Sources of Variations Between The Inflation Rates of Korea, Thailand and Indonesia During The Post-1997 Crisis

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Abstract:

Despite the large number of studies done on the recent East Asian crisis, hardly any of them has however simultaneously evaluated the roots of the inflationary pressures and unearthed the sources of sharp variations between the inflation rates of the various crisis-effected economies. To help fill in this gap, our paper examines and contrasts the sources of inflation in Thailand, Indonesia and South Korea during the period of 1985 to 2001. A number of potential sources of inflation will be considered in the study. But this study pays a particular attention to the possible roles of the monetary aggregates and the exchange rate uncertainties in encapsulating the rise in the inflationary pressures and the variations between the inflation rates experienced by these economies during the 1997 crisis.

JEL Classification: E41, E51, E52, E58, F41

Key Words: Inflation, Base Money, Expected Depreciation, Exchange Rate Policy, East Asian Financial Crisis

1. Introduction

The presence of more severe inflationary pressures has long been considered as a consistent feature of global financial crises in 1980s and 1990s. During the Tequila crisis in mid-1990s, Mexico had seen its price levels to increase by around 35 percent annually for two consecutive years (in 1995 and 1996 (Table 1)). Similarly, with the collapse of the banking sector and the fall of the currency board in Argentina in early 2002, the domestic price level has risen by around 30 percent within the first six months of 2002. It is interesting to also note that both Mexico and Argentina had posted remarkably low inflation rates a year before the break of the financial crises. Mexico had successfully lowered its inflation rate from 9.7 percent in 1993 to around 6.9 percent in 1994. Argentina, on the other hand, was experiencing deflationary pressures between 1999 and 2001.

Looking at the experience of Indonesia, Korea, Malaysia, Philippines and Thailand during the last few years of 1990s, the East Asian crisis is no exception (Table 1). During the peak of the crisis in 1998, the annual inflation rates of these countries were at least four to six percentage points higher than their perspective rates in 1996. However, unlike the recent crisis in Mexico and Argentina, the rise in the price level of the East Asian countries was generally less severe and less comparable. Despite the stronger inflationary pressures in Malaysia, Philippines, Thailand, Singapore and South Korea, the rates remained at a single digit even at the height of the financial crisis in 1998. Furthermore, these economies have successfully slashed their inflations rates in 1999.

In contrast, Indonesia suffered much more severe inflation rates in 1998 and 1999. During those two years, the consumer price index had risen to the rates parallel to those posted by Mexico and Argentina in 1995 and 2002, respectively. For a country that had a long reputation for its commitment to both prudent monetary policy and sound management of the fiscal policy, the inflation rates in 1998 and 1999 were in fact the worst that Indonesia had experienced in nearly 30 years.

What are the underlying "economic explanations" behind the sharp increase in the rates of inflation experienced by these major East Asian economies during the 1997 crisis? More importantly, how do we account for the substantial disparity between the inflation in Indonesia and the rates experienced by Thailand and Korea? Despite large studies done on the recent East Asian crisis, limited studies have however simultaneously evaluated the roots of the inflationary pressures and unearthed the sources of sharp variations between the inflation rates of the various crisis-effected economies.[1] To help fill in this gap, our paper examines and contrasts the sources of inflation in Thailand, Indonesia and South Korea during the period of 1985 to 2001. The focus of the paper will largely be on the post-1997 inflation episodes, but the pre-crisis observations are also incorporated to further highlight the similarities and differences between the pre-and post-crisis experiences within each economy and between them as well.

A number of potential sources of inflation will be considered in the study. But we will pay a particular attention to the possible roles of the monetary aggregates and the exchange rate uncertainties in encapsulating various issues surrounding the price levels of these economies. These two factors have frequently been cited as the roots of the stronger inflationary pressures during the early part of the crisis (IMF (2000 and 2002), Fane and McLeod (1999), Lane et.al (1999) and Ramakrishnan and Vamvakidis (2002)). Major devaluations of the key East Asian currencies helped to produce the worst

[1] Lane et.al (1999) had briefly sketched out possible sources of variations between the inflation rates of these three economies, but no in-depth empirical works were presented to conclusively support their analysis. Studies on the East Asian crisis can also be found in (http://faculty.washington.edu/karyiu/Asia/index.htm) and (http://www.stern.nyu.edu/globalmacro/).

volatilities that these currencies had experienced in the last three decades (Rajan, Siregar and Bird (2002)). Consequently, stabilizing the local currencies and limiting the inflationary consequences of the sharp devaluations have been one of the main objectives of the Letter of Intent (LOI) signed between the government of these economies and the International Monetary Fund (IMF)[2].

The other cornerstone of the Letter of Intent is on the management of key monetary aggregates. In late 1997 and early 1998, a number of these economies had experienced excessively high growths of base money due to the liquidity supports provided to troubled banks and the impact of depositor runs on banks. To contain the inflationary implications of the loose monetary policy, the Letter of Intent stipulates, in general, the limits on broad money (M2) growth, to be achieved mostly through controlling base money (M0) quarterly growths.

The outline of the paper is as follows. Next section presents a theoretical framework for the empirical model. Section 3 discusses the relevant empirical testing and findings. Section 4 highlights the similarities and differences between the relevant stylized facts of these economies, particularly during the post-crisis period. Brief concluding remarks section end the paper.

2. Working Model

Monetarists advocate that the rate of inflation (Δp_t) should equal the growth rate of the nominal money supply (Δm_t^S) minus the growth rate of real money demand

[2] Letter of Intent between IMF and the governments of the crisis-effected economies can be downloaded from the IMF Web-site (www.imf.org).

$\left(\Delta \frac{m^d}{p}\right)$ (Abel and Bernanke (2001), Deme and Fayissa (1995) and Darrat and Arize (1990)).

$$\Delta p = (\Delta m_t^S) - \left(\Delta \frac{m^d}{p}\right)_t \tag{1}$$

All variables are in the logarithmic forms. Δ denotes the first difference operation, and *t* captures time.

The basic real money demand function can be expressed as the following:

$$\left(\frac{m^d}{p}\right)_t = f(y_t, r_t) \tag{2}$$

That is real money demand is a function of income (y_t) and prevailing domestic interest rate (r_t).[3] However recent studies have shown that in an open and financially liberalized economy, the impacts of external factors in the demand for money are found to be significant (Arango and Nadiri (1981), Girton and Roper (1981), Miles (1981), Bordo and Choudhri (1982), Cuddington (1983), Khalid (1999) and Sriram (2001)). To incorporate the external factors, we follow early studies and specify the following simple real money demand function.

$$\left(\frac{m^d}{p}\right)_t = f(y_t, r_t, rf_t, ed_t) \tag{3}$$

where: (ed_t) is the expected depreciation rate of the local currency. It is proxied as the actual depreciation of the local currency during the last period.[4] (rf_t) is the foreign interest rate variable.

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[3] For a good review of money demand, please refer to Chapter 3 of McCallum (1989).

[4] (ed_t) is positive (negative) if there was a depreciation (appreciation) of the local currency last period.

Substituting equation (3) into equation (1) will yield the following general expression for domestic inflation:

$$\Delta p_t = f(\Delta y_t, \Delta r_t, \Delta rf_t, \Delta ed_t, \Delta m_t^S) \tag{4}$$

Equation (4) suggests that the level of domestic inflation is going to be influenced by the level of domestic income, domestic and foreign interest rates, expected depreciation of the local currency (the exchange rate factor) and domestic money supply.

The following first order conditions should hold.

$$\frac{\partial \Delta p_t}{\partial \Delta ed_t} > 0 \tag{5}$$

Given no other changes, a rise in (ed_t) lowers money demand. Therefore, there will be a relatively higher supply of money than demand for money in the domestic economy. Inflation is therefore expected to rise (Equation 1).

$$\frac{\partial \Delta p_t}{\partial \Delta rf_t} > 0 \tag{6}$$

Similarly, a rise in foreign interest rate (rf_t) will lower demand for money in domestic economy, as the opportunity cost of holding money increases. Given everything else in the economy remains unchanged, price level is expected to rise.

$$\frac{\partial \Delta p_t}{\partial \Delta y_t} < 0 \tag{7}$$

The rise in output / income should increase demand for money (Equation 2). Given money supply remains unchanged, the rise in the level of money demand relative to money supply will lead to a decline in inflation rate (Equation 1). Hence, a rise in output will eventually cause inflation rate to decline.

$$\frac{\partial \Delta p_t}{\partial \Delta r_t} > 0 \tag{8}$$

A rise in the domestic interest rate will increase the opportunity of holding money, hence demand for money should fall (Equation 2). With the supply of money unchanged, the fall in money demand should increase domestic inflation (Equation 1).

$$\frac{\partial \Delta p_t}{\partial \Delta m_t^S} > 0 \qquad (9)$$

Lastly, as clearly indicated by Equation 1, an increase in money supply, given everything else remains unchanged, should lead to a higher domestic inflation.

3. Data and Empirical Testing

3.1. Data

Variable *ed* represents the expected depreciation of the nominal exchange rate of rupiah, baht and won against the US dollar and the nominal effective exchange rates. *ed* at time (*t*) is represented as the actual change of the bilateral and nominal effective exchange rate at time (*t-1*). A positive *ed* implies an expected depreciation of the East Asian countries against the major global currencies (and vice versa).

The bilateral nominal exchange rates are adopted from the International Financial Statistics, the International Monetary Fund for various years and the Data Stream. The nominal effective exchange rate (*neer*) is a GDP-weighted of seven major world economies' currencies against each of the East Asian currencies.[5] Each weight is the ratio of each country's annual GDP over the total sum of the seven countries' GDPs. The nominal effective exchange rate is the total sum of the bilateral nominal exchange rate of each Asian currency against the major world currencies multiplied by the GDP-weight, respectively. The GDP series and the bilateral nominal exchange rate series are

[5] Those major economies are the United States, Japan, Germany, United Kingdom, Canada, France and Italy.

adopted from the International Financial Statistics, the International Monetary Fund for various years.

The base money series (m^s) and the nominal domestic interest rate are gathered from the database of Bank Indonesia and Data Stream. For the domestic interest rate (r), we adopted the 3 months rate of the Certificate of the Central Bank for Indonesia, and the money market rate for both Thailand and Korea. The Certificate of Bank Indonesia is from the Data Base of Bank Indonesia, and the money market series are from the Data Stream. The nominal foreign interest rate is the US three months deposit rate, taken from the International Financial Statistics CD-ROM. The domestic income variable is the real GDP of each country. These series are adopted from the database of the Econometrics Study Unit of the National University of Singapore. Inflation rate is calculated as the change in the consumer price index (CPI). The CPI series is sourced from the International Financial Statistics CD-ROM.

3.2. Unit Root Testing

To ensure the robustness of the test results, three most commonly used unit-root tests, namely the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and KPSS unit root tests, are applied on the relevant variables. The unit root test results on the log-forms of the relevant variables are reported in Tables 2-4. Note here, given the availability of the data series, we test output (y) variable based on quarterly observations. As for the rest of the variables, we apply the monthly series. We break the monthly observation set into pre-and post-crisis periods. By adopting this step, we avoid structural breaks on the series associated with the transition from the pre- to post-crisis period. For the quarterly data, we focus only on the pre-crisis. The use of monthly or quarterly series should not affect the final outcomes of the tests (Pierse and Snell (1995), and Marcellino (1999)).

The results reveal that the variables such as rate of inflation (Δp), and the expected depreciation of the local currency (ed) do not contain unit roots and thus stationary processes. But output (y), domestic interest rate (r), foreign interest rate (rf) and the money supply (*m0*) are found to be an I(1) series (non-stationary processes at the level and stationary processes at the first difference).

---- *(Insert Table 2-4)* ----

3.3 Short Run Dynamics

The main focus of this study is to analyze the role of various key economic variables on inflation rate. Given the unit-root test results, it is irrelevant to examine the long-run equilibrium relationship between the variables, especially as the dependent variable is stationary. Furthermore, due to the asymptotic properties of the Johansen cointegration test statistics, the application of the Johansen cointegration test on a limited sample size has been frequently argued to be unstable. Early studies, such as Sephton and Larsen (1991), Barkoulas and Baum (1997), Choi (1992), Choi and Chung (1995), Lahiri and Mamingi (1995) and Cheung and Lai (1993) showed that the Johansen test statistics are biased toward finding cointegration too often.[6]

Given the stability problem of the Johansen test under the limited sample periods as we have for the pre- and post-1997 crisis (of around 9 years for the pre-crisis and 4 years for the post-crisis), we therefore proceed with the employment of the

[6] Sephton and Larsen (1991), SL henceforth, showed that inference based on Johansen cointegration tests of foreign exchange market efficiency suffers from structural instability. Burkoulas and Baum (1997) re-examine the evidence found in SL to longer data sets. Instead of using a data set of less than 10 years, Burkoulas and Baum (1997) expand the sample up to 20 years and conclude that the stability of the test results increases as a longer observation period included in the test.

Autoregressive Distributed Lag model (ARDL), without incorporating any error correction component in the regression.[7] The Autoregressive Distributed Lag model (ARDL) has been constructed by treating inflation as an endogenous variable. The non-stationary explanatory variables are differenced appropriately to remove the unit roots. Hence our working model, based on the unit-root test results, will be as follows.

$$\Delta p_t = a + \sum_{i=0} \alpha_i \Delta m^s_{t-1} + \sum_{i=0} \beta_i \Delta y_{t-i} + \sum_{i=0} \delta_i ed_{t-1} + \sum_{i=0} \theta_i \Delta r_{t-1} + \sum_{i=0} \gamma_i \Delta rf_{t-1} + \varepsilon_t \qquad (10)$$

$$\sum_{i=0} \alpha_i \succ 0\,,\ \sum_{i=0} \delta_i \succ 0, \sum_{i=0} \theta_i \succ 0, \sum_{i=0} \gamma_i \succ 0\,, \text{ and } \sum_{i=0} \beta_i \prec 0$$

The expected signs of the coefficient estimates are consistent with Equation 4. a and ε are a constant and an error term variable, respectively. We assume that the error term to be a white noise process. Δ denotes the first difference operation, and all the variables are in the log-forms.

Up to eight lags for the monthly observations and four lags for the quarterly observations of the dependent variables are included in the initial estimation, and then sequentially we exclude the statistically insignificant lags of the variables.[8] As stated in the introduction of the paper, two different regressions are estimated: (1) pre-crisis

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[7] Just for the sake of completeness, we test for the cointegration relationship of the pre-crisis model with variables all at levels. We find two cointegration relationships. Note, given the exchange rate factor (ed) is I(0), at least 2 cointegration relationships should be found to confirm the long-run relationship (Johansen and Juselius (1992), and Rahmatsyah, Rajaguru and Siregar (2002)). Some of the the normalized cointegration coefficients of the Johansen test are however theoretically inconsistent and statistically insignificant. Incorporating the Error Correction component into the ARDL regression, we do find the overall results are in general consistent with the ARDL test results posted in Table 5a-7. Due to the stability problem discussed above and for the sake of brevity, we do not post the cointegration test results and the full ARDL with the error correction component. However the test results can be made available upon request to the authors.

[8] The numbers of lags are chosen to ensure that we have enough degrees of freedom. Our test results have shown that no significant results are found beyond the lags that we have imposed.

period and (2) post-crisis period. The pre-crisis regressions are done in both quarterly and monthly data[9]. The model for the post-crisis period is based on monthly data as the use of quarterly data for the post-crisis period highly suffers from the lack of degrees of freedom. Furthermore, since the output variable is not available in the monthly frequencies we omit them from the post-crisis analysis.

Table 5a – 7b report the overall results. We find the signs of the estimated coefficients are in general consistent with the theory discussed in section 2, except for the output variable for all pre-crisis cases.[10] The diagnostic statistics, including the R^2 statistics adjusted for degrees of freedom, the Durbin-Watson (DW), the Ljung-Box Q statistics, the F-statistics (and its probability), the Engle's ARCH test for heteroscedasticity and the Jarque-Bera normality test, are presented for each regression. The F-statistics indicate that the probability is at least 95 percent that one or more of the independent variables are non-zero. The Durbin-Watson statistics and the Q-statistics indicate that the serial correlations are not a problem in any of the regression results. The ARCH results conclude the absence of heteroscedasticity in general. Lastly, the Jarque-Bera test statistics confirm the normality of the disturbances. Several key findings warrant further analysis.

---- (Insert Table 5a-7b) ----

3.3.1 Indonesia

For the pre-crisis period, we do not find any of the interest rate variables contributes significantly to the changes in the domestic price level. Furthermore, while

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[9] The pre-crisis covers the period of quarter 1, 1987 to quarter 2, 1997, or January 1987 – June 1997. Availability of data dictates our sample observations. The post-crisis set includes observations from July 1997 to December 2001.

only the quarterly tests show that expected depreciation of rupiah significantly determines the inflation rate, both the quarterly and the monthly regressions confirm the important contribution of the money supply in explaining fluctuations of the inflation rate. Indicating the robustness of the test results, each set of regressions (with bilateral nominal exchange rates of rupiah against the US dollar and the nominal effective exchange rate) arrives at the same overall conclusion. The R-squares suggest that the explanatory variables can explain around 17 percent to 34 percent of the inflation rates in Indonesia for the pre-crisis period.

In contrast, the R-squares for the post-crisis period are well above 80 percent, suggesting a much higher explanatory power of the independent variables in explaining the inflation rates. Furthermore, each of the monthly regression results robustly confirms the significant roles of expected depreciation of rupiah, money supply and domestic interest rate in explaining changes in the inflation rate in the country. Among the significant explanatory variables, the test results also suggest that the base money is the most significant and persistent contributor to the substantial increase in the overall price level in Indonesia during the post-crisis period.

3.3.2 Thailand

All the explanatory variables are found to be significant and have theoretically consistent coefficient signs during the pre-crisis period, with the exception of the output variable. The test results for quarterly and monthly regressions are consistent for both the NEER and the bilateral nominal exchange rate of baht against the US dollar, confirming the robustness of the test results in general. The R-squares for the pre-crisis

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[10] We still include the output variable in the final regression as the coefficient estimate is found to be significant.

ranged between 17 percent to 23 percent for the monthly case, and 49 percent to 54 percent for the quarterly case.

The explanatory power of the model for the post-crisis period has improved, suggested by the respectably higher R-square (at 45 percent) for the monthly regression. The exchange rate factor, the base money and the domestic interest rate are found to be significant in causing price changes in both regressions of NEER and nominal baht against the US dollar. However, the foreign interest rate is significant only for the bilateral nominal exchange rate case. Unlike the case for Indonesia, it is less obvious as to which of the significant explanatory variables is the most influential factor in generating the post-crisis strong inflationary pressure in Thailand.

3.3.3 Korea

Both quarterly and monthly test results for the NEER and the bilateral nominal rate of won against the US dollar have robustly indicated that all explanatory variables are significant, with the exception of exchange rate factor. As in the previous cases of Indonesia and Thailand, we also find a sharp difference between the R-squares for the quarterly observation and the monthly case.

For the post-crisis, the monthly test results for both NEER and the bilateral won against the US dollar suggest that coefficient estimates of all explanatory variables are significant and theoretically consistent, except for the foreign interest rate. The R-squares are at around 62 percent, significantly higher than the pre-crisis monthly R-square (at 11 percent). The results underscore the important roles of the domestic factors in devising the inflationary pressures. Based on the number of the significant lags of the explanatory variables for both the NEER and the bilateral nominal exchange rate regressions, the test results also suggest that the impact of the expected depreciation of the local currency is not only the most significant factor but also has an immediate and a lasting impact on the post-1997 domestic price levels.

3.3.4 Testing the Implicit Assumption of Exogeneity

The validity of the econometrics test results posted in the previous tables crucially depends on the implicit assumption that the right-hand side variables in Equation (13) are statistically exogenous to inflation. To test for the statistical exogeneity, we employ the one-sided procedure to test for causality in the sense of Granger (1969). This one-sided Granger causality test is chosen from a number of alternative causality techniques in the light of the Monte Carlo evidence reported by Geweke, Meese, and Dent (1983).[11]

To be consistent with the ARDL tests, we also break the periods into pre-and post-crisis periods, and consider only the significant variables posted in Table 5a-7b. Furthermore, since the Granger test is narrowly interpreted here as a test for statistical exogeneity of particular variables within a given model, it seemed more prudent to maintain the same lag specifications as in the early results shown in Table 5a-7b when applying the Granger test.[12] For the sake of brevity, we will not report the test results.[13] However, we can confidently conclude that the implicit assumption of exogeneity for the explanatory variables is generally found to be applicable in our cases, except for the post-crisis domestic interest rate for the case of Indonesia.

3.3.5 Stability Test

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[11] The same procedure was also employed by Darrat and Arize (1990).

[12] We experimented with different lag structures and consistent overall results were obtained.

[13] The results can be made available upon any request to the authors.

In addition to exogeneity test, we also conduct the commonly used Chow-stability test (Chow, 1960) and the CUSUM test to evaluate the stability of each regression. Following Farley, Huinich, and McGuire (1975), we split the observation sets at its midpoint to maximize the empirical power of the test of the Chow test. In general, our test results confirm that our estimated equations are structurally stable. For the sake of brevity, we do not report the test results. But the results can be made available upon request.

3.4 Variance Decomposition

In addition to the ARDL models, we formulate the vector autoregressive models (VAR) to further evaluate the variability in inflation rates by the means of key explanatory variables, particularly expected depreciations of the local currency and the money supply. In each of the variance decomposition test, we only include the significant explanatory variables reported in each ARDL test. The objective here is to estimate further the explanatory powers of the significant independent variables listed in Table 5a-7b. The results are posted in Table 8a-10b.[14]

---- (Insert Table 8a-10b) ----

Several key findings ought to be underlined. The shares of the explanatory variables, in particular growth rates of the money supply and the expected depreciation factor, in explaining the variances in the domestic inflation are very modest during the pre-1997 crisis for all three countries in general. With the exception for the quarterly

[14] We have also estimated the variance decompositions for the various ordering of the variables, as the variance decomposition is sensitive to the causal ordering and Cholesky decomposition. We found that the general findings are the same. We have also adopted the impulse response and the generalized impulse response techniques for the robustness. Again the general conclusions are the same. For the sake of brevity, the results are not reported here and it can be made available from authors upon request.

case for Korea, where the variance of the money supply contributed as much as over 10 percent of the overall variation of the inflation rate, the statistics show that at least 80 percent of the variances of the inflation in these three economies can be explained by its own shocks. These findings are indeed consistent with the generally low-R squares reported in Table 5a-7b on the pre-crisis regressions.

In contrast to the mostly comparable results for the pre-crisis, there are both important similarities and contrasting evidences can be uncovered for the post-crisis results. Consistent with the sharp rise in the R-squares of the ARDL tests, the combined variances of the explanatory variables have contributed significantly in capturing the variance of the inflation rates for these three economies during the post-crisis. However the magnitudes are different. In one end, the explanatory variables, particularly the combination of the growth rate of the base money and the expected depreciation factor, have contributed between 10 percent to 26 percent of the variation in the domestic inflation rate in Thailand and Korea, respectively. While in Indonesia, close to 50 percent of the variation of the inflation rate can be explained by the shocks coming from the exchange rate and the base money factors.

Moreover, the test results also indicate that the role of money supply is indeed by far the most significant one for the Indonesian case, contributing as much as 37 percent of the variation in the inflation rate. As for the rupiah exchange rate, we find the contribution to be around 11 percent, the second largest factor in explaining the variations of the inflation rate. In Thailand and Korea, the role of exchange rate variable clearly dominates, contributing between 9 percent to 23 percent of the variation in the inflation rate. The test results also show that despite the significant coefficient estimates for the base money, the contribution of the variation of the growth rates of the monetary aggregates in explaining the variation of the inflation rate is in general found to be less than 2 percent, even smaller than that of the contribution of the variation in the domestic interest rate, except for the case of the bilateral nominal exchange rate of Thai baht.

4. Stylized Facts

Preceding findings have suggested that while the loose management of the base money in Indonesia has been the primary cause of high and persistent inflation, the volatility of the local currency contributes the most to the price changes in Thailand and Korea during the post-1997 crisis. Next, we will look into few stylized facts to confirm the validity of our empirics.

4.1 Rupiah, Baht and Won

Like most of the East Asian economies in 1990s, Indonesia, Thailand and Korea have actively intervened its foreign exchange market to manage the fluctuations of the local currencies, particularly against the US dollar (Frankel and Wei (1994), Hernandez and Montiel (2001) and McKinnon (2001)). From 1990 to the break of the financial crisis in 1997, Indonesia, Korea and Thailand had adopted crawling-peg, tightly managed floating and conventional fixed peg to basket, respectively (Bubula and Otket-Robe (2002)). The daily exchange rate bands for Korean won against the US dollar were set between ± 0.2 percent to ± 2.25 percent from 1990 to 1996 (IMF (2000)). Calvo and Reinhart (2000a) find the probabilities that the monthly percentage change of nominal exchange rates of Indonesian rupiah and Thailand bath against the US dollar fall within ± 1 percent band and ± 2.5 percent band were in average above 96 percent and 93 percent, respectively.

Illustrating further the rigidity of the pre-1997 exchange rate regime, the nominal exchange rate against the US dollar of the Indonesian rupiah and the Korean won had steadily depreciated by an annual average of 2 percent and 4 percent from January

1990 to December 1996 (Figure 1 and 3). Thai bath, on the other hand, had modestly appreciated by an average of 0.18 percent per annum for the same pre-crisis period (Figure 2). Opposite trends were however reported from the nominal effective exchange rate (NEER). From January 1990 to 1996, the nominal effective exchange rates of rupiah and won had appreciated on year on year basis by an average of 4 percent and 2 percent, respectively. Baht's NEER on the other hand had depreciated by around 0.8 percent year on year during the same pre-crisis period. Despite the opposite trends, both fluctuations of the NEER and the bilateral nominal exchange rate reflect the stability of the three currencies during the pre-crisis.

The financial crisis of 1997 however has brought about an unprecedented increase in the market uncertainties for most of the East Asian currencies. By the end of June 1998, the rupiah, the baht and the won have depreciated against the US dollar by around 400 percent, 35 percent and 38 percent from the June 1997 rate, respectively. Unlike the pre-crisis experiences, the post-crisis nominal effective exchange rates move closely with the bilateral nominal rates of each local currency against the US dollar, although the magnitudes of depreciation for the NEER were respectably smaller than those of the bilateral nominal against the US dollar (Figure 1 – 3). The adoption of a more flexible regime of exchange rate, as recommended in the IMF reform package to each of these economies, has arguably responsible for the post-crisis co-movements between the NEER and the bilateral nominal exchange rate.

4.2 Base Money in Korea, Thailand and Indonesia

4.2.1 Indonesia

In October 31, 1997 the government of Indonesia had signed its first post-crisis policy agreement, which restricted the expansion of base money in the nine-months starting from the end of September 1997 to only 7.7 percent. The day after the first IMF agreement was signed, the government of Indonesia announced the liquidation of 16 banks. Although the decision had already been foreshadowed, it created shock waves that resulted in a total loss of confidence in the banking system. Within a month after the announcement of the closures of the 16 banks, the level of base money has grown by more than 36 percent, largely due to Bank Indonesia Liquidity Supports to troubled banks and to lessen the impacts of depositor runs on banks. Figure 1 shows that by the end of July 1998, the base money had experienced an unprecedented increase of more than 115% from its level in November 1997.[15] By September 2001, the volume of base money in the domestic economy continued to be well in excess of the targeted level set by the IMF Letter of Intent by about Rp 5 trillion (Siregar (2001)).

4.2.2 Thailand

In sharp contrast to the Indonesian situation, Thailand announced tight limits on the monetary growth over the period of up to 12 months at the initial stages of their financial crisis and successfully met the targets. Resembling the LOI between the Indonesian government and the IMF, the Memorandum on Economic Policies signed by the government of Thailand and the IMF in August 1997 had envisaged an expansion of base money at around 8-10 percent for the next twelve months.[16] Thailand had also agreed and followed thru with the closure of more than 40 nearly insolvent financial firms that the government initially wanted to bail out, hence prevented excess liquidity in the domestic economy as experienced by Indonesia.

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[15] For the sake of comparison, between 1991 and 1996, the annual growth rate of base money in Indonesia had been averaging only around 25%, with the highest growth in 1996 at 38% and the lowest in 1991 at around 15%. Fane and McLeod (1999) argue that the margin by which the base money target for the early part of 1998 was missed so wide that any anti-inflationary effects of the earlier monetary contraction were more than undone.

[16] Refer to Thailand Letter of Intent, August 14, 1997 (http://www.imf.org/external/np/loi/081497.htm).

By December 1997, the level of base money in Thailand was targeted by the IMF Letter of Intents of August 14, 1997 to rise moderately to around 489 billion bath from the level of 455 billion bath in September 1997. The actual amount of reserve money, however, was reported to increase only to around 477 billion by December 1997. Furthermore, instead of expanding the base money to 499 billion baht by the end of March 1998 as forecasted by August 1997 LOI, the base money had contracted and reached the level of 448 billion baht by the end of the first quarter of 1998.

4.2.3 Korea

In late 1997, nearly one-third of South Korea's 30 chaebols failed or sought bankruptcy protection. In mid-December 1997, the Bank of Korea injected liquidity to the banking sector of about W 8 trillion or more than one-third of reserve money at end-November 1997. However, in contrast to the Indonesian case, the authorities quickly sterilized this large injection.[17] Rather than committing more fund to bail out the insolvent banks and chaebols, under the IMF deal brokered with South Korea in December 1997, foreign banks will be able to buy or merge with Korea's domestic banks and foreign corporations will be able to increase their stake in Korean firms to 55 percent from the previously allowed 26 percent.

As in the case of Thailand, the Korean monetary authority had also successfully followed thru with its tight monetary policy. The level of base money declined by more than 11 percent by December of 1998 from its level reported at the last month of 1997. By the end of first quarter 1998, Korea met base money target set by the IMF Letter of Intent of December 1997. In April 1, 1998, only about three months after the break of the

[17] To ease domestic liquidity constraint, the government of Korea eliminated all restrictions of foreign investment in domestic bond and also the aggregate ceiling on foreign portfolio investment was lifted in 1998.

financial crisis in the country, the newly revised Bank of Korea Act came into effect and clearly spells out that price stability is the primary goal of the monetary policy.

To summarize the contrasting experiences of these three economies, from December 1997 to December 1998, Indonesia had expanded (year on year) its monthly base money by an average of about 75 percent. For the same twelve months period, Thailand and Korea, on the other hand, had successfully tightened their monetary policy and reported a monthly average of “year on year” contraction of base money at around 0.35 percent and 7 percent, respectively. Consistent with these stylized facts, our test results have found that the rapid expansion of base money had eventually played the most significant role in generating post-crisis fierce inflationary pressure in Indonesia during the recent years. As for Korea and Thailand, the weak and volatile local currencies contributed significantly more to the price fluctuations than the base money.

5. Brief Concluding Remarks

Inflation rate of these three economies, while it initially exceeded the target sets by the IMF recovery programs, at least in Korea and Thailand turned out closer to target than would have been expected (Lane *et.al* (1999)). Korea had in fact kept its rates of inflation below the targeted rate set by the Letter of Intent starting 1999. In contrast, Indonesia’s program had gone off track and inflation rate raised well above the expected rate.

Our simple but intuitive monetary model successfully unveils a number of contrasting evidences on the post-crisis inflations. The contribution of base money in generating inflationary pressures was generally moderate in the case of Thailand and Korea. The empirical results conclusively suggest that the uncertainty with the local currencies was significantly a more dominant factor than the base money in explaining higher inflation rates in those two economies. For Indonesia, while both the growth rate of base money and the weak rupiah have indeed been found to be significant contributors to the rapid rise in the price level during the post-1997 period. The base money factor was, however, by far the most dominant contributor.

This leads us to conclude that the Latin American style of inflation that was reported in Indonesia during the recent crisis was clearly associated with the excess liquidity due to substantial supports provided to troubled banks. In contrast, despite the adverse consequences of the weak and volatile local currencies, more successful efforts by the monetary authorities in Thailand and Korea in managing the growths of the monetary aggregate had prevented the economies from experiencing pro-longed double digits rates of inflation in recent years.

With the adoption of a less rigid exchange rate policy, the monetary policy of Indonesia, Thailand and Korea have moved toward an inflation-targeting framework starting as early as 1998. At the initial stage, a series of practical issues must be resolved such as: (1) defining the price index that will be targeted and (2) estimating the level of inflation consistent with the objectives of the rest of the macroeconomics policies. As for the future, one lesson ought to be learnt from the recent crisis is that a transparent and credible management of the monetary aggregates is an essential foundation for any inflation targeting policy to be a successful one in any of these crisis-affected economies.

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Table 1
Inflation Rates During The Financial Crisis of 1990s and 2000s

Country	Year	Annual Inflation Rate[a]
Indonesia	1998 1999	58% 20%
Malaysia	1998 1999	5.1% 2.8%
Philippines	1998 1999	9.7% 6.7%
Thailand	1998 1999	8.1% 0.3%
Singapore	1998 1999	-0.3% 0.4%
South Korea	1998 1999	7.5% 0.8%
Argentina	2002[b]	30%
Mexico	1995 1996	35.0% 34.4%

Source: World Economic Outlook, September 2002, IMF.
[a]/ Based on consumer price index.
[b]/ The rate for the first six months of 2002, IMF Survey, Vol.31, No. 15, August 2002.

Table 2: Unit Root Test Results for Indonesia (January 1987 – June 1997)
(Pre-crisis period (Monthly Data Base))

Series		ADF statistics		PP test		KPSS		Test type	Order of integration
		Test statistic	Lags	Test statistic	Lags	Test statistic	Lags		
p	Level	-3.02	1	-2.82	4	0.24***	4	trend & drift	I(1)
	First difference	-6.67***	3	-9.58***	4	0.06	4	with drift	
ed1 (against US$)	Level	-5.38***	3	-10.69***	4	0.20	4	with drift	I(0)
ed2 (neer)	Level	-9.20***	0	-9.16***	4	0.15	4	With drift	I(0)
r	Level	-1.63	1	-2.01	4	0.58**	4	with drift	I(1)
	First difference	-8.78***	1	-14.57***	4	0.09	4	no drift	
r_f	Level	-2.12	8	-1.30	4	1.07***	4	with drift	I(1)
	First difference	-7.91***	0	-7.99***	4	0.21	4	no drift	
m0	Level	-1.16	2	-2.26	4	0.57***	4	trend & drift	I(1)
	First difference	-11.78***	1	-19.58***	4	0.34	4	with drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 2 (cont'd): Unit Root Test Results for Indonesia (July 1997 – December 2001) (Post-crisis period (Monthly Data Base))

Series		ADF statistics		PP test		KPSS		Test type	Order of integration
		Test statistic	Lags	Test statistic	Lags	Test statistic	Lags		
p	Level	-3.02	1	-2.82	4	2.23***	4	trend & drift	I(1)
	First difference	-6.67***	3	-9.58***	4	0.34	4	with drift	
ed1 (against US$)	Level	-5.38***	3	-10.69***	4	0.25	4	with drift	I(0)
ed2 (neer)	Level	-9.20***	0	-9.16***	4	0.25	4	With drift	I(0)
r	Level	-1.63	1	-2.01	4	0.62**	4	with drift	I(1)
	First difference	-8.78***	1	-14.57***	4	0.20	4	no drift	
r_f	Level	-2.12	8	-1.30	4	0.39*	3	with drift	I(1)
	First difference	-7.91***	0	-7.99***	4	0.24	4	no drift	
m0	Level	-1.16	2	-2.26	4	0.19**	4	trend & drift	I(1)
	First difference	-11.78***	1	-19.58***	4	0.13	4	with drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 2: Unit Root Test Results for Indonesia (cont'd):
Unit Root Test Results: Quarter 1, 1987 – Quarter 1, 1997 (Pre-crisis period)

Series		ADF statistics		PP test		KPSS		Test type	Order of integration
		Test statistic	Lags	Test statistic	Lags	Test statistic	Lags		
y	Level	-2.31	1	-2.79	3	0.15	2	With drift	I(1)
	First difference	-2.86***	0	-2.88***	2	0.19	2	no drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 3: Unit Root Test Results for Thailand (January 1987 – June 1997)
(Pre-crisis period (Monthly Data Base))

		ADF statistics		PP test		KPSS			
Series		Test statistic	Lags	Test statistic	Lags	Test statistic	Lags	Test type	Order of integration
p	Level	-2.69	3	-2.25	4	0.35***	4	trend & drift	I(1)
	First difference	-6.58***	3	-10.24***	4	0.29	4	with drift	
ed1 (against US$)	Level	-7.32***	1	-12.65***	4	0.11	4	with drift	I(0)
ed2 (neer)	Level	-5.89***	1	-12.22***	4	0.26	4	With drift	I(0)
r	Level	-1.78	1	-1.87	4	0.58***	4	with drift	I(1)
	First difference	-12.08***	0	-12.11***	4	0.05	4	no drift	
r_f	Level	-1.52	3	-1.36	4	1.29***	4	with drift	I(1)
	First difference	-8.37***	0	-8.42***	4	0.17	4	no drift	
m0	Level	-3.37*	7	-3.49*	4	0.26***	4	trend & drift	I(1)
	First difference	-9.78***	2	-25.53***	4	0.10	4	with drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 3 (cont'd): Unit Root Test Results for Thailand (July 1997 – December 2001) (Post-crisis period (Monthly Data Base))

Series		ADF statistics Test statistic	ADF Lags	PP test Test statistic	PP Lags	KPSS Test statistic	KPSS Lags	Test type	Order of integration
p	Level	-2.84	6	-2.52	3	0.19**	3	trend & drift	I(1)
	First difference	-3.31**	1	-5.28***	3	0.37*	3	with drift	
ed1 (against US$)	Level	-5.34***	1	-5.94***	3	0.23	3	with drift	I(0)
ed2 (neer)	Level	-5.64***	0	-5.61***	3	0.24	3	With drift	I(0)
r	Level	-1.61	0	-1.57	3	0.83***	3	with drift	I(1)
	First difference	-8.66***	0	-8.64***	3	0.30	3	no drift	
r_f	Level	-0.21	1	1.07	3	0.74***	3	with drift	I(1)
	First difference	-2.63***	1	-2.88***	3	0.33	3	no drift	
m0	Level	-2.76	5	-2.40	3	0.27***	3	trend & drift	I(1)
	First difference	-7.30***	2	-13.50***	3	0.29	3	with drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 3: Unit Root Results for Thailand (cont'd)
Unit Root Test Results: Quarter 1, 1985 – Quarter 1, 1997 (Pre-crisis period)

Series		ADF statistics Test statistic	ADF Lags	PP test Test statistic	PP Lags	KPSS Test statistic	KPSS Lags	Test type	Order of integration
y	Level	-1.42	0	-1.44	3	1.29***	3	With drift	I(1)
	First difference	-6.45***	0	-6.45***	3	0.34		with drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 4: Unit Root Test Results for Korea (January 1985 – June 1997)
(Pre-crisis period (Monthly Data Base))

Series		ADF statistics		PP test		KPSS			
		Test statistic	Lags	Test statistic	Lags	Test statistic	Lags	Test type	Order of integration
p	Level	-0.40	2	-0.38	4	3.09***	4	trend & drift	I(1)
	First difference	-8.72***	1	-9.94***	4	0.21	4	with drift	
ed1 (against US$)	Level	-4.11***	2	-7.15***	4	0.34	4	with drift	I(0)
ed2 (neer)	Level	-6.44***	1	-9.45***	4	0.34	4	With drift	I(0)
r	Level	-1.89	4	-2.48	4	1.21***	4	with drift	I(1)
	First difference	-12.42***	4	-12.65***	4	0.09	4	no drift	
r_f	Level	-1.52	3	-1.36	4	1.29***	4	with drift	I(1)
	First difference	-8.37***	0	-8.42***	4	0.17	4	no drift	
m0	Level	-2.59	3	-0.55	4	3.07***	4	trend & drift	I(1)
	First difference	-8.92***	3	-22.90***	4	0.07	4	with drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 4 (cont'd): Unit Root Test Results for Korea (July 1997 – March 2002) (Post-crisis period (Monthly Data Base))

Series		ADF statistics Test statistic	Lags	PP test Test statistic	Lags	KPSS Test statistic	Lags	Test type	Order of integration
p	Level	-2.82	2	-2.61	3	1.39***	3	trend & drift	I(1)
	First difference	-7.46***	1	-4.67***	3	0.13	3	with drift	
ed1 (against US$)	Level	-6.85***	0	-6.85***	3	0.12	3	with drift	I(0)
ed2 (neer)	Level	-4.49***	1	-6.42***	3	0.13	3	With drift	I(0)
r	Level	-1.40	3	-0.97	3	1.05***	3	with drift	I(1)
	First difference	-3.78***	0	-3.81***	3	0.10	3	no drift	
r_f	Level	-0.21	1	1.07	3	0.64***	3	with drift	I(1)
	First difference	-2.63***	1	-2.88***	3	0.37*	3	no drift	
m0	Level	-2.21	2	-2.40	3	1.25***	3	trend & drift	I(1)
	First difference	-7.87***	1	-12.38***	3	0.21	3	with drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 4: Unit Roots for Korea (cont'd)
Unit Root Test Results: Quarter 1, 1985 – Quarter 1, 1997 (Pre-crisis period)

Series		ADF statistics Test statistic	Lags	PP test Test statistic	Lags	KPSS Test statistic	Lags	Test type	Order of integration
y	Level	-2.73	2	-2.38	3	0.77***	3	With drift	I(1)
	First difference	-8.67***	0	-8.71***	3	0.08	3	with drift	

Note: a). ***, ** and * represents the rejection of null at 1%, 5% and 10% levels of significance respectively; b). Lag lengths for the ADF test regression is choosen such that Akaike Information Criteria (AIC) or the Schwarz Criteria (SC) is minimized; c). Truncation lag to evaluate the serial correlation for the Newey-West correction for both PP and KPSS test is computed by $q = floor(4(T/100)^{2/9})$.

Table 5a: ARDL Results for Indonesia

(With the expected depreciation of bilateral nominal exchange rate of Indonesian rupiah against the US$)

1). **ARDL Results : Quarter 1, 1987 – Quarter 1, 1997 (Pre-crisis)**

$$\Delta p_t = -0.297\Delta p_{t-2} + 0.051 ed_{t-3} + 0.204\Delta y_{t-4} + 0.009\Delta M^s_{t-4} + 0.021$$

$$(0.120)^{**} \quad (0.006)^{***} (0.079)^{**} \quad (0.003)^{***} \quad (0.004)^{***}$$

R-squared= 0.27, DW=2.09; F-stat=3.32; Prob (F-stat) = 0.020; ARCH (Prob) = 0.87, Prob(Q(4))=0.91; Prob(Q(8))=0.99; Prob(Q(12))=0.78; Prob(Q(16))=0.71; Prob(JB)=0.16

2). **ARDL Results : January 1987 - June 1997 (Pre--crisis)**

$$\Delta p_t = 0.227\Delta p_{t-1} - 0.218\Delta p_{t-2} + 0.206\Delta p_{t-3} - 0.278\Delta p_{t-4} + 0.016\Delta M^s_{t-2} + 0.007$$

$$(0.087)^{**} \quad (0.088)^{**} \; (0.087)^{**} \quad (0.083)^{***} \quad (0.009)^{*} \quad (0.001)^{***}$$

R-squared= 0.17, DW=2.00; F-stat=4.62; Prob(F-stat) = 0.001; ARCH (Prob) = 0.84; Prob(Q(4))=0.98; Prob(Q(8))=0.87; Prob(Q(12))=0.21; Prob(Q(16))=0.34; Prob(JB)=0.10

$$\Delta p_t = 0.530\Delta p_{t-1} + 0.041\Delta r_{t-1} + 0.055\Delta M^s_t + 0.101\Delta M^s_{t-1} + 0.074 M^s_{t-2} + 0.051 ed_{t-1}$$

3). **ARDL Results : July 1997 - December 2001 (Post-crisis)**

(0.064)*** (0.017)** (0.017)*** (0.019)*** (0.020)*** (0.009)***

R-squared= 0.85, DW=2.16; F-stat=51.79; Prob(F-stat) = 0.000; ARCH (Prob) = 0.118; ARCH (Prob) = 0.86; Prob(Q(4))=0.94; Prob(Q(8))=0.97; Prob(Q(12))=0.79; Prob(Q(16))=0.72; Prob(JB)=0.38

Note: ( ) is standard error; * Significant at 10%; **Significant at 5%; ***Significant at 1%; DW= Durbin-Watson; Q = the Ljung-Box Q autocorrelation test.; JB=Jarque-Bera Normality test statistic.

Table 5b: ARDL Results for Indonesia

(With the expected depreciation of nominal effective exchange rate of Indonesian rupiah)

$$\Delta p_t = -0.35\Delta p_{t-2} + 0.22 y_{t-4} + 0.02\Delta M^s_{t-1} + 0.07 ed_t + 0.02$$

1). **ARDL Results : Quarter 1, 1987 – Quarter 1, 1997 (Pre-crisis)**

(0.13)** (0.09)** (0.007)*** (0.04)* (0.003)***

R-squared= 0.34, DW=2.09; F-stat=4.74; Prob(F-stat) = 0.003; ARCH (Prob) = 0.63; Prob(Q(4))=0.81; Prob(Q(8))=0.87; Prob(Q(12))=0.68; Prob(Q(16))=0.61; Prob(JB)=0.15

2). **ARDL Results : January 1987 - June 1997 (Pre--crisis)**

$$\Delta p_t = 0.227\Delta p_{t-1} - 0.218\Delta p_{t-2} + 0.206\Delta p_{t-3} - 0.278\Delta p_{t-4} + 0.016\Delta M^s_{t-2} + 0.007$$

$$(0.087)^{**} \quad (0.088)^{**} \; (0.087)^{**} \quad (0.083)^{***} \quad (0.009)^{*} \quad (0.001)^{***}$$

R-squared= 0.17, DW=2.00; F-stat=4.62; Prob(F-stat) = 0.001; ARCH (Prob) = 0.84; Prob(Q(4))=0.98; Prob(Q(8))=0.87; Prob(Q(12))=0.21 Prob(Q(16))=0.34Prob(JB)=0.10

$$\Delta p_t = 0.531\Delta p_{t-1} + 0.041\Delta r_{t-1} + 0.057\Delta M^s_t + 0.101\Delta M^s_{t-1} + 0.072 M^s_{t-2} + 0.051 ed_{t-1}$$

3). **ARDL Results : July 1997 - December 2001 (Post-crisis)**

(0.064)*** (0.017)** (0.017)*** (0.019)*** (0.021)*** (0.009)***

R-squared= 0.85, DW=2.14; F-stat=51.69; Prob(F-stat) = 0.000; ARCH (Prob) = 0.118; ARCH (Prob) = 0.84;

Prob(Q(4))=0.90; Prob(Q(8))=0.92; Prob(Q(12))=0.76; Prob(Q(16))=0.70; Prob(JB)=0.36

Note: ( ) is standard error; * Significant at 10%; **Significant at 5%; ***Significant at 1%; DW= Durbin-Watson; Q = the Ljung-Box Q autocorrelation test.; JB=Jarque-Bera Normality test statistic.

Table 6a: ARDL Results for Thailand

(With the expected depreciation of bilateral nominal exchange rate of Baht against the US dollar)

1). **ARDL Results : Quarter 1, 1985 – Quarter 1, 1997 (Pre-crisis)**

$$\Delta p_t = 0.26\Delta p_{t-4} + 0.14 ed_t + 0.14\Delta y_{t-3} + 0.04\Delta M^s_{t-2} + 0.07\Delta M^s_{t-3} + 0.01\Delta r_{t-1} - 0.02\Delta rf_t + 0.023\Delta rf_{t-2} + 0.001$$

$$(0.09)^{***} \quad (0.07)^{**} \quad (0.06)^{**} \quad (0.02)^{*} \quad (0.02)^{***} \quad (0.002)^{***} (0.01)^{**} (0.01)^{***} \quad (0.001)$$

R-squared= 0.54, DW=2.38; F-stat=5.27; Prob(F-stat) = 0.000; ARCH (Prob) = 0.31; Prob(Q(4))=0.46; Prob(Q(8))=0.69; Prob(Q(12))=0.61; Prob(Q(16))=0.72; Prob(JB)=0.72

2). **ARDL Results : January 1985 – June 1997 (Pre-crisis)**

$$\Delta p_t = 0.19\Delta p_{t-1} - 0.25\Delta p_{t-2} + 0.12\Delta ed_{t-1} + 0.002\Delta r_{t-1} + 0.003\Delta r_{t-4} + 0.02\Delta M^s_{t-2} + 0.004$$

$$(0.087)^{**} \quad (0.078)^{***} (0.05)^{***} \quad (0.001)^{*} \quad (0.001)^{***} \ (0.008)^{*} \quad (0.001)^{***}$$

R-squared= 0.17, DW=1.92; F-stat=4.820; Prob(F-stat) = 0.0001; ARCH (Prob) = 0.73; Prob(Q(4))=0.50; Prob(Q(8))=0.71; Prob(Q(12))=0.22; Prob(Q(16))=0.23; Prob(JB)=0.77

$$\Delta p_t = 0.31\Delta p_{t-1} + 0.03 ed_t + 0.01\Delta r_{t-2} + 0.011\Delta rf_{t-2} + 0.03 M^s_{t-2} + 0.002$$

3). **ARDL Results : July 1997 - May 2002 (Post-crisis)**

(0.13)** (0.02)** (0.002)** (0.006)** (0.01)** (0.0005)***

R-squared= 0.45, DW=2.02; F-stat=8.53; Prob(F-stat) = 0.000; ARCH (Prob) = 0.63; Prob(Q(4))=0.37; Prob(Q(8))=0.27; Prob(Q(12))=0.44; Prob(Q(16))=0.65; Prob(JB)=0.38

Note: ( ) is standard error; * Significant at 10%; **Significant at 5%; ***Significant at 1%; DW= Durbin-Watson; Q = the Ljung-Box Q autocorrelation test.; JB=Jarque-Bera Normality test statistic.

Table 6b: ARDL Results for Thailand

(With the expected depreciation of nominal effective exchange rate of baht)

$$\Delta p_t = 0.34\Delta p_{t-4} + 0.16\Delta y_{t-3} - 0.057 ed_{t-1} + 0.005\Delta r_{t-4} + 0.019\Delta rf_{t-3} + 0.067\Delta M^s_{t-3} + 0.002$$

1). **ARDL Results : Quarter 1, 1985 – Quarter 1, 1997 (Pre-crisis)**

(0.065)*** (0.06)*** (0.026)** (0.003)** (0.006)*** (0.02)*** (0.001)

R-squared= 0.49, DW=2.34; F-stat=6.20 ; Prob(F-stat) = 0.0001; ARCH (Prob) = 0.50; Prob(Q(4))=0.69; Prob(Q(8))=0.26; Prob(Q(12))=0.25; Prob(Q(16))=0.17; Prob(JB)=0.48

2). **ARDL Results : January 1985 - June 1997 (Pre-crisis)**

$$\Delta p_t = 0.22\Delta p_{t-1} - 0.29\Delta p_{t-2} + 0.05\Delta ed_{t-1} - 0.04\Delta ed_{t-3} + 0.003\Delta r_{t-1} + 0.003\Delta r_{t-3} + 0.003\Delta r_{t-4} + 0.02\Delta rf_t +$$

(0.07)*** (0.07)*** (0.26)** (0.23)* (0.002)* (0.001)** (0.001)** (0.009)**

$$0.04\Delta M^s_{t-2} + 0.04\Delta M^s_{t-3} + 0.03\Delta M^s_{t-4} + 0.003$$

(0.016)** (0.016)** (0.016)* (0.0006)***

R-squared= 0.23, DW=2.02; F-stat=3.69; Prob(F-stat) = 0.0001; ARCH (Prob) = 0.49; Prob(Q(4))=0.80; Prob(Q(8))=0.59; Prob(Q(12))=0.21; Prob(Q(16))=0.29; Prob(JB)=0.30

3). **ARDL Results : July 1997 - December 2001 (Post-crisis)**

$$\Delta p_t = 0.268\Delta p_{t-1} + 0.035\Delta ed_t + 0.015\Delta ed_{t-3} + 0.007\Delta r_{t-2} + 0.03\Delta M^s_{t-2} + 0.001$$

(0.123)** (0.015)** (0.009)*** (0.003)*** (0.014)** (0.0005)***

R-squared= 0.45, DW=2.02; F-stat=8.62; Prob(F-stat) = 0.000; ARCH (Prob) = 0.67; Prob(Q(4))=0.25; Prob(Q(8))=0.13; Prob(Q(12))=0.20; Prob(Q(16))=0.41; Prob(JB)=0.25

Note: ( ) is standard error; * Significant at 10%; **Significant at 5%; ***Significant at 1%; DW= Durbin-Watson; Q = the Ljung-Box Q autocorrelation test.; JB=Jarque-Bera Normality test statistic.

Table 7a: ARDL Results for Korea

(With the expected depreciation of bilateral nominal exchange rate of Won against the US dollar)

1). **ARDL Results : Quarter 1, 1985 – Quarter 1, 1997 (Pre-crisis)**

$$\Delta p_t = 0.48\Delta p_{t-1} - 0.33\Delta p_{t-2} + 0.33\Delta p_{t-4} + 0.09\Delta y_t + 0.13\Delta y_{t-6} + 0.03\Delta M^s_{t-1} + 0.05\Delta M^s_{t-2} + 0.04\Delta M^s_{t-4} + 0.03\Delta r_{t-3} + 0.03\Delta r_{t-6}$$

$$(0.13)^{***}\ (0.10)^{***}\ (0.12)^{***}\ (0.06)^{*}\ (0.07)^{*}\ (0.01)^{***}\ (0.01)^{***}\ (0.01)^{***}\ (0.01)^{***}\ (0.01)^{***}$$

$$+0.03\Delta rf_{t-1} - 0.02\Delta rf_{t-2} - 0.001$$

$$(0.01)^{***}\ (0.01)^{***}\ (0.003)$$

R-squared= 0.72, DW=1.83; F-stat=6.52; Prob(F-stat) = 0.000; ARCH (Prob) = 0.52; Prob(Q(4))=0.69; Prob(Q(8))=0.18;

Prob(Q(12))=0.34; Prob(Q(16))=0.56; Prob(JB)=0.70

2). **ARDL Results : January 1985 – June 1997 (Pre-crisis)**

$$\Delta p_t = 0.23\Delta p_{t-1} - 0.01\Delta r_{t-1} + 0.01\Delta rf_{t-3} + 0.01\Delta M^s_t + 0.02\Delta M^s_{t-4} + 0.003$$

$$(0.08)^{***}\ (0.004)^{*}\ (0.008)^{*}\ (0.005)^{**}\ (0.006)^{***}\ (0.0004)^{***}$$

R-squared= 0.11, DW=1.99; F-stat=3.44; Prob(F-stat) = 0.0058; ARCH (Prob) = 0.62; Prob(Q(4))=0.55; Prob(Q(8))=0.56;

Prob(Q(12))=0.80; Prob(Q(16))=0.11; Prob(JB)=0.72

3). **ARDL Results : July 1997 - March 2002 (Post-crisis)**

$$\Delta p_t = -0.32\Delta p_{t-2} - 0.28\Delta p_{t-3} + 0.04 ed_t + 0.04 ed_{t-1} + 0.03 ed_{t-2} + 0.02 ed_{t-3} + 0.02\Delta r_{t-4} + 0.01 M^s_{t-3} + 0.004$$

(0.13)** (0.09)*** (0.01)*** (0.01)*** (0.01)*** (0.01)*** (0.005)*** (0.006)* (0.001)***

R-squared= 0.62, DW=2.20; F-stat=9.96; Prob(F-stat) = 0.000; ARCH (Prob) = 0.63; Prob(Q(4))=0.60; Prob(Q(8))=0.83;

Prob(Q(12))=0.85; Prob(Q(16))=0.82; Prob(JB)=0.38

Note: ( ) is standard error; * Significant at 10%; **Significant at 5%; ***Significant at 1%; DW= Durbin-Watson; Q = the Ljung-Box Q autocorrelation test.; JB=Jarque-Bera Normality test statistic.

Table 7b: ARDL Results for Korea

(With the expected depreciation of nominal effective exchange rate of Won)

1). **ARDL Results : Quarter 1, 1985 – Quarter 1, 1997 (Pre-crisis)**

$$\Delta p_t = 0.48\Delta p_{t-1} - 0.33\Delta p_{t-2} + 0.33\Delta p_{t-4} + 0.09\Delta y_t + 0.13\Delta y_{t-6} + 0.03\Delta M^s_{t-1} + 0.05\Delta M^s_{t-2} + 0.04\Delta M^s_{t-4} + 0.03\Delta r_{t-3} + 0.03\Delta r_{t-6}$$

$$(0.13)^{***}\ (0.10)^{***}\ (0.12)^{***}\ (0.06)^{*}\ (0.07)^{*}\ (0.01)^{***}\ (0.01)^{***}\ (0.01)^{***}\ (0.01)^{***}\ (0.01)^{***}$$

$$+0.03\Delta rf_{t-1} - 0.02\Delta rf_{t-2} - 0.001$$

$$(0.01)^{***}\ (0.01)^{***}\ (0.003)$$

R-squared= 0.72, DW=1.83; F-stat=6.52; Prob(F-stat) = 0.000; ARCH (Prob) = 0.52; Prob(Q(4))=0.69; Prob(Q(8))=0.18; Prob(Q(12))=0.34; Prob(Q(16))=0.56; Prob(JB)=0.70

2). **ARDL Results : January 1985 - June 1997 (Pre-crisis)**

ARDL Results : January 1985 – June 1997 (Pre-crisis)

$$\Delta p_t = 0.23\Delta p_{t-1} - 0.01\Delta r_{t-1} + 0.01\Delta rf_{t-3} + 0.01\Delta M^s_t + 0.02\Delta M^s_{t-4} + 0.003$$

$$(0.08)^{***}\ (0.004)^{*}\ (0.008)^{*}\ (0.005)^{**}\ (0.006)^{***}\ (0.0004)^{***}$$

R-squared= 0.11, DW=1.99; F-stat=3.44; Prob(F-stat) = 0.0058; ARCH (Prob) = 0.62; Prob(Q(4))=0.55; Prob(Q(8))=0.56; Prob(Q(12))=0.80; Prob(Q(16))=0.11; Prob(JB)=0.72

$$\Delta p_t = -0.35\Delta p_{t-2} - 0.28\Delta p_{t-3} + 0.03ed_t + 0.04ed_{t-1} + 0.02ed_{t-2} + 0.02ed_{t-3} + 0.018\Delta r_{t-4} + 0.012M^s_{t-3} + 0.004$$

3). **ARDL Results : July 1997 - December 2001 (Post-crisis)**

(0.12)*** (0.10)*** (0.01)*** (0.008)*** (0.008)*** (0.007)** (0.005)*** (0.006)** (0.001)***

R-squared= 0.62, DW=2.21; F-stat=10.06; Prob(F-stat) = 0.000; ARCH (Prob) = 0.63; Prob(Q(4))=0.63; Prob(Q(8))=0.80; Prob(Q(12))=0.88; Prob(Q(16))=0.82; Prob(JB)=0.14

Note: ( ) is standard error; * Significant at 10%; **Significant at 5%; ***Significant at 1%; DW= Durbin-Watson; Q = the Ljung-Box Q autocorrelation test.; JB=Jarque-Bera Normality test statistic.

Table 8a: Variance Decomposition of Δp for Indonesia

(With the expected depreciation of bilateral nominal exchange rate of rupiah against the US dollar)

(Pre-Crisis Period on Quarterly Data)

Δm Δy

Period	Δp	*ed*		
1	100.00	0.00	0.00	0.00
4	96.63	0.15	0.33	2.89
8	96.31	0.16	0.34	3.19
12	96.31	0.16	0.34	3.19
16	96.30	0.16	0.34	3.19
20	96.30	0.16	0.34	3.19

Δm

(Pre-Crisis Period on Monthly Data)

Period	Δp	
1	100.00	0.00
4	96.71	3.29
8	96.65	3.34
12	96.65	3.35
16	96.65	3.35
20	96.65	3.35

(Post-Crisis Period on Monthly Data

Period	Δp	Δ m	*ed*	Δr
1	100.00	0.00	0.00	0.00
4	48.77	37.55	11.79	1.89
8	48.52	37.33	11.27	2.88
12	48.50	37.36	11.22	2.92
16	48.50	37.36	11.22	2.92
20	48.50	37.36	11.22	2.92

Table 8b: Variance Decomposition of Δp for Indonesia

(With the expected depreciation of nominal effective exchange rate of rupiah)

(Pre-Crisis Period on Quarterly Data)

Δm Δy

Period	Δp	*ed*		
1	100.00	0.00	0.00	0.00
4	96.30	0.32	1.55	1.83
8	96.09	0.33	1.57	2.01
12	96.08	0.33	1.57	2.01
16	96.08	0.33	1.57	2.01
20	96.08	0.33	1.57	2.01

Table 8b (cont'd): Variance Decomposition of Δp for Indonesia

Δm

(Pre-Crisis Period on Monthly Data)

Period	Δp	
1	100.00	0.00
4	96.71	3.29
8	96.65	3.34
12	96.65	3.35
16	96.65	3.35
20	96.65	3.35

(Post-Crisis Period on Monthly Data)

Period	Δp	Δ m	*ed*	Δr
1	100.00	0.00	0.00	0.00
4	49.12	37.68	11.26	1.94
8	48.87	37.46	10.79	2.88
12	48.85	37.48	10.76	2.91
16	48.85	37.48	10.75	2.91
20	48.85	37.48	10.75	2.91

Table 9a: Variance Decomposition of Δp for Thailand

(With the expected depreciation of bilateral nominal exchange rate of baht against the US dollar)

(Pre-Crisis Period on Quarterly Data)

Δm Δy

Period	Δp	*ed*	Δr	Δrf		
1	100.0	0.0	0.0	0.0	0.0	0.0
4	81.9	1.2	7.0	0.3	6.9	2.6
8	81.8	1.2	7.0	0.3	7.0	2.6
12	81.8	1.2	7.0	0.3	7.0	2.6
16	81.8	1.2	7.0	0.3	7.0	2.6
20	81.8	1.2	7.0	0.3	7.0	2.6

(Pre-Crisis Period on Monthly Data)

Δm

Period	Δp	*ed*	Δr	
1	100.0	0.0	0.0	0.0
4	99.0	0.0	0.9	0.1
8	99.0	0.0	0.9	0.1
12	99.0	0.0	0.9	0.1
16	99.0	0.0	0.9	0.1
20	99.0	0.0	0.9	0.1

Table 9a (cont'd): Variance Decomposition of Δp for Thailand

(Post-Crisis Period on Monthly Data)

Δm

Period	Δp	*ed*	Δr	Δrf	
1	100.0	0.0	0.0	0.0	0.0
4	80.9	15.1	0.3	2.7	1.0
8	79.8	15.0	0.3	3.9	1.0
12	79.7	15.0	0.3	4.0	1.0
16	79.7	15.0	0.3	4.0	1.0
20	79.7	15.0	0.3	4.0	1.0

Table 9b: Variance Decomposition of Δp for Thailand

(With the expected depreciation of nominal effective exchange rate of baht)

(Pre-Crisis Period on Quarterly Data)

Δy Δm

Period	Δp	*ed*	Δr	Δrf		
1	100.0	0.0	0.0	0.0	0.0	0.0
4	84.3	1.0	4.8	0.4	7.1	2.4
8	84.2	1.0	4.8	0.4	7.1	2.4
12	84.2	1.0	4.8	0.4	7.1	2.4
16	84.2	1.0	4.8	0.4	7.1	2.4
20	84.2	1.0	4.8	0.4	7.1	2.4

(Pre-Crisis Period on Monthly Data)

Δm

Period	Δp	*ed*	Δr	Δrf	
1	100.0	0.0	0.0	0.0	0.0
4	97.7	0.0	0.9	1.2	0.1
8	97.7	0.0	0.9	1.2	0.1
12	97.7	0.0	0.9	1.2	0.1
16	97.7	0.0	0.9	1.2	0.1
20	97.7	0.0	0.9	1.2	0.1

(Post-Crisis Period on Monthly Data)

Δm

Period	Δp	*ed*	Δr	
1	100.0	0.0	0.0	0.0
4	87.7	8.4	2.7	1.1
8	87.5	8.5	2.9	1.1
12	87.5	8.5	2.9	1.1
16	87.5	8.5	2.9	1.1
20	87.5	8.5	2.9	1.1

Table 10a: Variance Decomposition of Δp for Korea

(With the expected depreciation of bilateral nominal exchange rate of Won against the US dollar)

(Pre-Crisis Period on Quarterly Data)

Δy Δm

Period	Δp	Δr	Δrf		
1	100.0	0.0	0.0	0.0	0.0
4	78.9	1.3	4.1	13.9	1.7
8	77.2	2.2	4.6	13.7	2.2
12	77.2	2.2	4.6	13.7	2.2
16	77.2	2.2	4.6	13.7	2.2
20	77.2	2.2	4.6	13.7	2.2

(Pre-Crisis Period on Monthly Data)

Δm

Period	Δp	Δr	Δrf	
1	100.0	0.0	0.0	0.0
4	95.3	1.5	2.8	0.4
8	91.3	2.1	3.5	3.1
12	91.2	2.1	3.5	3.2
16	91.2	2.1	3.5	3.2
20	91.2	2.1	3.5	3.2

(Post-Crisis Period on Monthly Data

Δm

Period	Δp	*Ed*	Δr	
1	100.0	0.0	0.0	0.0
4	73.9	21.6	2.8	1.7
8	73.9	21.5	2.9	1.7
12	73.9	21.5	2.9	1.7
16	73.9	21.5	2.9	1.7
20	73.9	21.5	2.9	1.7

Table 10b: Variance Decomposition of Δp for Korea

(With the expected depreciation of nominal effective exchange rate of won)

(Pre-Crisis Period on Quarterly Data)

Δy Δm

Period	Δp	Δr	Δrf		
1	100.0	0.0	0.0	0.0	0.0
4	78.9	1.3	4.1	13.9	1.7
8	77.2	2.2	4.6	13.7	2.2
12	77.2	2.2	4.6	13.7	2.2

16	77.2	2.2	4.6	13.7	2.2
20	77.2	2.2	4.6	13.7	2.2

Table 10b (cont'd): Variance Decomposition of Δp for Korea

(Pre-Crisis Period on Monthly Data)

Δm

Period	Δp	Δr	Δrf	
1	100.0	0.0	0.0	0.0
4	95.3	1.5	2.8	0.4
8	91.3	2.1	3.5	3.1
12	91.2	2.1	3.5	3.2
16	91.2	2.1	3.5	3.2
20	91.2	2.1	3.5	3.2

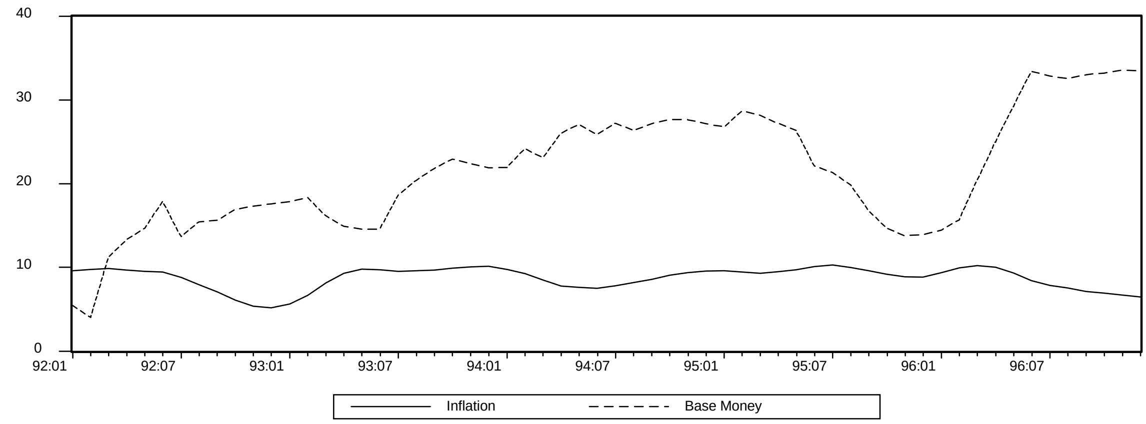
(Post-Crisis Period on Monthly Data)

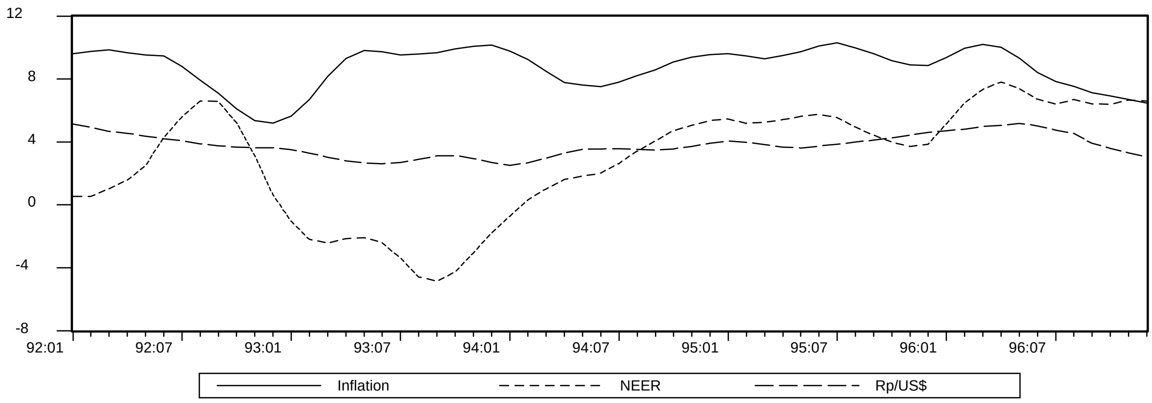
Δm

Period	Δp	*Ed*	Δr	
1	100.0	0.0	0.0	0.0
4	72.5	23.1	2.9	1.5
8	72.5	23.1	2.9	1.6
12	72.5	23.1	2.9	1.6
16	72.5	23.1	2.9	1.6
20	72.5	23.1	2.9	1.6

Figure 1: (for Indonesia)
Inflation , Growth Rate of Base Money and Change in Nominal Rupiah

Pre-Crisis: January 1992 - December 1996 (per annum in %) (4 month moving average)





Post Crisis: July 1997 - December 2000 (per annum, in %) (4 month moving average)

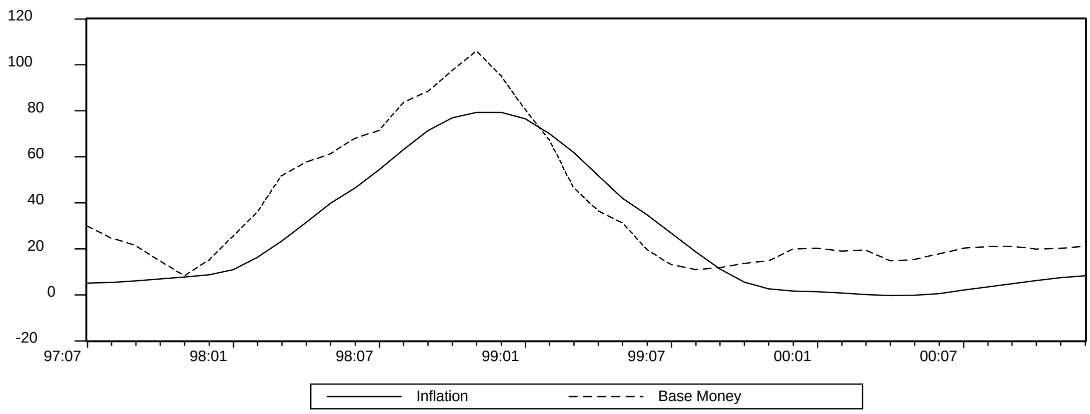


Figure 1: (for Indonesia) cont'd:

Post Crisis: July 1997 - December 2000 (per annum, in %) (4 month moving average)

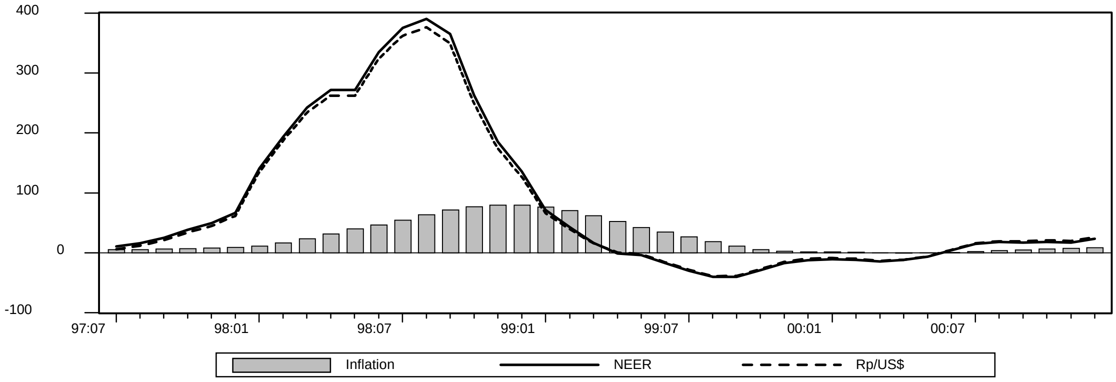
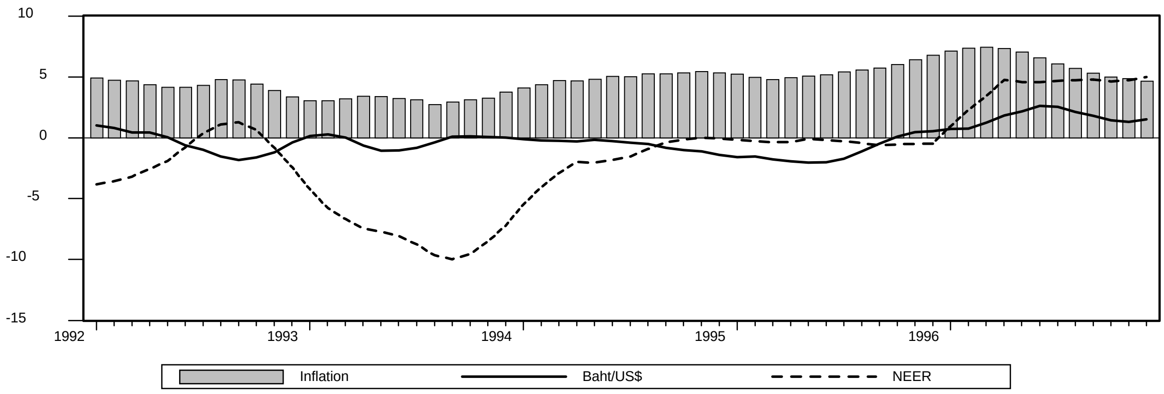


Figure 2: (for Thailand)
Inflation, Growth Rate of Base Money and Change in Nominal Baht

Pre-Crisis: January 1992 - December 1996 (per annum in %) (4 month moving average)



Post Crisis: July 1997 - December 2000 (per annum, in %) (4 month moving average)

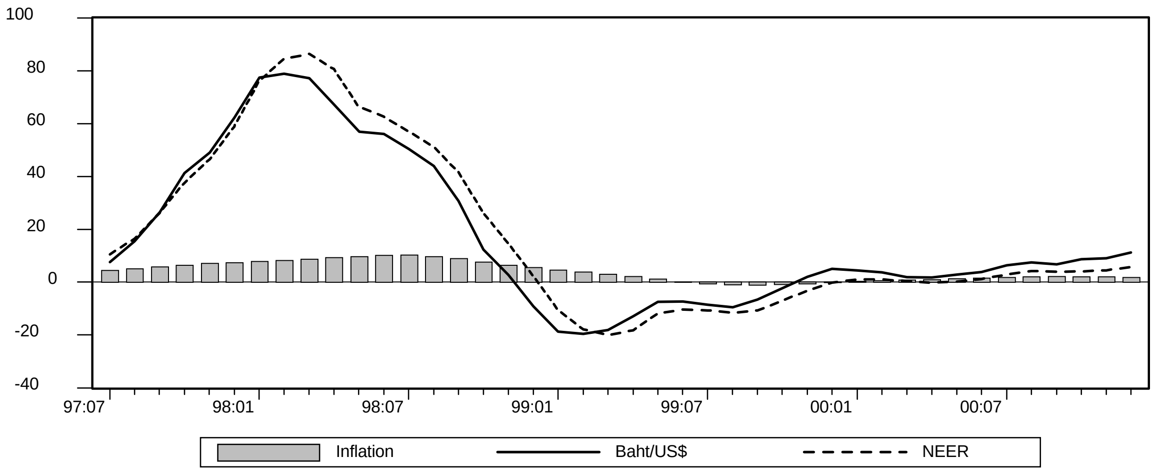
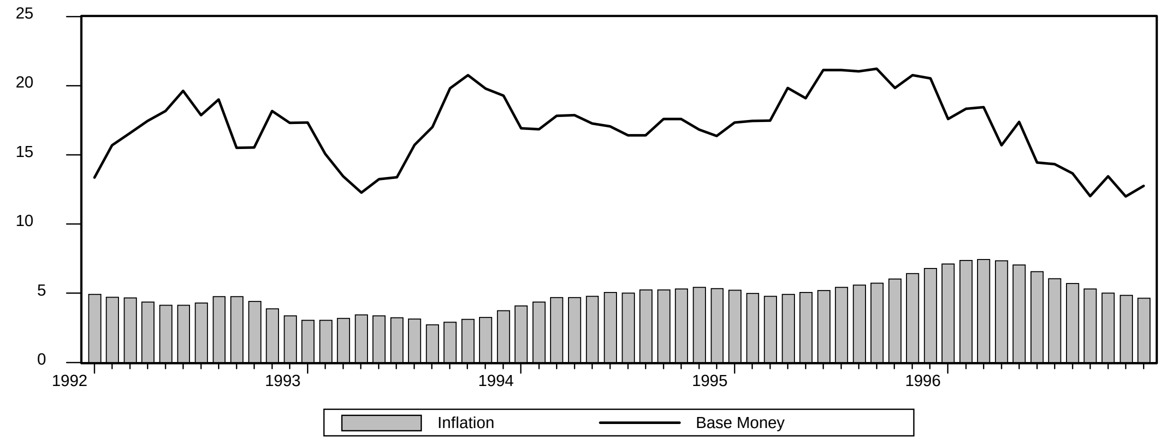


Figure 2: (for Thailand) cont'd

Pre-Crisis: January 1992 - December 1996 (per annum in %) (4 month moving average)



Post Crisis: July 1997 - December 2000 (per annum, in %) (4 month moving average)

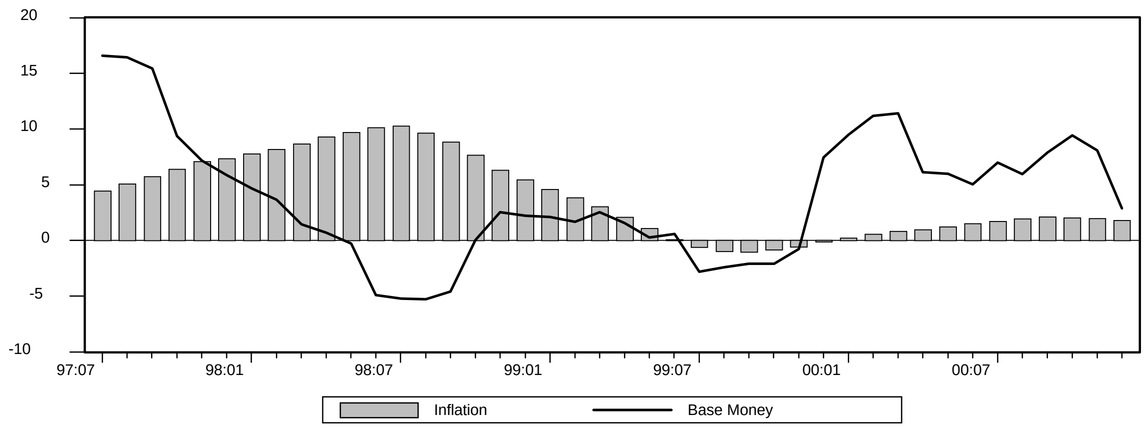


Figure 3: (for Korea)
Inflation, Growth Rate of Base Money and Change in Nominal Baht

Pre-Crisis: January 1992 - December 1996 (per annum in %) (4 month moving average)

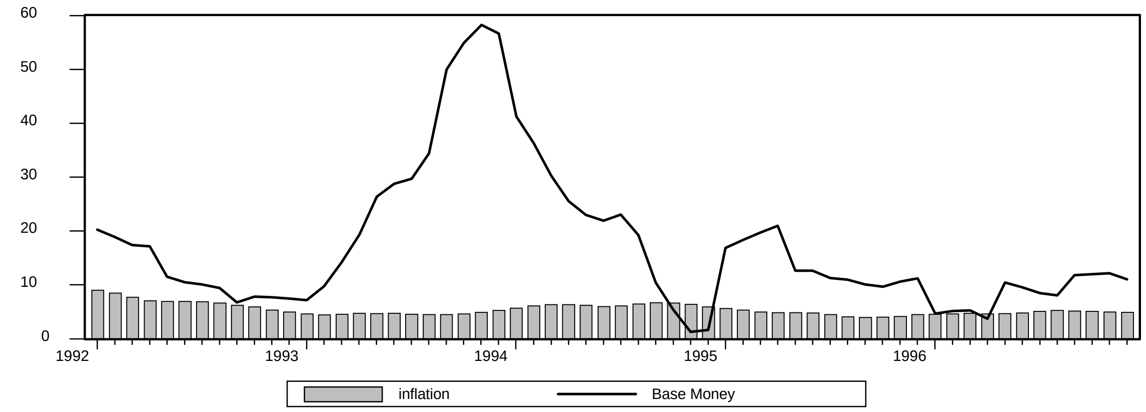
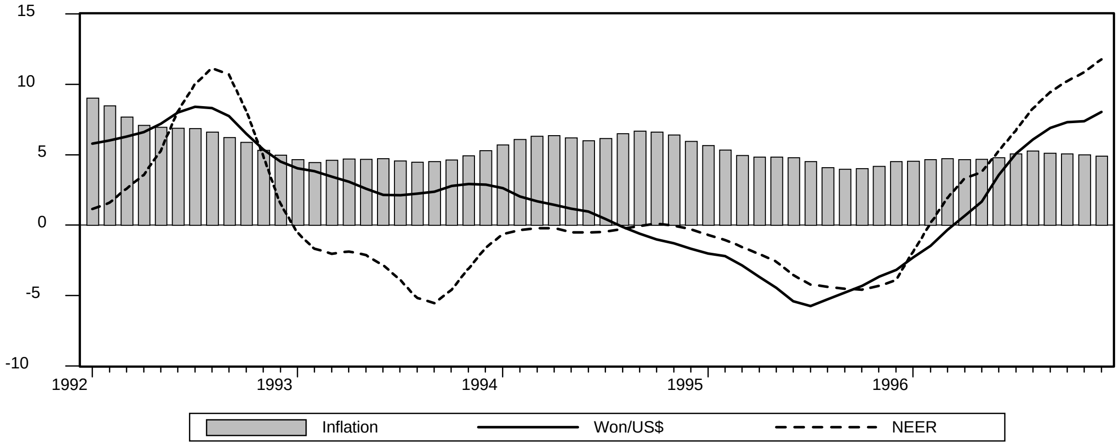


Figure 3: (for Korea) cont'd

Pre-Crisis: January 1992 - December 1996 (per annum in %) (4 month moving average)



Post Crisis: July 1997 - December 2000 (per annum, in %) (4 month moving average)