Assessing the Performance of Inflation Targeting in East Asian economies
— A Co-integration Approach between Money and Inflation —

Hiroyuki Taguchi

Vice President

Policy Research Institute, Ministry of Finance

Chizuru Kato

Senior Economist

Policy Research Institute, Ministry of Finance

March 2010

Assessing the Performance of Inflation Targeting

in East Asian economies

— A Co-integration Approach between Money and Inflation —

Hiroyuki Taguchi and Chizuru Kato[1]

Policy Research Institute, Ministry of Finance

Abstract

This paper aims at assessing the performance of the inflation targeting framework from the quantitative perspective of the money and inflation relationship, focusing on the four East Asian economies, i.e. Korea, Indonesia, Thailand and the Philippines, who adopted the inflation targeting framework soon after the 1997-98 Asian currency crisis. Our estimation results told us that the inflation targeting framework in the sample economies, except for the Philippines, has functioned well as an anchor to curb inflation, in the sense that the framework speeds up price adjustment against money supply compared with their previous regime of pegged exchange rates. We interpret the speeding-up of price adjustment under inflation targeting framework in such a way that the framework may have been able to curb inflation through stabilizing inflationary expectations. We also found that the well-functioning inflation targeting framework was consistent with another estimation outcome: that of enhanced monetary autonomy under the post-crisis floating exchange rate regime.

Key words: inflation targeting framework, East Asian emerging market economy, money-inflation relationship, co-integration test, error correction estimation.

JEL Classification Codes: E52, F33, C23

---

1. Introduction

Inflation targeting has become popular as a framework of monetary policy among not only advanced countries but also emerging market economies since the 1990s. Under the background that many countries in the world seriously suffered from high inflation in the 1980s, there came the necessity for monetary authority to make a solid commitment to lower inflation through curbing expected inflation without sacrificing output and employment, thereby inflation targeting framework having been adopted at first by such advanced countries as New Zealand, Canada, the United Kingdom, Sweden and Australia in the early stage of the 1990s. A number of emerging market economies with pegged exchange rate regimes have experienced unhappy financial crises under the drastic increase in international capital flow in the 1990s, and thus most of them have switched to the floating exchange rate regime. Given the need for emerging-market countries to search for alternative nominal anchors, inflation targeting have been adopted by such countries as Chile, Brazil, South Africa and East Asian countries (Korea, Indonesia, Thailand, and the Philippines) since the 1990s-2000s. This seems to have been probably because inflation targeting, which appears to have been successfully used by a number of advanced countries, has become as an attractive alternative anchor for emerging market economies.

The question is how we can evaluate the performance of the inflation targeting framework that has so far been adopted. As far as the cases of emerging market countries are concerned, there have been less than sufficient advances in research on inflation targeting to date, and consensus views have not been formed in academic literature (see Section 2 below). Especially, in East Asian countries, which only started to introduce inflation targeting about ten years ago, there is little accumulation of academic studies and analyses on the performance of their inflation targeting. The largest difficulty that emerging market economies, not advanced countries, are facing in performing inflation targeting is the issue of how to manage the exchange rate under the condition that their external debt is primarily denominated in U.S. dollars. A framework of inflation targeting can be realized only when monetary autonomy is secured under floating exchange rate regime. Emerging market economies have, however, a "fear of floating," which comes from a lack of credibility toward currency value (see Calvo and Reinhart, 2002). Their care for exchange rate volatility prevents emerging market countries from concentrating their monetary policy fully on inflation targeting.

This article, given the background mentioned above, aims at assessing the performance of inflation targeting framework focusing on the cases of East Asian

countries from the quantitative perspective of money and inflation relationship. To be specific, the study compares the money-inflation relationship under different monetary regimes— inflation targeting regime with floating exchange rate, and pegged exchange rate regime without inflation targeting—through conducting co-integration test for investigating the existence of a long-run relationship between money and inflation, and then estimating an error-correction model for examining price adjustment speed against money supply. We intend to show that the inflation targeting framework, compared with a pegged exchange rate regime, consolidates co-integration between money and inflation, and speeds up price adjustment against money supply through affecting inflationary expectations, i.e. with the less sacrifice of output and employment, on the assumption that monetary autonomy holds under a floating exchange rate regime.

The paper is organized as follows. Section 2 reviews previous studies and clarifies this paper's position. Section 3 presents empirical analyses, introducing the methodology and data and discussing the estimate results. Section 4 summarizes the results and concludes.

2. Previous Studies and Our Position

This section first overviews the literature on the inflation targeting framework, and then focuses on previous studies on the performance of emerging market economies who adopted inflation targeting for monetary policy, and finally clarifies the position of this paper.

Overview

There are a number of studies that deal with the theories and empirical analyses on inflation targeting. Bernanke and Mishkin (1997), Mishkin and Posen (1997), and Bernanke *et al*. (1999) are the prominent papers that described a comprehensive overview of the major issues on inflation targeting. Mishkin and Schmidt-Hebbel (2007) conducted a comprehensive study to examine the performance of inflation targeting in industrial countries.

Bernanke and Mishkin (1997), discussing inflation targeting with some details of how this approach has been implemented in practice, represented their assessment that this approach—when construed as a framework for making monetary policy, rather than as a rigid rule—has a number of advantages, including more transparent and coherent policymaking, increased accountability, and greater attention to long-run considerations in day-to-day policy debates and decisions.

Mishkin and Posen (1997) examined the experience of the first three countries to adopt an inflation-targeting strategy—New Zealand, Canada, and the United Kingdom—as well as Germany, which had a monetary targeting scheme that incorporated many elements of inflation targeting even earlier, and found that the countries adopting a numerical inflation target have successfully enjoyed low inflation rates with the benefits of increased central bank accountability, heightened public understanding of monetary policy, and an improved climate for economic growth.

Bernanke *et al*. (1999), examining how the monetary policy strategy of inflation targeting has worked in a number of countries using case studies of their experiences, presented the following five elements that characterize a framework of inflation targeting: (a) making public a specific numerical inflation target; (b) the central bank making an explicit commitment, by means of institutional arrangements, to setting price stability as its ultimate goal, and economic growth and employment as its secondary goals; (c) a forward-looking monetary policy by comprehensive consideration of all the economic indicators related to price stability; (d) accountability to market participants and the public for monetary policy decisions and the reasons that led to them in relation to achieving inflation targets; and (e) the central bank holding itself accountable to achieving the inflation target.

Mishkin and Schmidt-Hebbel (2007) provided panel evidence for inflation-targeting countries and a control group of high-achieving industrial countries that do not target inflation, and suggested from their evidence that inflation targeting helps countries achieve lower inflation in the long run, have smaller inflation response to oil-prices and exchange-rate shocks, strengthen monetary policy independence, improve monetary policy efficiency, and obtain inflation outcomes closer to target levels.

To sum up the above-mentioned overview, inflation targeting adopted in advanced countries appears to be considered as a supportive framework for monetary policy and macro-economy.

Studies on Emerging Market Economies

When we focus on the cases of emerging market economies who have adopted inflation targeting, the empirical evidence has been relatively scarce, probably because most of them have no more than around ten years' experience since their adoption of inflation targeting.

Mishkin (2000; 2004), discussing the advantages and disadvantages of inflation targeting in emerging market countries, argued that although inflation targeting is more complicated in emerging market countries and thus is not a panacea, when done

correctly, inflation targeting can be a powerful tool to help promote macroeconomic stability in these countries. Picking up the Chilean and Brazilian successful examples, he also noted that the success of inflation targeting cannot be solely attributed to the actions of the central bank: supportive policies such as the absence of large fiscal deficits and rigorous regulation and supervision of financial sector have been crucial to its success. The International Monetary Fund (IMF), in the World Economic Outlook in the Spring of 2001, concluded that the combination of inflation targeting and a floating exchange rate has worked relatively well in emerging market countries, based on the findings of Schaechter *et al*. (2000) on the inflation targeting experiences of six countries (Brazil, Chile, the Czech Republic, Israel, Poland and South Africa). Lin (2009) evaluated the treatment effect of inflation targeting in thirteen developing countries that have adopted this policy by the end of 2004. Using a variety of propensity score matching methods, it showed that, on average, inflation targeting has large and significant effects on lowering both inflation and inflation variability in these thirteen countries, and also revealed that the performance of a given inflation targeting regime can be affected by a country's characteristics such as the government's fiscal position, the central bank's desire to limit the movements of exchange rate, its willingness to meet the preconditions of policy adoption, and the time length since the policy adoption.

Looking at cases in Latin America, Mishkin and Savastano (2001) examined the advantages and disadvantages of three basic monetary frameworks—a hard exchange-rate peg, monetary targeting, and inflation targeting— and concluded that it depends on the country's institutional environment. Concerning inflation targeting, they argued that in countries such as Chile, which can constrain discretion, inflation targeting is likely to produce a monetary policy that keeps inflation low yet appropriately copes with domestic and foreign shocks. Fraga *et al*. (2003), picking up the Brazilian experience, argued that inflation targeting in emerging market economies has been relatively successful but has proven to be a challenging task due to the volatility of output, inflation, and interest rate and exchange rate, and recommended: i) high levels of communication and transparency; ii) target bands treated mainly as communication devices; iii) a methodology to calculate the convergence path following a shock; and iv) better IMF conditionality under inflation targeting.

Concerning the cases of East Asian countries, Ito and Hayashi (2004), through a cross-country comparison of inflation targeting practices among Korea, Indonesia, Thailand, and the Philippines, concluded that the introduction of inflation targeting has promoted sound monetary policy and contributed to enhancing the transparency and accountability of the monetary policy conduct. At the same time, they presented the

following two recommendations, considering the characteristics of emerging market economies: emerging market countries should set an inflation target central rate slightly higher and a target range slightly wider than a typical advanced countries; small, open economy countries may pursue both an inflation target range and an implicit basket band exchange rate regime, as both targets are expressed in a range (the targets work as the source of stability in expectations, and the ranges allow some flexibility). Hayashi (2003), focusing on Korean inflation targeting as the first example in Asia, evaluated its performance by stating that the more independent legal status of the Bank of Korea, a wider band for the target and a longer target horizon would be helpful in making the framework more effective. Siregar *et al.* (2008) highlighted the basic features of the inflation targeting (IT) policies adopted by Indonesia and Thailand, and evaluated their overall performance by employing a markov-switching approach to examine the monetary reaction functions of the central banks. They showed that these economies have seen their inflation rates decline during the post-IT period, and that pass-through rates for both tradable and non-tradable prices in the two emerging markets have also declined; more importantly, no trade-offs between output growth and inflation have been reported. They also pointed out that the implementation of IT policy in these two Southeast Asian economies have however largely been "flexible" rather than "strict", seeking the balance between minimizing output gap and achieving price stability.

While the fore-mentioned literature represented supportive assessments toward inflation targeting in emerging market economies, Eichengreen(2002) offered negative messages on that issue. He argued that inflation targeting is difficult in emerging markets for three reasons: they are open; their liabilities are dollarized; and their policy makers lack credibility. He also stressed that although emerging markets that are less open, have well regulated financial institutions and markets on which foreign exposures can be hedged, and whose central banks possess a reasonable degree of policy credibility may prefer inflation targeting, the question is how many emerging markets will soon fall under this heading.

Our Position

This paper helps to place the fore-mentioned debates on inflation targeting in emerging markets in the context of observed facts, and provides empirical evidence using recent data on the assessment on the performance of inflation targeting framework. To be specific, this paper extends the existing literature in the following directions. First, we focus our assessment on the cases of the East Asian countries. Several East Asian countries adopted inflation targeting soon after the 1997-98 Asian currency crisis: Korea

instituted it in 1998, followed by Indonesia and Thailand in 2000, and by the Philippines in 2002. The literature on inflation targeting, especially the evidence on its evaluation in East Asian countries has been extremely scarce until now. It seems to be an appropriate time to get started on assessing the performance of inflation targeting, now that about ten years have passed since the East Asian countries adopted inflation targeting, thereby necessary data for its assessment having accumulated.

Second, we conduct our assessment of the East Asian countries in a *quantitative* manner using macroeconomic data. The evaluations of the cases of the East Asian countries have so far concentrated on the institutional perspective, e.g. the evaluation of the independence of the central bank in terms of legal status (again, see Hayashi, 2003). This study assesses the performance of inflation targeting by examining the quantitative relationship between money and inflation. Specifically, the co-integration relationship between money and inflation, and the price adjustment speed against money supply movement will be examined under different monetary regimes, i.e. the inflation targeting regime in the post-crisis period and the pegged exchange rate regime in the pre-crisis period. The comparison of money-inflation correlations between the two regimes enables us to evaluate whether or not inflation targeting framework functions well as an anchor to curb inflation rate, in the sense that inflation targeting, by affecting expectations, lowers inflation with less cost in stopping inflation in terms of foregone output. As for the effect of an inflation targeting framework on inflation expectations, Cerisola et al. (2009), for instance, proved that the inflation targeting framework helped anchor expectations with the dispersion of inflation expectations declining considerably.

3. Empirical Studies

We will now proceed to the empirical analysis. We herein take the following two-step estimation procedures for the pooled and individual countries, under different monetary regimes, i.e. the inflation targeting regime in the post-crisis period and the pegged exchange rate regime in the pre-crisis period. We first examine the existence of a co-integration relationship in the long run between money and inflation. Second, we run an error-correction model to investigate price adjustment speeds against money supply towards the long-run equilibrium. This section clarifies the methodology and data, then shows the estimation results and interprets the results.

3.1 Methodology

We herein specify the model for estimation first, and then explain the estimation technique for examining the co-integration relationship for ordinary time series and panel data in detail.

Specification of Model

We will now investigate the money-inflation relationship under different monetary regimes. The money-inflation relationship can be represented most simply in the form of the quantity theory of money: *M/P = kY*, where *M*, *P* and *Y* denote money, price and output respectively. The quantity theory of money tells us that the central bank, which controls the money supply, has ultimate control over the rate of inflation: if the central bank keeps the money supply stable, the price level will be stable. We expect that inflation targeting framework, through stabilizing inflationary expectations, consolidates money-inflation relationship suggested by the quantity theory, and further speeds up price adjustment against money supply.

The equation of the quantity theory is rewritten into the following logarithm form for the estimation under data constraints:

$$\ln P = \ln M - (a + b * T) \quad (1)$$

where T denotes time trends, i.e. a proxy variable for the change of output. Based on the equation, we take the following two-step estimation procedures to investigate the money-inflation relationship. As the first step, we examine the co-integration relationship between $\ln P$ and $\ln M$, following the ideas of Engle *et al*. (1987). We begin by proving that $\ln P$ and $\ln M$ are integrated in the same order of $I(1)$ process, i.e. a single unit root (which was confirmed, but the details of the test results are not reported here to conserve space). We then test the existence of co-integration between $\ln P$ and $\ln M$, by regressing Equation (1) using the OLS method, and examining whether the estimated residuals are stationary using unit root tests (for test specifications, see the next section). If the residual terms are stationary, the co-integrating relationship holds. Once the co-integrating relationship among economic series is identified, Engle *et al*. (1987) suggested as the representation theorem that the relationship can be turned into an error-correction model, which combines both the short-run dynamics and the long-run equilibrium relations among the series. Under an error correction model, we can estimate price adjustment speeds against money supply toward the long run co-integrating relationship as the second-step estimation. Specifically, the following equation can be estimated.

$$\Delta \ln P_t = C + \alpha \Delta \ln M_t + \beta(\ln P_{t-1} - \ln M_{t-1} + (a + b * T)) + \varepsilon_t \quad (2)$$

The specification above can be interpreted in such a way that the long-run behavior of money and inflation converges in their co-integrating relationship while their short-run adjustment dynamics are allowed; the deviation from long-run equilibrium is corrected through a series of partial short-run adjustments. The coefficient of the β measures the adjustment speed of price against money supply towards the long-run equilibrium. We would then expect a negative sign in β. A larger value for β means faster adjustment.[2] Under the above-mentioned estimation framework, we expect the following outcomes under different monetary regimes (inflation targeting regime with floating exchange rate, and pegged exchange rate regime without inflation targeting): the inflation targeting regime, compared with pegged exchange rate regime, would consolidate co-integration between money and inflation, and speed up price adjustment against money supply.

As we mention later, we construct for the estimation a monthly data set from January 1986 to November 2009 excluding the turbulent crisis period, for the four sample countries (Korea, Indonesia, Thailand and the Philippines). By using the data set, we conduct two kinds of estimation: the panel estimation for the pooled countries and the ordinary estimation for individual countries. We take the fore-mentioned two-step procedures for both types of estimations.

Procedures of Unit Root tests

We herein clarify in more detail the estimation technique of the unit root tests that we use in the co-integration analysis described in the previous section, for ordinary time series of individual countries and for panel data with the pooled countries.

As for the tests for ordinary time series data, we use the augmented Dickey-Fuller (ADF) test (Said *et al*., 1984). The ADF test runs a regression of the first difference of the series against the series lagged once, lagged difference terms as well as a constant and time trend optionally. We here choose to include only a constant item judging from data observation. The output of the test consists of the t-statistic of the coefficient of the series lagged and critical values for the test of a zero coefficient. If the coefficient is significantly different from zero, then the hypothesis that the series contains a unit root is rejected.

---

[2] In case of Korea, dummy variable from January to October in 2008 will be inserted for estimation (2), considering the pass-through effect on price of drastic depreciation of Korean won in that period.

Regarding the test for panel data, we adopt the following four types of panel unit root tests, which are shown in the E-Views 6: Levin, Lin, and Chu (2002), Im, Pesaran, and Shin (2003), and Fisher-type tests using ADF and PP tests (Maddala and Wu (1999) and Choi (2001)).[3] Although all the tests are characterized by the combined individual unit root tests to derive a panel-specific result, we can classify the tests on the basis of whether there are restrictions on the autoregressive process across cross-sections. One type of the tests assumes that the parameters of the series lagged are common across cross-sections. The test of Levin, Lin, and Chu (LLC) employs this assumption. The other type allows the parameters to vary freely across cross-sections. The tests of Im, Pesaran, and Shin; Fisher-ADF; and Fisher-PP are of this form. This study does not depend on the results of one type of these tests but adopts both types of tests. Although the method for all the tests can choose to include individual constants, or to include individual constant and trend terms, we choose to include individual constant only judging from data observation.

3.2 Data

The sample countries are the ones who have adopted an inflation targeting framework among the East Asian emerging market economies: Korea, Indonesia, Thailand and the Philippines. Selecting the sample periods in monthly term is crucial in our analysis because its purpose is to compare the money-inflation relationship between before and after adopting inflation targeting. The period after adopting inflation targeting is the one from its executed month to the present time (November 2009): Korea from April 1998; Indonesia from January 2000; Thailand from April 2000; the Philippines from January 2002. We specify the period before adopting inflation targeting as the one in which exchange rate was substantially pegged to U.S. dollar as a nominal anchor: different monetary regimes from inflation targeting. As the starting month of that period, we set "January 1986" when all the four countries had adopted pegged exchange rate regimes regardless of their formality[4] (until 1985, the Philippines had experienced a floating exchange rate regime). The ending months are the ones in which the pegged exchange rate regime came to an end due to the outbreak of the Asian financial crises: Korea in November 1997; Indonesia in July 1997; Thailand and the

_____

[3] The description in this section is based on the EViews 6 User's Guide. The Guide also includes the tests of Breitung (2000) and Hadri (2000). The former was not adopted in this study since the test specification is confined to including both individual constant and trend terms. The latter was not adopted too because it is said to over-reject the null of stationarity, and may yield results that directly contradict those obtained using alternative test statistics (see Hlouskova and Wagner, 2006).

[4] For the classification of exchange rate regime, we follow Reinhart *et al*. (2009).

Philippines in June 1997.

Our data source for money supply and price indexes comes from the International Financial Statistics of the International Monetary Fund (IMF). For money supply, we use "Money" in line 34 of the Country Tables, which is frequently referred to as M1, indicating the stock of narrow money comprising transferable deposits and currency outside deposit money banks. For price index, we use "Consumer Prices" in line 64, the most frequently used indicators of inflation (base period 2005=100).

3.3 Estimation Results

We will first look at the results of the first step's estimates: unit root tests on estimated residuals for identifying the co-integration relationship between money and inflation. As for the results of panel unit root test for the pooled countries in Table 1, both the cases of pre- and post- inflation targeting reveal the rejection of the null hypothesis of a unit root on estimated residuals in at least three types of tests at the significant level of one to five percent. The results of panel unit root tests seem to support roughly the co-integration relationship between money and inflation regardless of the different monetary regimes.

Table 2 reports the results of unit root tests for individual countries. Similar to the test results of pooled estimates, both the cases of pre- and post- inflation targeting indicate the rejection of the null hypothesis of a unit root on estimated residuals in the ADF test, thereby implying the existence of a co-integration relationship between money and inflation regardless of the different regimes.

We next look at the results of the second step's estimates: error-correction estimates for investigating price adjustment speed against money supply towards the long-run co-integrating relationship between money and inflation. As for the results of pooled estimates in Table 3, both cases of pre- and post- inflation targeting have a coefficient of β showing the adjustment speed with the correct sign and significance at one percent. Comparing the adjustment speeds, however, the speed in post- inflation targeting (–0.01768) is greater than that in pre- inflation targeting (–0.01228). It tells us that inflation targeting regime, compared with pegged exchange rate regime, might speed up price adjustment against money supply.

Table 4 reports the results of error-correction estimates for individual countries. Korea has a significant coefficient of β with the correct sign in the post- inflation targeting period, not in the pre- inflation targeting one. In Indonesia and Thailand, while both cases of pre- and post- inflation targeting have a coefficient of β with the correct sign and significance, the coefficients in post- inflation targeting are greater than those

in pre- inflation targeting. On the contrary, the Philippines has a significant coefficient of β with the correct sign only in the pre- inflation targeting period. All in all, Korea, Indonesia and Thailand, but not the Philippines, show a higher speed of price adjustment against money supply under the inflation targeting regime than under the pegged exchange rate regime.

3.4 Summary and Interpretation

We summarize and interpret the estimation results above as follows.

First, our estimation results basically tell us that the inflation targeting framework adopted in East Asian emerging market economies has functioned well as an anchor to curb inflation, in the sense that the inflation targeting framework speeds up price adjustment against money supply compared with the previous regime of pegged exchange rates. The error-correction estimates showed that the price adjustment speed against money supply in the post- inflation target period was greater than that in the pre- inflation targeting period for pooled countries' estimates as well as for individual countries' estimates (except for that of the Philippines). We interpret the speeding-up of price adjustment under the inflation targeting framework in such a way that the framework might have been able to curb inflation through stabilizing inflationary expectations without paying much cost of stopping inflation in terms of foregone output.

Second, the well-functioning inflation targeting framework appears to be consistent with another estimation outcome: that of enhanced monetary autonomy under the post-crisis floating exchange rate regime. Table 5 indicated estimation results on the sensitivity of the domestic interest rate against the U.S. interest rate in the selected East Asian economies, according to the extracts from of Taguchi (2009). The outcomes of error-correction estimation reported that the adjustment speed of the domestic interest rate against the U.S. rate lessened clearly from the pre-crisis pegged exchange rate regime towards the post-crisis floating regime in Korea, Indonesia and Thailand, and not in the Philippines. This outcome implies that monetary autonomy has been enhanced in Korea, Indonesia and Thailand under the post-crisis floating exchange rate regime, thereby being consistent with the estimation results of the post-crisis well-functioning inflation targeting framework in those three countries. The Philippines has maintained its soft pegged exchange rate regime even during the post-crisis period and records the highest sensitivity of domestic interest rate against U.S. interest rate among the sample cases in Table 5. This seems to be why only the Philippines did not improve its price adjustment speed against money supply, even after adopting an

inflation targeting framework, because sustaining the soft pegged exchange rate regime may have prevented the Philippines from acquiring monetary autonomy: i.e. from concentrating her monetary policy fully on achieving inflation targeting.

Third, the long-run relationship between money and inflation seems to hold regardless of different monetary regimes—in both the pre-crisis pegged exchange rate regime and post-crisis inflation targeting regime—although the price adjustment speed against money supply differs in each regime. The co-integration test identified that the long-run behavior of money and inflation converged into a co-integrating relationship in the pooled countries' estimate as well as in individual countries' estimates. This outcome implies the validity of the quantity theory of money in the long run in East Asian emerging market economies.

4. Concluding Remarks

This article set out to assess the performance of inflation targeting framework from the quantitative perspective of the money and inflation relationship, focusing on the four East Asian economies, i.e. Korea, Indonesia, Thailand and the Philippines who adopted inflation targeting frameworks soon after the 1997-98 Asian currency crisis. To be specific, the study compared the money-inflation relationship under different monetary regimes—the inflation targeting regime with floating exchange rate in the post-crisis period, and pegged exchange rate regime without inflation targeting in the pre-crisis period—by conducting co-integration testing for investigating the existence of a long-run relationship between money and inflation, and then estimating an error-correction model for examining price adjustment speed against money supply.

Our estimation results showed us that the inflation targeting frameworks in East Asian emerging market economies except for the Philippines have functioned well as an anchor to curb inflation, in the sense that the inflation targeting framework speeds up price adjustment against money supply, compared with the previous regime of pegged exchange rate. We interpret the speeding-up of price adjustment under the inflation targeting framework in such a way that the framework might have been able to curb inflation through stabilizing inflationary expectations without paying much cost of stopping inflation in terms of foregone output. We also found that the well-functioning inflation targeting framework was consistent with another estimation outcome: that of enhanced monetary autonomy under the post-crisis floating exchange rate regime.

References

Bernanke, B.S. and F.S. Mishkin. 1997. Inflation Targeting: A new Framework for Monetary policy? Journal of Economic perspectives, vol.11, no.2, Spring: 97-116.

Bernanke, B.S., T. Laubach, F.S. Mishkin, and A.S. Posen. 1999. Inflation Targeting: lessons from the International Experience. Princeton University Press.

Breitung, J. 2000. The Local Power of Some Unit Root Tests for Panel Data, in B. Baltagi (ed.), Advances in Econometrics, Vol. 15: Nonstationary Panels, Panel Cointegration, and Dynamic Panels, Amsterdam: JAI Press, 161-178.

Calvo, G. and C. Reinhart. 2002. Fear of floating. Quarterly Journal of Economics, 117 (2), 379–408.

Cerisola, M., and G. Gelos. 2009. What drives inflation expectations in Brazil? An empirical analysis. Applied Economics, 41:1215-1227.

Choi, I. 2001. Unit Root Tests for Panel Data. Journal of International Money and Finance, 20: 249-272.

Eichengreen, B. 2002. Can Emerging Markets Float? Should They Inflation Target?" Banco Central do Brazil Working Paper, No.36, February.

Engle, R.F. and C.W.J. Granger. 1987. Co-integration and error correction: representation, estimation, and testing. Econometrica. 55:251-276.

Fraga, A., I. Goldfajn, and A. Minella. 2003. Inflation Targeting in Emerging Market Economies. NBER Working Paper Series 10019.

Hadri, K. 2000. Testing for Stationarity in Heterogeneous Panel Data. Econometric Journal, 3:148-161.

Hayashi, T. 2003. Inflation Targeting and Exchange Rate Policy in Asia—An Option after the Asian Currency Crisis and Korea's Case—. JBICI Review, No.8, November: 231-258.

Hlouskova, J., and M. Wagner. 2006. The Performance of Panel Unit Root and Stationarity Tests: Results from a Large Scale Simulation Study. Econometric Reviews, 25:85-116.

Im, K. S., M. H. Pesaran, and Y. Shin. 2003. Testing for Unit Roots in Heterogeneous Panels. Journal of Econometrics, 115:53-74.

Ito, T and T. Hayashi. 2004. Inflation Targeting in Asia. Hong Kong Institute for Monetary Research, Occasional Paper, No. 1, March, 62pages.

Levin, A., C. F. Lin, and C. Chu. 2002. Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. Journal of Econometrics, 108:1-24.

Lin, S., Ye, H., 2009. Does inflation targeting make a difference in developing countries? Journal of Development Economics 89 :118–123.

Maddala, G. S., and S. Wu. 1999. A Comparative Study of Unit Root Tests with Panel Data and A New Simple Test. Oxford Bulletin of Economics and Statistics, pl.61:631-52.

Mishkin, F.S. 2000. Inflation Targeting in Emerging-Market Countries. American Economic Review, May, 90(2).

Mishkin, F.S. 2004. Can Inflation Targeting Work in Emerging Market Countries? NBER Working Paper Series 10646.

Mishkin, F.S. and A.S. Posen. 1997. Inflation Targeting: Lessons from Four Countries. Federal Reserve Bank of New York, Economic Policy Review, vol. 3: 9-110.

Mishkin, F.S. and M. Savastano. 2001. Monetary Policy Strategies for Latin America. Journal of Development Economics, vol.66, October: 415-444.

Mishkin, F.S. and K. Schmidt-Hebbel. 2007. Does Inflation Targeting Make a Difference? NBER Working Paper Series 12876.

Reinhart, C.M., and E.O. Ilzetzki. 2009. Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?" http://www.wam.umd.edu/~creinhar.

Said, S. and D.A. Dickey. 1984. Testing for unit roots in autoregressive-moving average models of unknown order. Biometrika, 71:599-607.

Schaechter, A., M.R. Stone, and M. Zelmer. 2000. Adopting Inflation targeting: Practical Issues for Emerging market Countries. International Monetary Fund. Occasional Papers.

Siregar, R., and S. Goo. 2008. Inflation Targeting Policy: The Experiences of Indonesia and Thailand. CAMA (Centre for Applied Macroeconomic Analysis in the Australian National University) Working Paper 23.

Taguchi, H. 2009. Currency Regime and Monetary Autonomy—Empirical Evidence Using Recent and Global Data from 1990 to 2007—. PRI Discussion Paper Series 09A-08, Ministry of Finance in Japan.

Table 1 Panel Unit Root Tests for Pooled Countries

	Pre- Inflation Tageting	Post- Inflation Tageting
Levin, Lin and Chu	-1.110	-0..604
Im, Pesaran and Shin	-3.436 ***	-2.376 ***
Fisher - ADF	28.333 ***	18.722 **
Fisher - PP	37.101 ***	27.946 ***
Sample	546	428

Note) ***, **, and * indicate rejection of the null of nonstationarity at the 1 percent, 5 percent, and 10 percent significance levels with critical values.

Table 2 Unit Root Tests for Individual Countries

	Pre- Inflation Tageting	Post- Inflation Tageting
Korea	-4.228 ***	-3.163 **
Indonesia	-2.960 **	-2.929 **
Thailand	-3.373 **	-2.991 **
the Philippines	-2.693 *	-2.603 *

Note) ***, **, and * indicate rejection of the null of nonstationarity at the 1 percent, 5 percent, and 10 percent significance levels with critical values.

Table 3 Error Correction Estimates for Pooled Countries

	Pre- Inflation Tageting	Post- Inflation Tageting
Constant	0.00555 ***	0.00389 ***
Standard Error	0.00025	0.00030
t-value	22.25673	12.88290
Coefficient α	-0.00493	-0.00142
Standard Error	0.00509	0.00752
t-value	-0.96898	-0.18973
Coefficient β	-0.01228 ***	-0.01768 ***
Standard Error	0.00305	0.00428
t-value	-4.02957	-4.12506

Note) ***, **, and * indicate that the coefficient is significant at the 90,95,and 99 percent levels, respectively.

Table 4 Error Correction Estimates for Individuals Countries

	Pre- Inflation Tageting	Post- Inflation Tageting
Korea		
Constant	0.00469 ***	0.00211 ***
Standard Error	0.00040	0.00036
t-value	11.6452	5.78652
Coefficient α	-0.00665	0.00151
Standard Error	0.00636	0.00673
t-value	-1.04425	0.22534
Coefficient β	-0.00672	-0.01168 **
Standard Error	0.00456	0.00519
t-value	-1.47480	-2.25038
Indonesia		
Constant	0.01378 ***	0.00680 ***
Standard Error	0.00299	0.00088
t-value	4.60415	7.66794
Coefficient α	0.01822	0.02595
Standard Error	0.02616	0.02633
t-value	0.69633	0.98561
Coefficient β	-0.02180 ***	-0.03790 ***
Standard Error	0.00891	0.01347
t-value	-2.44622	-2.81356
Thailand		
Constant	0.00395 ***	0.00241 ***
Standard Error	0.00038	0.00057
t-value	10.16023	4.17270
Coefficient α	-0.01297	-0.02798
Standard Error	0.00973	0.01950
t-value	-1.33255	-1.43480
Coefficient β	-0.01438 ***	-0.02428 ***
Standard Error	0.00538	0.00836
t-value	-2.67234	-2.90037
the Philippines		
Constant	0.00706 ***	0.00454 ***
Standard Error	0.00057	0.00043
t-value	12.38950	10.55747
Coefficient α	0.01119	-0.03684 ***
Standard Error	0.01223	0.01362
t-value	0.91455	-2.70396
Coefficient β	-0.04711 ***	0.00099
Standard Error	0.00923	0.00742
t-value	-5.10158	0.13351

Note) ***, **, and * indicate that the coefficient is significant at the 90,95,and 99 percent levels, respectively.

Table 5 Sensitivity of Domestic Interest Rate against U.S. Interest Rate

Country	Periods	Regimes	Adjustment Speed
Korea	90.01-97.11	Soft Peg	-0.150 ***
	98.07-07.12	Managed Float	-0.113 ***
Indonesia	90.01-97.07	Soft Peg	-0.305 ***
	99.04-07.12	Managed Float	-0.239 ***
Thailand	90.01-97.06	Hard Peg	-0.435 ***
	98.01-07.12	Managed Float	-0.108 ***
Philippines	90.01-93.04, 99.12-07.12	Soft Peg	-0.488 ***

Notes:

1) For details, see Taguchi (2009).

2) The 'Adjustment Speed' means a coefficient of β in error correction term of the following estimation equation.

   $\Delta r_t = C + \alpha \Delta r^*_t + \beta(r_{t-1} - r^*_{t-1}) + \varepsilon_t$ where r and r^* denote dinestic interest rate and U.S. interest rate respectively.