.59, 22.69 and 27.2 Baht:US$ in May and July, 1981, and November, 1984, respectively. Furthermore, it also exceeded the official fixed rate in other period such as during January to April, 1982 and from September, 1983 until the end of 1984.

In May, 1981, the probability rose up to 48 percent and did not drop until after July, 1981 when it reached a peak at 53 percent. After that the probability fell dramatically. While the probability in 1984 was in the trough.

Comparing to the previous study, in the modified model, the results demonstate that the expected exchange rate, computed by this model, were 21.71, 22.9 and 27.0007 in May and July, 1981, and November, 1984, respectively are close to the rate, announcing when devaluations occured. Moreover, the expected rate exceeded the official fixed rate only in three times of devaluation, considering only 1980-1984.

In addition, although the probabilities when devaluations occurred were not at the highest level, the probabilities of devaluation immediately reached local peak. Considering only 1980-1984, it peaked at the last

quarter of 1984 which was consistent to the highest percent of Baht devaluation. The probabilities of devaluation were 38.89, 40.29 and 71.26 percent in May and July, 1981, and November, 1984, respectively

These different results may come from two different factors between these studies. Firstly, the difference in the assumption of international reserves. Secondly, the difference in type of applied data, in the previous, the monthly data from monetary surveys was used while the quarterly data from financial surveys was in this study. Then it leads to the difference in δ. The previous task, δ is 1.5 while in this study it equals to 2.0099. It means that disturbance term that forces the collapse of regime becomes larger.

The accurate results, estimated by this model can be guaranteed by the estimation result, showing that the unconditional exchange rates are closely correlated with the forward rates. The conditional forecasted exchange rates are also very close to the exchange rates set when devaluations occurred.

In conclusion, the movement of probability can be explained by the movement of the conditional exchange rate. In the central part of this model, the conditional exchange rate has been determined by money supply in the economy. The excessive money supply causes the inflation and leads to depreciation of domestic currency.

Actually, there are many factors that influence the change in excessive money supply. In the case of Thailand, capital account surplus induces an increased international reserves while the domestic credit also rises. These lead to an excessive money supply and its dramatical increasing trends.

There are a variety of reasons causing capital inflows. The most outstanding one is the interest rate and its differential. To visualize clearly, if the gap between domestic interest rate and foreign interest rate increases, the capital inflows will rise due to more attractive profit. More excessive supply will reduce the price of domestic currency and ultimately pressure the devaluation.