Effectiveness and Commitment to Inflation Targeting Policy: Evidences from Indonesia and Thailand

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Abstract:

The chief objective of our paper is to highlight basic features of the IT policies adopted by Indonesia and Thailand, and to evaluate the commitment of the monetary authorities and the overall performances of the IT regime. The results demonstrate that the IT regime in these two economies has had some success, but not during the immediate aftermath of the Lehman Brothers' collapse in the last quarter of 2008. Furthermore, the implementations of the IT policy in these two Southeast Asian economies have largely been "flexible" during the stable period, seeking the balance between narrowing output gap, managing exchange rate volatility, and anchoring inflationary pressure. However during the turbulent period, there had been a heightened focus in anchoring inflationary expectation.

JEL Classification: E52, E58, F31, F33

Key Words: Inflationary Expectation; Output Gap; Inflation Targeting; Pass-through, Monetary Policy Rule.

1. Introduction

Managing price stability, especially for those emerging economies with prohibitive vulnerability to sudden shifts in global investor sentiment, is imperative. The efforts to achieve this policy objective have been made more complex with unstable commodity prices and global financial meltdown, triggered initially by the sub-prime mortgage crisis in the United States. A number of policy initiatives have been carried out. To rein in the unwanted consequences of volatile capital inflows on the local currency in particular, and on the domestic economies in general, most of the major Asian economies were often forced to resort to heavy sterilization (Table 1). However, facing the mounting cost and declining effectiveness of the sterilization measures, a number of these countries have gradually introduced more flexible regimes of exchange rate and carried out the necessary adjustments in their monetary, fiscal, investment and trade policies. For some emerging markets, the adoption of the more flexible exchange rate policy has proven to be an initial step toward the full adoption of the inflation targeting (IT) policy as the anchor of their monetary policy in particular and their macroeconomic policies in general.

Two of the most severely affected economies by the 1997 East Asian crisis, namely Indonesia and Thailand have officially adopted the IT regime. Although the process and the timing varied from one country to another, the needs to abandon the unsustainable rigid exchange rate policy and to strengthen the operation, and the effectiveness of the monetary policy have been the principal advocates behind the adoption of the IT policy by these two major Southeast Asian countries.

There are two primary objectives of our paper. The first one is to highlight the basic features of the IT policies adopted in Indonesia and Thailand, and to evaluate their overall performances, especially during the recent turbulent years. We will first review a number of performance indicators such as price stability, growth rate and output volatility. Subsequently, our study will examine pass-through effects in both tradable and non-tradable prices, and the effectiveness of nominal exchange rate as a shock absorber.

The second objective is to examine the commitment of the monetary authorities of these two major Southeast Asian countries to credibly implement the IT framework. This pertinent concern has been frequently debated by past studies, but it has not been fully examined. The IT policy is credibly enforced, if the monetary authority is committed to rein in inflationary expectation as a primary or one of key objectives of its monetary policy reaction function during *both* stable and volatile economic environments (Schmidt-Hebbel and Tapia (2002), and Bernanke and Mishkin (2007)). Prior to 2007, a sustained mild global inflation environment induced price stability in general and reduced potential trade-off and cost of having low inflation in the local economy. However, uncertainties with global economic conditions heightened significantly, particularly since early 2007, posing challenges to policy efforts to manage price stability. Hence, it is pertinent to evaluate the commitment of these two countries to implement IT policy, and more importantly, to draw lessons on the effectiveness of the policy during the past few years of turbulent period.

Recent studies have been conducted on the above list of issues. Yet, most of these early works focused their analyses mainly on the implementation of the IT policy in the industrialized economies, and only a few have attempted to examine the implementation of the IT regime in these two economies.[1] Our study hopes to fill in the gap in the literature and ultimately aims to draw further policy lessons for the other emerging markets around the globe.

This paper proceeds as follows. Next section briefly discusses policy backgrounds and basic economic performance indicators under the IT regime. Section three lays out the pass through equation and the monetary policy rule framework to be tested in our study. The empirical section introduces the data sets and presents the findings of the autoregressive distributed lag (ARDL) for the pass-through effects. We employ markov-switching approach to examine the monetary reaction functions of the central banks. The test results allow us to compare and contrast the objectives of the monetary authorities of these two countries during the pre and post-IT periods, and thus scrutinize their commitments to implement the IT-policy. The conclusion section ends the paper.

2. Brief Policy Backgrounds and Primary Performance Indicators

2.1 Policy Backgrounds

2.1.1 Indonesia

Bank Indonesia (BI), the monetary authority of Indonesia, had officially launched its IT policy as its new monetary policy framework in July 2005. Under the IT framework, the inflation target represents the overriding monetary objective set by the Indonesian government after coordination with BI. The authorities have initially allowed the headline

[1] Charoenseang, J. & Manakit, P. (2007) and Kubo (2008) have examined the monetary policy transmission in Thailand during the IT period. Alamsyah et.al. (2001) discuss issues facing Indonesia during preparation stages of the inflation targeting policy.

inflation to fluctuate between the range of $9 \pm 1\%$ in 2003, before gradually revising the headline inflation target downward to $5 \pm 1\%$ for 2008 (Table 2).

Several reasons have been well documented as factors behind the move away from the past base money targeting framework to the current IT framework. To start, the effectiveness of the base money targeting policy of BI has significantly declined since mid-1990s, especially during the post-1997 East Asian financial crisis. Boediono (1998) underlined two reasons behind this. First is with the open market instrument. The markets for the central bank securities/bills (SBIs) and money market paper were relatively thin and segmented. The SBIs, in particular, were mostly held by the state banks in mid to late-1990s. Second, there were periods of pro-cyclicality of base money. During periods of upswings in the economy, rising aggregate demand was accompanied by both increased foreign borrowings and liquidation of SBIs, resulting in the excessive rise of money supply.

In addition, the growing success of international experiences with IT countries in reining in inflation without increasing output volatility had also influenced the decision to adopt the IT policy in Indonesia (Alamsyah, et.al. (2001)). In particular, the experiences of the first group of IT economies, such as New Zealand, Australia and other industrial economies, demonstrate that with the rise in the central bank credibility over time, IT policy reduces the variability of both inflation and output (Cecchetti and Ehrmann (1999)).

To boost the effectiveness of monetary policy signals as well as to provide greater market certainty, the BI rate is chosen as the interest rate instrument for Bank Indonesia. The BI rate is determined during the quarterly or monthly Board of Governors' meeting, in respond to the outlook for the achievement of the inflation target. Moreover, the BI rate is used as a reference in the monetary control operations to ensure that the weighted average of

1-month Certificate of Bank Indonesia (SBI) rate formed in the Open Market Operations (OMOs) auctions remains at around the level of the BI rate.[2] Accordingly, the 1-month SBI rate is expected to influence interest rates on the interbank money market and longer-term interest rates.

2.1.2 Thailand

The Bank of Thailand (BOT) formally adopted the IT policy in May 2000 after exited from the IMF financial assistance programme. Similar to the case of Indonesia, the decision to shift from the previous monetary targeting regime to the current IT regime in Thailand was largely driven by the recognition that the relationship between monetary indicators and output growth had became less stable, especially in the immediate aftermath of the 1997 financial crisis and under the rapidly changing financial sector in Thailand (Charoenseang and Manakit (2007) and Kubo (2008)). In addition, the implementation of IT is needed to restore the BOT credibility as well as its independence (Jansen, 2001).

Under the IT framework, the quarterly average target of the core inflation (the headline inflation excluding raw food and energy prices) has been set at a range of 0-3.5% from 2001 onwards (Table 2). The target bandwidth of 3.5% is expected to mitigate temporary economic shocks and to minimize the need for the BOT to carry out frequent monetary policy adjustments. The BOT sets the 14-day repurchase rate as its policy rate to

[2] The monetary control operations take place through the use of the following instruments: (i) Open Market Operations (OMOs), (ii) standing facilities; (iii) foreign exchange market intervention, (iv) establishment of the minimum statutory reserve requirement, and (v) moral suasion. The most important monetary control instrument is the OMOs. BI began issuing its own debt in the form of SBI to manage the money supply since 1984. Currently the one-month SBI is auctioned weekly and the three-month SBI is auctioned monthly.

influence the short-term money market rates, and the monetary authority signals the shifts in its policy stance through the announced changes in the key policy rate via the open market operations (OMOs)[3].

Looking at data from January 1991 through April 2000, the averages of the core inflation and headline inflation in Thailand were relatively identical (McCauley (2006)). The maintenance of price stability in terms of core inflation had therefore been expected to lead to stable headline inflation (Sriphayak (2001)). The recent episodes of subprime financial crisis and soaring prices of key commodities have however challenged this early view on the stable relationship between core and headline inflations in Thailand (Figure 1). The average gap between the core and headline inflations in the country has not only widened, especially since 2005, but it has become less stable as well.[4] We will come back to this issue at the latter stage of the paper.

2.2 Preliminary Performance Indicators

A number of basic performance indicators have often been applied to evaluate the outcome of the inflation targeting policy. Most have considered the potential trade-offs between economic growth and inflation. Cecchetti & Ehrmann (1999) for instance argue that one should expect to see heightened levels of output volatility in the IT countries as the

[3] In conducting the OMOs, the BOT undertakes transaction in the financial markets to affect the aggregate level of reserve balances available in the banking system and thus affects the short-term interest rates.

[4] A commonly used ADF-unit root testing shows that the gap between the core and headline was stationary from 1991 to 2002. However it became non-stationary during the period of 2004 to 2008. The test result can be made available upon request.

monetary authority manipulated the output gap to reverse shocks to inflation. Similarly, Mishkin and Schmidt-Hebbel (2007) examine both the mean and the standard deviation of the inflation rate and the GDP growth rate during the pre-and post-IT periods to examine the growth and the volatility, and the potential trade-offs between them. For the IT policy to be considered successful, the following outcomes should at least be achieved:

- Lower inflation and output volatility are posted during the post-IT when compared to the pre-IT rates.
- The sacrifice ratio (i.e. the output cost of maintaining inflation rate within the targeted range) decline over time.

Table 3 reports the mean (*the growth*) and standard deviation (*the volatility*) of the annualized monthly consumer price index (CPI)-based inflation and the annualized quarterly GDP growth rate for both economies during the period of two years before $(t-2)$ and after $(t+2)$ the full adoption of the IT policy. Following IMF (2005), two features/conditions must be met to be considered under the full-fledged IT period:

a) The central bank is mandated, and commits to, a unique numerical target in the form of a level or a range of annual inflation, and
b) The inflation forecast over some horizon is the de facto intermediate target of the monetary policy.

Based on those two conditions, the official starting dates of the IT framework in Indonesia and Thailand are reported in Table 2.

We find several consistent and contrasting findings.

1. In general, we found inflation rates in Thailand, but not in Indonesia, to be relatively lower and less volatile during two immediate years following the adoption of the IT policy than during the pre-IT period. Noted, since the target is the core

inflation, Table 3 reports both core and headline inflation for the case of Thailand. The high inflation rate at $(t+2)$ in Indonesia was driven by significant cuts on subsidies for a number of feul and its related products in the second quarter of 2005.

2. Most encouragingly, there seems to be no trade-off between inflation and economic growth. The average GDP growth rates of Indonesia and Thailand during $(t+2)$ have in general been significantly higher and less volatile (smaller standard deviations) than the rates during the pre-IT period.

3. The headline inflation rates in these two economies had risen significantly in recent years. For Indonesia, the mean of the annualized headline inflation had been well above the target rate, especially starting the second half of 2008. The rise in the key commodity prices in the world market contributed significantly to sudden rise in the domestic inflations of the two major Southeast Asian economies.[5] From January 2007 to January 2008, the average headline inflation rate in Indonesia was still hovering well within the target of Bank Indonesia, at around 6 percent. The inflation rate had however almost doubled during the second half of 2008.

4. Despite the rise in the headline inflation, the core inflation rate continued to remain well below the inflation target of Bank of Thailand in recent years. There has indeed been a mark increase in the core inflation and a significant widening gap between the core and the headline inflation, capturing the steep rise in the non-core inflation driven by the escalated and volatile commodity prices between 2006 and 2008 (Figure 1).

5. Although the overall growth rates remained strong for the full year of 2008, we have seen adverse impacts of the global financial crisis (especially since September 2008 with the closure of the Lehman Brothers) and the volatile prices of key commodities. The final quarter of 2008 has seen the annualized GDP growth rate of Thailand to contract by around 4 percent. The recent experiences with high inflation and low growth reconfirm the concern over the effectiveness and superiority of inflation target regime over the other monetary regimes during episodes of economic turbulences.

[5] For Indonesia in 2008, three general categories of consumer goods contributed the most to the inflation, namely - food; - processed food, beverage and cigarettes and tobbaco; and -housing, water, electricity, gas and fuel products. The price of light sweet crude oil at the New York stock exchange (NYMEX) for instance was at around US$99 per barrel in early January 2008, before reaching its peak at around US$145 per barrel in July of the same year. Similarly, the price of crude palm oil had increased by over 40 percent during the first two months of 2008 to US$1,315 per ton.

3. Working Model

3.1. Inflation Inertia and Pass-through Effects

To further examine the performance of the IT policy, our next task is to examine the pass-through effects in these two economies. Has the IT regime reduced the pass-through effects and inflation inertia, and therefore contributed to the reported fall in the domestic inflation rate of these two economies? Taylor (2000) argues that the extent of a pass-through decline is highly influenced by the strong commitment of the monetary authority toward price stability. Supporting Taylor's claim, Gagnon and Ihrig (2004) tested a sample of advanced nations and found that the decline in the pass-through has been related to the changes in monetary policy procedures, and in particular, to the adoption of inflation targeting.

Edwards (2006), however, demonstrates that "pass-through problem" does not only relate to the issue of inflation, but also to the overall effectiveness of the nominal exchange rate as a shock absorber. Therefore, the study argues that it is important to make a distinction between the pass-throughs of exchange rate changes into the domestic price of non-tradable and into the domestic price of tradable. From a policy perspective, a desirable situation is to realize a more efficient shock absorbing exchange rate where the pass-through coefficients for tradable and non-tradable are low and different, with pass through for tradable goods being higher than that for non-tradable goods.

To address the set of questions introduced earlier, our study employs the following empirical model based on Edwards (2006)[6]:

Equation 1:

$$\Delta \log P_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta \log E_{t-i} + \sum_{i=1}^{n} \beta_{2i} \log \Delta P_{t-i}^{\ *} + \sum_{i=1}^{n} \beta_{3i} \log \Delta P_{t-i} + \sum_{i=1}^{n} \beta_{4i} \left(\Delta \log E_{t-i} * DIT \right) +$$
$$\sum \beta_{5i} \left(\Delta \log P_{t-i} * DIT \right) + \varepsilon_t$$

Where:

- P_t is a domestic price index –either of tradable or non-tradable. As proxies, the rate of change of the CPI is for the non-tradable inflation, and the rate of change for the producer price index (PPI) is for the tradable inflation.
- E_t is the nominal effective exchange rate (an increase implies a nominal depreciation of the local currency).
- P_t^* is a world price index. The change of this index captures the rate of world inflation. The US consumer price index is going to be adopted here as a proxy.
- DIT is a dummy variable for Inflation Targeting regime. It is equal to zero before the adoption of the inflation target in the country, and equals to one otherwise.

Several fundamental assessments can be derived from the regression outcomes on Equation 1:

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[6] This model is the variant of the models introduced by Campa and Goldberg (2002) and Gagnon and Ihrig (2004).

- The first one is the pre-IT short-run pass through, captured by $\sum \beta_1$. We would expect $\sum \beta_1$ to be equal or greater than zero, i.e. a depreciation of the nominal effective exchange rate $(\Delta \log E > 0)$ would lead to a rise in the inflation $(\Delta \log P > 0)$, and vice versa.

- The second one is the post-IT short run pass through $\left(\sum \beta_1 + \sum \beta_4\right)$. If $\left(\sum \beta_4 < 0\right)$, the pass through effect for the post-IT period is lower than that of the pre-IT. Hence, we find evidence to support Taylor (2000) that a more inflationary-focused policy such as IT should reduce pass through.

- The third one is the pre-IT long-run pass through, estimated as $\left(\dfrac{\sum \beta_1}{1 - \sum \beta_3}\right)$. Similar to the short-run pre-IT pass through, we would expect the long-run pre-IT pass through to be positive.

- The next one is the long-run pass through estimates for the post-IT period, $\left(\dfrac{\sum \beta_1 + \sum \beta_4}{1 - \left(\sum \beta_3 + \sum \beta_5\right)}\right)$.

- $\left(\dfrac{\sum \beta_1}{1 - \sum \beta_3}\right) > \left(\dfrac{\sum \beta_1 + \sum \beta_4}{1 - \left(\sum \beta_3 + \sum \beta_5\right)}\right)$ implies that the adoption of the IT policy has reduced the long-run pass through effects.

- $\sum \beta_5 > 0$ suggests that inflation inertia has risen in the local economy. The rise (fall) in inflation inertia may contribute as well to the rise (fall) in the long-run pass through during the post-IT as compared to the pre-IT period.

- Lastly, we will evaluate whether the ratio of the pass-through coefficients for the non-tradable price over those of the tradable prices has declined (increased), suggesting that the nominal exchange rate is becoming a more (less) efficient shock absorber.

3.1.1 Robustness Testing: The Degree of Economic Openness

Early works, such as Campa and Goldberg (2002), Gagnon and Ihrig (2004), Frankel, et.al.(2005) and BIS (2005) among others, have recorded a broad-based decline in the exchange rate pass-through (ERPT) during the past two decades. These studies offer a number of plausible explanations for the decline in the ERPT, but most of them consistently underline the significant contribution of import penetration, international mobility of capital, and overall degree of economic openness.

Given the possibility that the degree of economic openness may have contributed to a possible fall in the size of the exchange rate pass-through in our two economies, it is therefore warranted to ensure the robustness of our test results that the openness variable is added as a control variable in Equation 1:[7]

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[7] Investment and Trade reforms in Indonesia and Thailand had taken place rapidly in mid-1980s and were followed by aggressive liberalization of the financial sector, particularly in the banking and capital market. Both economies shifted away from import-substitution policy to export promotion in 1980s and committed themselves into both multilateral trade arrangements (such the world trade

(continued)

Equation 2:

$$\Delta \log P_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta \log E_{t-i} + \sum_{i=1}^{n} \beta_{2i} \log \Delta P_{t-i}^{\ *} + \sum_{i=1}^{n} \beta_{3i} \log \Delta P_{t-i} + \sum_{i=1}^{n} \beta_{4i} \left(\Delta \log E_{t-i} * DIT\right) +$$
$$\sum_{i=1}^{n} \beta_{5i} \left(\Delta \log P_{t-i} * DIT\right) + \sum_{i=1}^{n} \beta_{6i} \left(\Delta Openness\right) + \varepsilon_t$$

We construct (*Openness*) control variable for Indonesia and Thailand. This variable would capture the impact of both trade and financial sector reforms on the degree of economic openness of the countries. The monthly (*Openness*) variable is calculated as the product of log-normalized values of export $\left(\ln Export_t\right)$, import $\left(\ln \mathrm{Im}\, port_t\right)$ and market capitalization of the stock exchanges $\left(\ln MarketCap_t\right)$, hence $\left(Openess_t = \ln Export_t * \ln \mathrm{Im}\, port_t * \ln MarketCap_t\right)$.[8] Accordingly, the rate of change in the degree of the economic openness is calculated as $\left(\Delta Openness_t = Openness_t - Openness_{t-1}\right)$.

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organization (WTO) and the Asia Pacific Economic Cooperation (APEC)) in 1990s, and bilateral trade arrangements with their key trading partners, such as the USA and Japan in 2000s (refer to Sen and Rajan (2005) and Kastner and Kim (2008). As an annual percentage of GDP, the average total export and import surged from the levels around 36 percent and 53 percent in 1985-1990 in Indonesia and Thailand, respectively, to as high as around 45 percent and 118 percent in 2002-2007. Much more impressive trends have been demonstrated by the market capitalizations of the stock exchanges in these two Southeast Asian nations. The capitalizations of the Jakarta Stock Exchange and the Bangkok Stock Exchange were averaging around 0.10 percent and 3 percent per annum of GDP in 1980-1985, and surged to 30 percent and 67 percent, respectively, in 2002-2007.

[8] Given no monthly official GDP data for both economies, we are not able to calculate the composition of the (*Openness*) control variable as monthly percentages of GDP.

As the rise in the degree of the economic openness should reduce the inflationary pressure in the local economy, the sign of the coefficient estimate (β_6) is expected to be negative.

3.2 Monetary Policy Reaction Function Under Inflation Targeting Policy

Can the decline in the inflation rate and the pass-through effect during the IT period be attributed to the full commitment of the monetary authority to the pursuit of the IT policy? One way to address this question is by examining the monetary policy rule of the central bank during the pre- and the post-IT period. Taylor in his seminal 1993 paper proposes a very specific and simple monetary policy rule, where the central bank adjusts its key interest rate in a smooth manner responding to the changes in the expected inflation and output gap. Furthermore, his study and many others have argued that the domestic monetary policy does not systematically respond to external shocks.[9] Therefore, exchange rate variable should not explicitly be included in the reaction function of the monetary authority. The arguments are two folds. First, the exchange rate should already play indirect roles through inflation and output variable. Second, adding exchange rate into the policy rule will only place considerably more volatility to monetary policy (Taylor, 2001). Mishkin and Schdmit-Hebbel (2001) shared this view as well. Likewise, Clarida (2001) contends that even though central banks do not target the exchange rate explicitly, the central banks' objective to stabilize inflation will lead to the increase in short-term interest rate when the domestic currency is weakening and vice versa.

[9] For instance, refer to Corbo, et.al (2001) and Trehan and Wu (2007).

Others however challenge the exclusion of the exchange rate in the optimal monetary policy rule. Svensson (2000) for instance argues the need to allow for the indirect and direct exchange rate transmission channel in the optimal monetary policy reaction function. In his 1993 seminal paper, Taylor had initially allowed for a significant role of exchange rate factor in the policy reaction function of the Federal Reserve Board (FRB). Due to its adverse implication on the overall performance of the macroeconomic performance when the FRB reacted too strongly to the exchange rate, the study eventually omitted the exchange rate in the 1993 rule for the FRB. However, Taylor acknowledges that ‘it is not clear that the same conclusion would hold for other countries’ (Taylor (2001)). Note, the importance of exchange rate factor has also been underscored in a recent study of Aizenman, et.al. (2008).

For our study, there are a number of compelling reasons to explicitly account for the role of the exchange rate variable in the monetary policy reaction function. To start with, external shocks are transmitted largely through exchange rate movements in small open economies, such as Indonesia and Thailand. More importantly, the monetary authorities of these economies had officially and unofficially adopted rigid exchange rate policy regimes in the past. Hence, by including the exchange rate variable, we can examine whether the monetary authority continued to place a significant weight on the exchange rate variable during the IT-period.

To test the monetary policy reaction function, we adopt an approach introduced by Clarida, Gali and Gertler (1998), henceforth refer to as the CGG approach:[10]

[10] As briefly mentioned, the CGG approach is often referred to as an augmented version of Taylor rule with forward looking expectation on inflation, output and exchange rate gaps (refer to Taylor (2001) and Chadha, Sarno and Valente (2004)).

$$r_t^* = r^* + \sum_i^n \delta_i E_{t-i}\pi_{t+1-i} + \sum_i^n \phi_i (E_{t-i} y_{t+1-i} - y^*) + \sum_i^n \zeta_t (q_{t-i}) + \varepsilon_t \quad (3)$$

Where: r_t^* is the short-term policy interest rate target; $\bar{r}$ is the desired nominal interest rate; $E_t \pi_{t+1}$ and $E_t y_{t+1}$ are expected inflation and output for period $(t+1)$, respectively, conditioned on information set available at time (t); (y^*) is the potential output; (q_{t-i}) denotes the lagged real exchange rate fluctuation, captured by periodical percentage change of real effective exchange rate.[11] A positive (q) implies a weakening of the local currency. δ, ϕ and ζ are the parameters determining the central bank's response to deviations of expected inflation from inflation targets, expected output gap and past exchange rate volatilities, respectively.

Early studies have demonstrated that under the forward looking expectation, interest rate smoothing behavior, such that $r_t = (1-\rho) r_t^* + \rho(L) r_{t-i} + \varepsilon_t$, should have a stabilizing effect on the monetary policy reaction function (Rudebusch and Svensson (1999) and Clarida, Gali and Gertler (1998)). Incorporating interest rate smoothing into Equation (3) and the two above adjustments, the following monetary policy reaction function can be specified:

[11] Managing volatility of the local currency has indeed been part of critical feature of the IT policy in both Indonesia and Thailand (Alamsyah, et.al.(2001) and Charoenseang and Manakit (2007)).

$$r_t = \omega + \sum_i^n \rho_i r_{t-1-i} + \sum_i^n \delta_i E_{t-i}\pi_{t+1-i} + \sum_i^n \phi_i (E_{t-i} y_{t+1-i} - y^*) + \sum_i^n \zeta_{t-i}\left(q_{t-1-i}\right) + \varepsilon_t \qquad (4)$$

Where r_t is the current interest rate, $\rho \in [0,1]$ captures the interest rate smoothing behavior, $\omega = (1-\rho)(\bar{r} - \beta\pi^*), \delta = (1-\rho)\beta$, $\phi = (1-\rho)\gamma$ and $\zeta = (1-\rho)\lambda$. Note: $i = 1,2,...,n$.

Equation 4 basically indicates that key central bank interest rate will be determined by the past levels of interest rate and exchange rate volatility, and the past and present level of expected inflation rate and expected output gap. Based on the significance and the size of the estimate coefficients of ρ, δ, ϕ and ζ, we can analyze the relative weights of these key economic indicators on the monetary policy rule of the country. Theoretically, we would expect δ, ϕ and ζ to be all positive. The rise in the inflation expectation should lead to the tightening of the monetary policy. Similarly, rising expected output gap $(E_{t-i} y_{t+1-i} - y^*)$ should result in stronger inflationary pressure, and therefore requires tighter monetary policy stance. Lastly, a positive rise in (q) should trigger stronger imported inflation and warrants an upward adjustment in the key interest rate.

To ensure consistent analyses, we consider the implementation of the IT policy to be credible if and only if the expected inflation variable is significant during both regimes. That is the forward looking policy to rein in inflation should always be fully enforced under both stable and volatile economic conditions. In an extreme case where an IT country places a significant weight only on inflation variable, then this country, according to literature, is following IT *rule*. On the other hand, the implementation of the IT policy would be considered a flexible one --following IT *framework*, when there is a discretionary space for the monetary authority to place more important weights to other factors, such as output stability or exchange rate volatilities, than to price stability (Bernanke and Mishkin (2007)).[12] Naturally, if none of the above conditions is met, then IT policy has not been enforced. Accordingly, one can argue that other factors, such as more stable macroeconomic environment, are largely responsible for the low inflation and the more moderate pass-through effects.

4. Empirics

4.1. Data and Date Selection

Our monthly data series run from January 1990 to December 2008. Most of the raw data for prices, key interest rates and exchange rates are sourced from the official websites of the central banks of the individual countries and the International Financial Statistics of the International Monetary Fund. However, due to the lack of official data, the nominal and real effective exchange rates of Indonesia are sourced from the database of JP-Morgan. As discussed earlier, we follow IMF (2005) for selecting the starting dates for the official implementation of the IT policy.

All raw variables are in the log-form. The inflation rate is calculated as the monthly percentage change in the price levels (consumer price index (CPI) and producer price index (PPI)). The monthly industrial production index (IP) for each country is adopted to proxy the domestic output, and the growth rate is calculated as the monthly percentage change of the

[12] The discretionary to make the necessary adjustment is what Bernanke and Mishkin (2007) consider as the advantage of pursuing flexible IT framework.

IP. For the key policy rate, we employ the three month-SBI rate for Indonesia and the 14-day repurchase rate for Thailand.[13]

4.2. Autoregressive Distributed Lag Approach for Pass-Through and Inflation Inertia

4.2.1 Exponential Smoothing Inflation of Cogley (2002)

Most studies examining the pass-through effects for developing countries often rely on the most common measure of inflation such as the CPI-based or PPI-based rates of inflation. However it is well known that there is a substantial presence of transient noises in the CPI series of the developing economies, due for instance to the relatively larger shares of household expenditures on food and energy products. The volatility of the world prices of food and energy commodities, especially since mid-2005, has indeed contributed to the much more fluctuated CPI-series in Indonesia and Thailand in recent years. Therefore to enhance the quality of our pass through estimates, in addition to the CPI and the PPI based inflation series, we also calculate the exponentially smoothed version of the CPI and PPI-based inflation series proposed by Cogley (2002).

Extending the early works of Bryan and Cechetti (1995) and Cecchetti (1997), Cogley (2002) proposes a simple adaptive method for filtering inflation data to remove transient noise. The study demonstrates that by considering the source of *persistent* movements in inflation, it can further reduce the still relatively high-frequency variation of

[13] To reduce the noise and short-run volatilities, we calculate the six-month moving average of the exchange rate and the price indices.

the transient noise in the inflation series derived from the early approach of Bryan and Cechetti (1995).[14]

Cogley (2002) develops a core measure of inflation that down-weights distant movements in the price index. The study proposes the following core inflation measure, involving the exponential smoothing of current and past aggregate inflation series:

$$\tilde{\pi}_t = g_0 \sum_{j=0} (1 - g_0)^j \pi_{t-j} \qquad\qquad 0 < g_0 < 1 \tag{5}$$

Where π denotes the relevant aggregate CPI or PPI-based inflation rates. Equation (5) defines the core measure as a one-sided geometric distributed lag of current and past inflation. Cogley (2002) sets the gain parameter of $g_0 = 0.125$. For our study however, we do not predetermine the size of g_0, instead we estimate the smoothing parameter (g_0) that will minimize the sum of squares of one-step forecast errors.

Figures 2 and 3 contrast and compare the monthly inflation rates based on the actual CPI against that derived by the exponentially smoothing approach of Cogley (2002). Clearly, a fair amount of transient noises in the CPI-based inflation rates of Indonesia and Thailand has successfully been taken out by the smoothing process. For the sake of brevity, we do not report the exponential smoothed inflation figures based on the PPI series.[15] Given these

[14] Since the CPI index for each components of the aggregate CPI index is not officially available for Indonesia (full data only available starting 2000) and Thailand (only 7 components are available), we are not able to calculate the weighted median measure of the aggregate inflation series proposed by Brian and Cecchetti (1994) for both of these economies. Moreover, given the adaptive measure of Cogley (2002) has been demonstrated to successfully generate less volatile inflation series than the approach of Brian and Cecchetti (1994), we will only employ the former methodology.

[15] However, these figures can be made available upon request.

results, the inflation series employed in our pass-through testing will be that of the exponentially smoothed series of the tradable and non-tradable inflation series.

4.2.2 Pass-Through Effects

Early studies have acknowledged that $(\Delta \log E)$ may not be exogenous in Equation 2 and may very well be correlated with the error term. However, finding an appropriate instrumental variable for $(\Delta \log E)$ is difficult.[16] One way to circumvent the problem is to employ the classical ARDL (Autoregressive Distributed Lag) testing with the general to specific approach (Hendry, 1976). This is a common approach adopted by early studies such as Campa and Goldberg (2002) and Gagnon and Ihrig (2004). To avoid potential endogeneity, the ARDL testing includes variables at period $(t-1-i)$ only, with $i = 0,...,n$.[17] In addition, a crisis dummy is included in the testing to capture potential structural breaks due to the financial and exchange rate crisis started in the middle of 1997. Furthermore, a battery of test statistics will be reported to ensure that our coefficient estimates are valid and robust.

Prior to conducting the ARDL testing, we test the unit-root properties of each of the variables in Equation 2. To anticipate possible presences of structural breaks, we employed Banerjee et al. (1992) –henceforth BLS, in addition to standard unit-root tests, i.e. the ADF-

[16] The difficulty in finding a good instrument for exchange rate variable was initially highlighted by Meese and Rogoff (1983).

[17] Due to the degree of freedom, we start with $i = 5$ (up to six month lag). In all cases, we do not find higher lagged variables to be significant.

test, the Phillip Perron test and the KPSS test.[18] Depending on the unit-root properties of the series, we test for the possible cointegrating relationship among the variables in Equation 2. If cointegrating relationship is found, then the error-correction component series (ECM_{t-1}) will be included in the ARDL testing.

Based on our set of unit-root tests, all relevant series are all found to be non-stationary and integrated of order 1 at their level ---I(1) series (Table 4).[19] Furthermore, the $(Openness_t)$ variable is also tested to be non-stationary at the level, hence having a consistent unit-root property with the rest of the variables in Equation 2. Furthermore, with the exception for the case of tradable price of Indonesia, we found weak evidences of cointegrating relationship in Equation 2. Accordingly, the error correction component will include in the ARDL regression. The pass-through test results are reported in Tables 5 and 6.[20] The R-squares suggest that the explanatory variables can explain in average around 80 percent of the monthly price changes of tradable and non-tradable goods. The F-statistics indicate that one or more of the independent variables are non-zero. In addition, the Breusch-Godfrey serial correlation LM test statistics confirm that autocorrelations in the residuals are not a problem in any of the regressions.

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[18] The BLS provides a more in-depth investigation of the possibility that aggregate economic time series can be characterized as being stationary around 'a single or multiple structural breaks'. It extends the Dickey-Fuller *t*-test by constructing from the time series of rollingly computed estimators and their t-statistics. Following the BLS procedure, we compute the smallest (minimal) and the largest Dickey-Fuller *t*-statistics.

[19] For the sake of brevity, the results of the standard unit-root tests will not be posted, but they can be made available upon request.

[20] The cointegrating test results, the coefficient estimates for the crisis dummy, and the error correction variables from the ARDL regressions are excluded from Table 5. They can however be made available upon request.

Supporting the claims of Taylor (2000) and Gagnon and Ihrig (2004), our test results suggest that the short- and long-run pass-through effects for the non-tradable prices have all declined in the post-IT periods in these two economies (Table 6). The rates of changes for short-run pass-through ($\left(\sum \beta_1 + \sum \beta_4\right) - \sum \beta_1$) and long-run pass-through effects ($\left(\frac{\sum \beta_1 + \sum \beta_4}{1 - \left(\sum \beta_3 + \sum \beta_5\right)}\right)$-$\left(\frac{\sum \beta_1}{1 - \sum \beta_3}\right)$) are in the ranges of (-0.067 to -0.129) for Indonesia and (-0.016 to -0.048) for Thailand. Similar evidences have been reported as well from the tradable price of Thailand, but not for the case of Indonesia.

The effectiveness of the IT policy in mitigating inflation inertia has also been demonstrated in two countries for the case of non-tradable price. Yet, the policy has had limited success in anchoring inflation inertia in domestic tradable prices of these two major Southeast Asian nations. Inflation inertia ($\sum \beta_5$) for the tradable price has in fact increased by about (0.18) and (0.21) for Indonesia and Thailand, respectively, during the post-IT period.

There is also no conclusive evidence that the nominal exchange rate has become more efficient shock absorber. As highlighted, the nominal exchange rate is considered to be more efficient absorber, if the rates of decline in both short- and long-run pass-through effects of the non-tradable prices are larger than those reported for tradable prices. This is not reported for the case of Thailand. Similarly, the evidence is at most a weak one for the case of Indonesia, as the pass-through effects for the tradable price in Indonesia continued to rise during the post-IT period.

The overall ARDL test results seem to suggest that the inflation targeting policy in Thailand has, in general, shown more favorable outcomes. It is interesting to note however that the less encouraging results for the IT policy performance in Indonesia are largely consistent with the prevailing stylized facts. To begin, the IT policy has only officially been launched in July 2005, about five years later than when it was first initiated in Thailand. Furthermore, the IT policy was first implemented during the time when the government of Indonesia initiated its gradual reductions of various energy subsidies. The measure has successfully alleviated pressures on the current expenditure of the central government budget, but at the cost of rising transportation and production costs, and eventually increasing the prices of key commodities, including food products, especially during the episodes of unprecedented surges in the prices of various energy commodities, between late 2007 to middle of 2008. The rise in the non-tradable price has in turn fueled inflationary pressure on the overall headline inflation in the country (Table 3).

Robustness Testing: The Role of Openness

As discussed, to ensure the robustness of our pass-through test results and that the pass-through effects have not been over-estimated, we include openness variable in Equation 2. We find the coefficient estimate of the openness variable $(\Delta Openness_t)$ to be significant only for the case of Indonesia (Table 5). The negative coefficient signs seem to support the early findings of Campa and Goldberg (2002), Gagnon and Ihrig (2004), Frankel, et.al.(2005) and BIS (2005) that the rise in the overall degree of openness should dampen the inflationary pressure domestically.

It is important to emphasize here however that those previous assessments on the degrees of the pass-through effects and inflation inertia, and the roles of IT policy in explaining their changes from the pre and post-IT periods have been based on the assumption that the monetary authorities of these two countries have indeed been committed in implementing the IT policy. This is clearly a brave assumption that needs to be examined, and the objective of the next step of our study is to do so.

4.3. Markov-Switching Approach for Monetary Policy Rule

To compare and contrast the experiences and the shifts in the policy rules under the pre- and post-IT periods, past studies, in general, separated the sample observations into two sets, the pre- and the post-IT periods based on the pre-determined starting dates of the IT policy. This approach however would lead to potential problem with the degree of freedom. For the case of Indonesia in particular, we will not be able to carry out any testing for the post-crisis period as Indonesia only officially adopted the IT policy in July 2005. By breaking the samples into the pre and post-IT groups, we would not have enough degree of freedom to carry out any testing for the post-IT period. To avoid the above shortcomings, we will employ the Markov-Switching (MS) regression procedure on Equation 4. The MS-VAR does not require us to break the observations into two sample sets as it is designed to pick out changes in the generating mechanism of a series. In our case, the changes in the central banks' operating rule will almost for sure affect the stochastic process of the short-term interest rate in Equation 4.

Furthermore, the dynamic of the interest rate may change from the period of stability to that of volatility.[21] Understanding the change is critical in our efforts to assess the commitment of the central banks in implementing IT policy. As discussed earlier, the monetary authority is committed to IT, if and only if they continue to place a significant weight on inflation during both stable and turbulent periods.

The Markov-switching VAR framework is essentially extending Hamilton's (1989) Markov-switching regime framework to the Vector Autoregressive (VAR) systems (see Krolzig, 1997; Sims, 1999; Valente, 2003). Our study considers three types of MS-VAR models that allows for either regime shifts in intercept term, variance-covariance matrix or autoregressive terms. Firstly, we will consider a *M*-regime *p*-th order Markov-switching VAR that allows for regime shifts in variance-covariance matrix. This model, the Markov-Switching-Heteroscedastic-VAR or MSH(*M*)-VAR(*p*), may be written as follows:

$$\mathbf{y}_t = \mathbf{v} + \sum_{i=1}^{p} \mathbf{A}_i \mathbf{y}_{t-i} + \boldsymbol{\varepsilon}_t \tag{5}$$

Where $\mathbf{y}_t$ is a *K*-dimensional observed time-series vector, $\mathbf{y}_t = [y_{1t}, y_{2t}, ..., y_{Kt}]'$ and for this paper matrix $\mathbf{y}_t$ contains all variables used in our monetary policy reaction functions (see Equation (3)). $\mathbf{v}$ is a *K*-dimensional column vector of intercept terms, $\mathbf{v} = [v_1, v_2, ..., v_K]'$; the $\mathbf{A}_i$'s are $K \times K$ matrices of autoregressive parameters; $\boldsymbol{\varepsilon}_t = [\varepsilon_{1t}, \varepsilon_{2t}, ..., \varepsilon_{Kt}]'$ is a *K*-dimensional vector of Gaussian white noise process with a regime-dependent variance-

[21] To our knowledge, hardly any study has applied the MS-VAR approach to examine the impacts of regime shifts on the monetary policy rule. Valente (2003) has examined the monetary policy rules of the central banks from 6 OECD economies, namely France, Germany, Italy, UK and USA.

covariance matrix Σ, $\boldsymbol{\varepsilon}_t \sim NID(\mathbf{0}, \Sigma(\mathbf{s}_t))$. The regime-generating process is assumed to be a hidden Markov chain with a finite number of states $s_t \in \{1,...,M\}$ governed by the transition probabilities $p_{ij} = \Pr(s_{t+1} = j \mid s_t = i)$, and $\sum_{j=1}^{M} p_{ij} = 1$ for $\forall i, j \in \{1,...,M\}$. We can then collect all the conditional transition probabilities p_{ij} into a transition matrix $\mathbf{P}$ as follows:

$$\mathbf{P} = \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1M} \\ p_{21} & p_{22} & \cdots & p_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ p_{M1} & p_{M2} & \cdots & p_{MM} \end{bmatrix}$$

Secondly, we will consider a M-regime p-th order Markov-switching VAR that allows for regime shifts in both intercept terms and variance-covariance matrix. The Markov-Switching-Intercept-Heteroscedastic-VAR or MSIH(M)-VAR(p) may be written as follow:

$$\mathbf{y}_t = \mathbf{v}(s_t) + \sum_{i=1}^{p} \mathbf{A}_i \mathbf{y}_{t-i} + \boldsymbol{\varepsilon}_t \qquad (6)$$

where $\mathbf{v}(\mathrm{s}_t)$ is a K-dimensional column vector of regime-dependent intercept terms, $\mathbf{v}(s_t) = [v_1(s_t), v_2(s_t), ..., v_K(s_t)]'$; $\boldsymbol{\varepsilon}_t \sim NID(\mathbf{0}, \Sigma(\mathbf{s}_t))$ as in equation (5), and $s_t \in \{1,...,M\}$.

Finally, we will consider a M-regime p-th order Markov-switching VAR that allows for regime shifts in all intercept terms, autoregressive parameters and variance-covariance matrix. The Markov-Switching-Intercept-Autoregressive Heteroscedastic-VAR or MSIAH(M)-VAR(p) can be presented as the following equation:

$$\mathbf{y}_t = \mathbf{v}(s_t) + \sum_{i=1}^{p} \mathbf{A}_i(s_t) \mathbf{y}_{t-i} + \boldsymbol{\varepsilon}_t \qquad (7)$$

where $\mathbf{v}(s_t)$ is a K-dimensional column vector of regime-dependent intercept terms, $\mathbf{v}(s_t) = [v_1(s_t), v_2(s_t), ..., v_K(s_t)]'$; the $\mathbf{A}_i(s_t)$'s are $K \times K$ matrices of regime-dependent autoregressive parameters; $\boldsymbol{\varepsilon}_t \sim NID(\mathbf{0}, \Sigma(\mathbf{s}_t))$ and $s_t \in \{1, ..., M\}$.[22]

In short, there are several advantages of adopting the MS-VAR approach to test Equation 3.

- The MS approach allows the coefficient estimates to change over time (time variant) in response to possible switches in the policy. Thus, the shifts in the parameter estimates of the key variables should reveal any changes in the policy commitments and the priorities of the monetary authority during the pre-IT and the post-IT periods.
- The test results disclose the type of regimes (low (stable) and high (volatile) regimes) that the IT period falls under, and allow us to analyze whether the implementation of the IT only occurs under one particular regime. The period of stable regime is the one with smaller standard error. As discussed, the IT policy is credible *if and only if* the role of expected inflation is significant under both stable and volatile regimes. That is to say for the policy to be credible, the central bank must be committed to address expected inflationary pressure under *both* stable and less conducive economic environment. This way we can ensure to some extent that the lower inflation rate is not simply due to the economic environment/condition.[23]

Prior to conducting the MS-VAR testing, the expected output gap $(E_t y_{t+1} - y^*)$ and the expected inflation $(E_t \pi_{t+1})$ variables in Equation 4 have to be estimated. Following Valente (2003), the expected rate of inflation can be obtained using a preliminary signal extraction procedure. This process would extract the unobservable expected rate of inflation

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[22] All of the above Markov-switching VAR models will be estimated using the expectation-maximization (EM) algorithm (see Hamilton, 1989 and Krolzig, 1997).

[23] The possible association between the economic condition and the commitment to inflation targeting has not been addressed by most of the past studies.

from the observed rate of inflation by applying the law of iterated projections following the Kalman filter technique. Since we are investigating the monetary policy reaction function of the Bank of Thailand (BOT) and the Bank of Indonesia (BI), it is only appropriate that we extract the expected inflation series from the central banks' official targeted inflation rates, namely the core inflation rate for the BOT and the headline inflation for the BI.

To estimate the expected output gap variable, we adopt two stages of estimation:

- The Hodrick and Prescott (1997) filtering approach is employed to obtain a smooth estimate of the long-run trend component of the industrial production (IP) index as proxy for output. The gap between the actual IP index and its long-run trend component would give us the proxy of the actual output gap at time (t).
- Next, we employ the Kalman filtering technique, as described earlier, to estimate the expected output gap $(E_t y_{t+1} - y^*)$.

For the sake of brevity, the estimates for the expected inflation and the output gap will not be reported.

Dictated by the availability of the continuous monthly key policy interest rate data series for Thailand, our MS-VAR testing cover only the period of January 1998 to November 2008, thus excluding the pre-1997 financial crisis period. As for the Indonesian case, the observation period starts from January 1994 to November 2008. Before conducting the MS-VAR testing, we evaluate the unit-root properties on all variables in Equation 4.[24] We found

[24] Here again, we employed four Unit-Root tests: - the BLS; -the standard Augmented Dickey Fuller (ADF) test; - the Phillip-Perron test; and – the KPSS test. For the sake of brevity, we do not report the results in the paper.

that all relevant variables for both economies to be generally stationary at their levels ---(I(0)) series.

Table 7 presents the estimates from the MS-VAR. To incorporate regime shifts in the conditional variance, two and three states were estimated. Testing was performed with both the normal and the *t*-distribution, and with different lags based on the Akaike Information Criteria (AIC). In order to arrive at the most plausible specification in describing the conditional volatility, a bottom-up strategy following Krolzig (1997) was pursued. The starting point is to formally test the null hypothesis of no regime switch ($m = 1$) against the alternative of a regime switch ($m = 2$). If the conventional likelihood ratio test suggests that the null hypothesis of no regime switching can, indeed, be rejected, we then proceed to test the null hypothesis of two regimes ($m = 2$) against the alternative of three regimes ($m = 3$). [25] On the basis of the set of bottom-up testing, the monetary policy reaction functions (Equation 4) for these two Southeast Asian countries are adequately characterized as having at most two regimes (stable (Regime 1) and volatile (Regime 2)) during the period of observations.[26]

In general, we find the significant coefficient estimates to have theoretically consistent signs (Table 7). Based on the sizes of the standard errors and the dates listed, it is clear that Regime 2 associates predominantly with the periods of economic turbulences

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[25] A word of caution is necessary in interpreting this result. In Markov switching models, the usual regularity conditions justifying the use of classical tests such as the likelihood ratio test are violated. This is because, under the null hypothesis of only one state, the transition probabilities are not identified, implying that the sample likelihood function is flat with respect to these parameters. As in Hamilton and Susmel (1994), the likelihood ratio test results mentioned here should be treated more as a descriptive summary than formal statistical tests. The likelihood ratio test statistics can be made available upon request.

[26] We also apply the LR statistics to choose the optimal MS-VAR model, i.e. to test the null of MSH and MSIH model against the alternative of the more unrestricted MSIAH model.

(Table 8). As expected, the early and peak stages of the 1997 financial crises, covering the period of third quarter of 1997 to late 1999 have predominantly fallen under the regime 2. For the case of Thailand, a large part of the country's IT period has taken place during the volatile regime, especially since August 2003. In contrast, the IT policy in Indonesia had largely benefited from a relatively stable period (Regime 1). Whilst the breakdowns of the regimes suggest that the management of the policy rate in Thailand has seen more turbulent period during the recent sub-prime crisis, both countries were in Regime 2 during the immediate aftermath of the closure of the Lehman Brothers in September 2008.

Most importantly, our test results provide adequate evidence that managing inflationary expectation has indeed been the focus of the monetary policies of these economies during both stable and volatile regimes. Hence, there has indeed been a credible commitment to the implementation of the IT policy in these two economies. In particular, the commitment of Bank of Thailand to pursue the IT policy has withstood a predominantly turbulent period.

We also find that during the stable period (Regime 1), Indonesia and Thailand had adopted a flexible approach to the IT policy, or known as IT *framework*.[27] The policy rate has been accordingly adjusted to respond to exchange rate volatility, inflationary expectation, and expected output gap (Table 7). Interestingly, a greater policy focus has been placed on inflationary expectation during the turbulent period. The test results seem to suggest that during the volatile period, the output gap did not significantly influence the interest rate policy of both Bank Indonesia and Bank of Thailand. In the case of Thailand, the monetary

[27] This finding supports that of Alamsyah, et.al. (2001) and Kubo (2008).

authority shifted to a full IT *rule* from IT *framework* during Regime 2. As for Indonesia, managing exchange rate volatility continued to be one of the objectives of the interest rate policy, in addition to anchoring inflationary expectation. This finding on the importance of the management of exchange rate volatility supports the official statement of Bank Indonesia on its IT policy implementation framework (Alamsyah, et.al. (2001)).

In summary, a credible and flexible commitment to IT framework is evident in the cases of Indonesia and Thailand. Both Bank of Indonesia and Bank of Thailand pursued a forward looking policy to manage price, exchange rate volatilities, and output gaps. The country's monetary authorities were steadfast on anchoring inflationary expectation, especially during the Regime 2. During a more stable period, the IT policy was adjusted to aim at balancing inflation, exchange rate volatilities, and output stabilities (Table 7).

5. Concluding Remarks

A series of initiatives have been proposed and implemented by the Asian governments to prevent the repeat of the 1997 financial crises in their economies. Deepening of the bond market is another important step taken to reduce reliance on bank financing. Recent years have also seen impressive growths in the net foreign asset holdings of the Asian economies. In addition to the strengthening of the key financial institutions and reducing potential vulnerabilities of the financial sector, there is a growing consensus among the policy makers and academics in general that consistent macroeconomic policy frameworks must be in place. In pursue of credible anchor of monetary policy, maintaining price stability, either as explicit or implicit nominal anchor of the monetary policy framework, has clearly gained popularity in the last decade. Prior to the outbreak of the 1997 East Asian financial crises, none of the Asian economies adopted the IT policy. In fact, in total only five developed economies have officially announced their inflation targets before 1997. By end of 2006, 24 economies have inflation targeting as the official policy objective of their monetary authorities, and more than half of these economies are from the emerging markets.

Our paper has examined the implementation and the performance of the IT policy in Indonesia and Thailand. We conducted in-depth analyses on the pass-through effects, both for non-tradable and tradable prices in the local economy. In addition, the markov-switching approach is employed to test for the shift in the monetary policy rule of the monetary authorities during the pre-and post-IT periods. In general, these economies have seen their inflation rates to fall during the post-IT period. The pass-through effects in these economies have in general declined considerably, except for the tradable price of Indonesia. Furthermore, we find robust evidence of credible implementation of the IT policy these two economies during both stable and volatile period. While Indonesia continued with its *flexible IT framework*, Thailand shifted to *strict IT rule* during the turbulent period.

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Table 1:

Sterilization Coefficients [a,b]

	2000-2007	2000-2002	2003-2004	2005-2007
India	-0.79*	-0.72*	-1.00*	-0.72*
Indonesia	-0.82*	-0.85*	-0.79*	-0.77*
Korea	-1.00*	-0.93*	-1.02*	-1.06*
Philippines	-0.85*	-0.72*	-0.92*	-1.15*
Thailand	-0.87	-0.91*	-0.69	-0.90*

Source: Asia Pacific Regional Economic Outlook, IMF, October 2007.

[a] The sterilization coefficient is the coefficient from a regression on the contribution of net domestic assets to reserve money growth on the contribution of net foreign assets to reserve money growth. Net domestic assets in the regression are defined as reserve money minus net foreign assets.

[b] An asterik denotes that the null hypothesis of full sterilization (a coefficient equal to or smaller than -1) cannot be rejected at the 95 percent confidence level.

Table 2:
Implementation and Design of Inflation Targeting Framework

Country	Date Introduced	Target Price Index	Inflation Target Level	Target Horizon	Policy/ Official Interest Rate	Target Set By	Escape Clauses	Accountability of Target Misses	Publication and Transparency
Indonesia	July 2005	CPI	2000: 3 – 5% 2001: 4 – 6% 2002: 9 – 10% 2003: 9% (± 1%) 2004: 5.5 % (± 1%) 2005: 6% (± 1%) 2006: 8% (± 1%) 2007: 6% (± 1%) 2008: 5% (± 1%)	Indefinite	1-month SBI (Certificate of Bank Indonesia) rate	Government in consultation with Central Bank (CB)	None	None, but the House of Representatives can request progress report at any time.	Periodically publications of: ▪ Weekly Report ▪ Monthly Indonesian Financial and Economic Statistics ▪ Monthly Review of Monetary Policy ▪ Quarterly Monetary and Economic Progress ▪ Quarterly Report on Monetary Policy Progress ▪ Annual Report
Thailand	May 2000	Core CPI[a]	Since 2000: 0 – 3.5%	Indefinite	14-day repurchase rate	Government in consultation with CB	None	Public explanation of target breach and measures taken as well as time required to bring inflation within the target	▪ Publication of inflation report. ▪ Publication of inflation projections. ▪ Publication of the minutes of monetary policy meetings.

Note:

a) Thailand core CPI is defined as CPI excluding raw food and energy prices.

Sources: Compiled by authors from the Bank Indonesia and the Bank of Thailand web-pages, Mishkin & Schmidt-Hebbel (2001), Ho & McCauley (2003)

Table 3: Pre- and Post-IT Headline Inflation and GDP Growth Rates at $(t-2)$ to $(t+2)$ [1]

(Mean and Standard Deviation)[2]

	Inflation at $(t-2)$	Inflation at $(t+2)$	Inflation January 2006 – December 2008	GDP Growth rate $(t-2)$	GDP Growth rate $(t+2)$	GDP Growth Rate q1, 2006 – q4, 2008	Official Starting Dates of IT Framework
Indonesia	6.5 (±1.02)*	11.74 (±4.99)*	9.91 (±4.04)*	5.07 (±0.91)*	5.65 (±0.52)*	5.94 (±0.58)*	July 2005
Thailand	Headline: 2.81 (±3.82)* Core: 3.28 (±2.98)*	Headline: 1.51 (±0.75)* Core: 1.01 (±0.36)*	Headline: 4.13 (±2.17)* Core: 1.89 (±0.81)*	-1.94 (±8.80)*	3.41 (±1.54)*	4.29 (±2.77)*	May 2000

[1]/ $(t-2)$ denotes two years prior to the adoption of inflation targeting framework and $(t+2)$ implies two years after the adoption of IT framework.

[2]/ Mean for inflation is calculated as the monthly average of year on year inflation $\left(\Delta p = \left[\frac{CPI_t - CPI_{t-12}}{CPI_{t-12}}\right]*100\right)$. The mean for GDP growth rate is the average of the annualized quarterly GDP growth rate $\left(\Delta GDP = \left[\frac{GDP_t - GDP_{t-4}}{GDP_{t-4}}\right]*100\right)$. Note: GDP is in local currency at constant market price.

* The numbers inside ( ) are the standard deviation.

Table 4: BLS-rolling unit-root test results

	Indonesia		Thailand	
Non-tradable	$\widehat{t}_{DF}^{\max}$	$\widehat{t}_{DF}^{\min}$	$\widehat{t}_{DF}^{\max}$	$\widehat{t}_{DF}^{\min}$
$\log P_t$	-0.55	-2.25	-0.31	-2.51
$\Delta \log P_t$	-2.76	-4.92	-7.67	-45.27
Tradable				
$\log P_t$	1.17	-1.81	-0.39	-1.03
$\Delta \log P_t$	-7.38	-16.69	-5.32	-13.26
Other Key Variables				
$\log P_t^*$	0.43	-0.01	-0.04	-2.02
$\Delta \log P_t^*$	-7.58	-9.37	-7.58	-9.37
$\log E_t$	-0.67	-2.13	-1.17	-3.63
$\Delta \log E_t$	-3.22	-4.69	-3.13	-4.90
$\log Openness_t$	1.31	-0.96	0.63	-1.17
$\Delta \log Openness_t$	-2.21	-4.90	-1.50	-4.60*

Notes: Critical value for the maximal DF statistics at 5 percent level for total observation set of around 250 (or less) is (-1.48) and critical value for the minimal DF statistics at 5 percent for the same set of observation is (-4.85). Our total observation set is around 220.*/ $\widehat{t}_{DF}^{\min}$ is lower than the critical value for the minimal DF statistics at 10 percent.

Table 5: Pass-Through Effects

	Indonesia (CPI)	Indonesia (PPI)	Thailand (CPI)	Thailand (PPI)
Constant	-0.218 (-5.173)***	0.004 (5.299)***	0.011 (2.109)**	-0.034 (-2.444)**
$\Delta \log E_{t-1}$	(---)	0.323 (11.575)***	(---)	0.223 (4.992)***
$\Delta \log E_{t-2}$	0.069 (4.128)***	-0.194 (-5.033)***	(---)	(---)
$\Delta \log E_{t-3}$	(---)	(---)	(---)	-0.232 (-2.629)***
$\Delta \log E_{t-4}$	(---)	0.090 (3.692)***	0.021 (2.721)***	0.167 (2.307)**
$\Delta \log P^*_{t-1}$	(---)	(---)	(---)	(---)
$\Delta \log P^*_{t-2}$	(---)	(---)	(---)	(---)
$\Delta \log P^*_{t-3}$	(---)	(---)	(---)	(---)
$\Delta \log P^*_{t-4}$	(---)	(---)	(---)	-0.129 (-1.745)*
$\Delta \log P_{t-1}$	0.818 (10.484)***	0.888 (12.823)***	0.972 (13.447)***	0.833 (8.897)***
$\Delta \log P_{t-2}$	-0.345 (-5.059)***	-0.389 (-5.766)***	-0.206 (-2.992)***	-0.366 (-5.228)***
$\Delta \log P_{t-3}$	(---)	(---)	(---)	(---)
$\Delta \log P_{t-4}$	(---)	(---)	(---)	(---)
$\Delta \log E_{t-1} * DIT$	-0.469 (-3.304)***	(---)	0.067 (2.257)**	0.386 (2.088)**
$\Delta \log E_{t-2} * DIT$	0.402 (2.524)**	(---)	(---)	-0.626 (-3.387)***
$\Delta \log E_{t-3} * DIT$	(---)	(---)	-0.188 (-3.428)***	(---)
$\Delta \log E_{t-4} * DIT$	(---)	(---)	0.105 (2.319)**	(---)
$\Delta \log P_{t-1} * DIT$	-0.394 (-2.826)***	(---)	(---)	0.206 (2.085)**
$\Delta \log P_{t-2} * DIT$	0.255 (1.820)*	0.573 (4.258)***	(---)	(---)
$\Delta \log P_{t-3} * DIT$	(---)	-0.685 (-3.692)***	(---)	(---)
$\Delta \log P_{t-4} * DIT$	-0.248 (-2.115)**	0.295 (2.303)***	-0.129 (-2.962)***	(---)
ΔOpenness$_{(t-1)}$	-0.0002 (-3.089)***	-0.0001 (-1.685)*	(---)	(---)
ΔOpenness$_{(t-2)}$	(---)	(---)	(---)	(---)
ΔOpenness$_{(t-3)}$	(---)	(---)	(---)	(---)
ΔOpenness$_{(t-4)}$	(---)	(---)	(---)	(---)
Adj R-squared	0.860	0.884	0.784	0.674
Prob (LM-test)	0.119	0.395	0.258	0.633
Prob (F-stat)	0.000	0.000	0.000	0.000

Note: (---) implies not significant, hence excluded from the final test;
( ) t-statistics; */10% significant; **/5% significant; ***/1% significant

Table 6: Summary of Impact of IT on the Pass-Through Effects (1)

	IT Impact on Short-Run Pass-Through	IT Impact on Long-Run Pass-Through	Inflation Inertia
	$\left(\sum\beta_1 + \sum\beta_4\right) - \sum\beta_1$	$\left(\frac{\sum\beta_1 + \sum\beta_4}{1-\left(\sum\beta_3 + \sum\beta_5\right)}\right) - \left(\frac{\sum\beta_1}{1-\sum\beta_3}\right).$	$\sum\beta_5$
1. Non-Tradable			
Indonesia	-0.067	-0.129	-0.387
Thailand	-0.016	-0.048	-0.129
2. Tradable			
Indonesia	0.000	0.251	0.183
Thailand	-0.240	-0.547	0.206

Note:
[1/] (-) indicates that IT has managed to reduce the pass-through effects and inflation inertia.

Table 7: the MS-VAR Test Results

	Indonesia (Headline) **MSIAH(2,2)** (January 1994 – November 2008)		**Thailand (Core)** **MSIAH(2,3)** (Jan 1998 - November 2008)	
	Regime 1	**Regime 2**	**Regime 1**	**Regime 2**
Constant	-0.232 (-2.403)**	3.265 (2.569)**	-0.197 (-12.816)***	-0.003 (-0.548)
r_{t-1}	1.161 (33.444)***	0.986 (5.901)***	0.254 (2.655)**	0.167 (2.672)***
r_{t-2}	-0.162 (-5.376)***	-0.209 (-1.522)	-0.128 (-1.149)	0.035 (0.565)
r_{t-3}	----	----	-1.267 (-9.789)***	0.122 (2.343)**
q_{t-1}	-0.099 (-0.170)	11.769 (2.235)**	-1.015 (-4.247)***	-0.027 (-0.079)
q_{t-2}	3.672 (4.734)***	14.892 (2.911)***	1.707 (8.269)***	-0.077 (-0.192)
q_{t-3}	----	----	0.407 (1.489)	-0.168 (-0.535)
$E_{t-1}\pi_t$	28.645 (5.589)***	-5.822 (-0.062)	39.636 (8.421)***	1.967 (0.466)
$E_{t-2}\pi_{t-1}$	16.182 (2.571)***	239.06 (3.529)***	-14.266 (-3.449)***	13.188 (2.811)***
$E_{t-3}\pi_{t-2}$	----	----	21.339 (5.622)	-1.887 (-0.438)
$E_{t-1}y_t - y^*$	0.025 (1.737)*	0.030 (0.105)	-0.006 (-1.377)	0.0002 (0.084)
$E_{t-2}y_{t-1} - y^*$	-0.024 (-1.868)*	-0.239 (-0.914)	-0.010 (-2.137)**	-0.001 (-1.121)
$E_{t-3}y_{t-2} - y^*$	**----**	**----**	0.091 (-17.938)***	0.0006 (0.487)
Std Error	0.367	2.546	0.032	0.046

Note: The numbers inside ( ) are the t-statistics. ***, **, and * denote significance at 1%, 5% and 10% respectively. T-test critical values: at 1% = 2.66; at 5%=2.00 and at 10% =1.67.

Table 8: MS-VAR Stable and Volatile Regimes

	Indonesia	Thailand
Regime 1: Stable Period	1994:1 - 1997:7 1997:11 - 1997:11 1998:2 – 1998:3 1999:1 – 1999:3 1999:8 – 1999:8 2000:1 – 2000:6 2000:9 – 2001:6 2001:11 - 2005:9 2005:11 - 2008:9	1998:2 - 1998:5 1998:7 – 1998:12 1999:3 – 1999:4 2001:6 – 2001:6 2003:7 – 2003:7
Regime 2: Volatile Period	1997:8 – 1997:10 1997:12 – 1998:1 1998:4 – 1998:12 1999:4 – 1999:7 1999:9 – 1999:12 2000:7 – 2000:8 2001:7 – 2001:10 2005:10 – 2005:10 2008:10 – 2008:11	1998:1 - 1998:1 1998:6 – 1998:6 1999:1 - 1999:2 1999:5 – 2001:5 2001:7 - 2003:6 2003:8 – 2008:7 2008:8 – 2008:11

Figure 1: Year on Year Core and Headline Inflations of Thailand

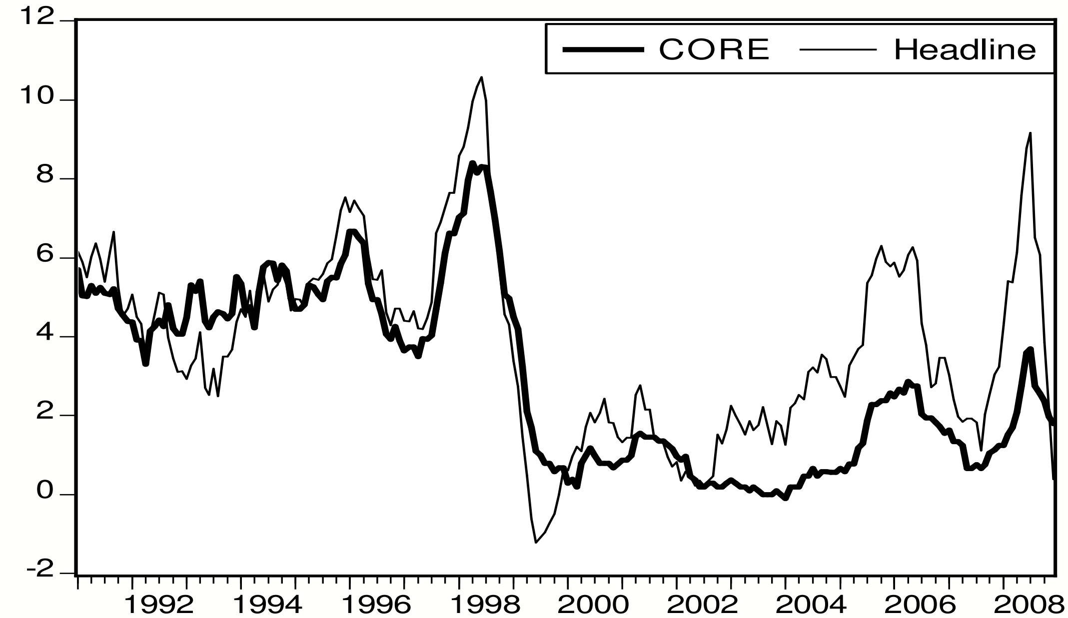

Figure 2: Monthly CPI based Inflation in Indonesia $\left(\ln P_t - \ln P_{t-1}\right)$

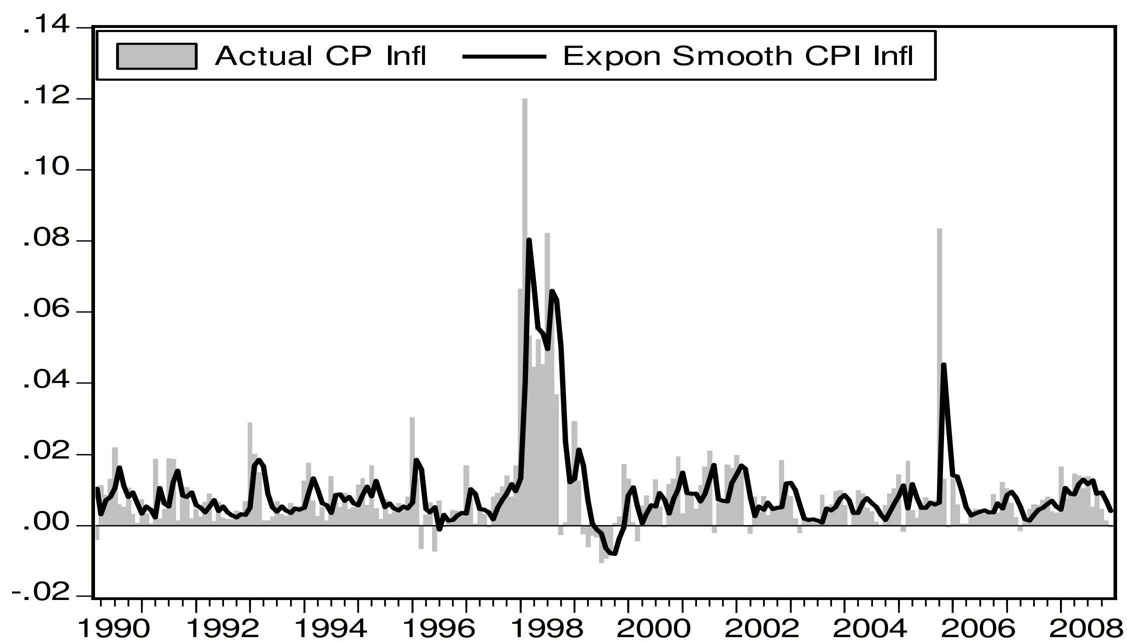

Figure 3: Monthly CPI based Inflation in Thailand $\left(\ln P_t - \ln P_{t-1}\right)$