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Abstract

This paper examines the trends in monetary autonomy and its interaction with financial integration, currency regime and foreign reserves for the past two decades in select Asian countries viz., Thailand, Korea, Indonesia, Philippines, and India. Our main findings are as follows: First, Thailand, Korea and Indonesia, who experienced the change in currency regime towards a floating regime, have lowered the sensitivities of their interest rates (have raised monetary autonomy) after the regime change, while India without any change in currency regime has continued to raise the sensitivities of its interest rates (has lowered monetary autonomy) in line with increased financial integration. Second, in all sample economies, the accumulation of foreign reserves has contributed to retaining monetary autonomy in terms of preventing the sensitivities of interest rates from rising. We speculate that their accumulation might take a role as an anchor for monetary autonomy to the emerging market economies facing "fear of floating".

Key words: *monetary autonomy, financial integration, currency regime, foreign reserves, Asian emerging market economies, fear of floating*

JEL Classification Codes: *E52, F33, F41.*

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Introduction

The primary objective of monetary policy in Asian countries is to promote growth and employment by maintaining price stability. However, with the increased financial integration of Asian countries, monetary policy has an additional role of ensuring the stability of the financial system. The autonomy of monetary policy is one of the most fundamental issues in an open economy to both policy and academic circles. The conventional wisdom of "impossible trinity" in international macroeconomics tells us that countries can pursue only two of the three options – fixed exchange rates, domestic monetary autonomy and capital mobility. Thus, without restrictions on capital flows, fixing exchange rates constrain domestic monetary autonomy, while floating rates allow the authority to pursue an independent monetary policy. An alternative view of "fear of floating", represented by Calvo and Reinhart (2001 and 2002), argues that the lack of a currency's credibility prevents countries from pursuing an independent monetary policy, regardless of their announced regime. This "fear of floating" tends to be stronger for open or small emerging market economies (EMEs), for which currency credibility is hard to achieve. So far, no clear consensus has been reached.

The recent surge in capital inflows in EMEs under the recovery process from the 2008 global financial crisis has refocused attention on the feasibility of monetary autonomy of these economies. Large capital inflows have complicated monetary policy management with their potential to generate exchange rate appreciation, inflation pressures, or asset price boom-and-bust cycles. Since Asian countries are getting more open to trade and financial flows, exchange rate management has been accepted as tool of domestic macro management. But in the process, monetary policy autonomy is compromised creating a situation of 'Impossible trinity'. To be specific, suppose that some EME raises her interest rate to cope with inflation pressures as one of the exiting strategies, her behavior attracts capital inflow reflecting interest rate differentials with advanced economies. Capital inflows lead to exchange rate appreciation in the first place. The authority may, then, intervene in the exchange rate market to avoid currency appreciation which will damage competitiveness of trade sector. This intervention itself results in an increase in money supply, thereby re-creating inflation pressures. The authority can, alternatively, sterilize the intervention to avoid inflation pressures. This sterilization, in turn, keeps domestic interest rate at a relatively high level, thereby perpetuating capital inflows. This monetary loop is a reflection of nothing but a policy constraint in terms of endangered monetary autonomy, regardless of any hypothesis, i.e. "impossible trinity" or "fear of floating".

Asian countries have experienced financial integration in line with the progress of globalization over the last twenty years. However, several East Asian economies suffered from the 1997-98 currency crises, resulting in the currency regime shift from US-dollar-pegged exchange rate regime to a more flexible one. However, the policy objective in countries is to maintain stable exchange rate or low nominal volatility of exchange rate by keeping it within a specific range thereby compromising autonomy of monetary policy. At the same time, the objective of stable exchange rate in these select Asian economies, particularly by East Asian countries after 1997-98 crisis, has resulted in accumulation of international reserves. Considering these changes in components of "impossible trinity" and international reserves, this paper will examine the trends in monetary autonomy and its interaction with financial integration, currency regime and foreign reserves in select Asian countries. The rest of the paper is structured as follows. Section 2 reviews previous studies and clarifies the contribution of the present study. Section 3 presents the methodology and data for empirical analysis and estimation results. Section 4 summarizes the results and provides the conclusion.

1. Previous Studies and Our contribution

There are a large number of previous studies that deal with the issue of monetary autonomy. Some of them focus on its relationship with currency regime, while others investigate monetary autonomy in the context of capital control. There seem, however, to be relatively a few studies that examine monetary autonomy in the comprehensive framework of "impossible trinity". As an example, Aizenman *et al*. (2008) have carried out a comprehensive study on the linkage among the three trilemma variables (monetary independence, exchange rate stability and financial integration) and international reserves. In this section, we first outline the literature related to monetary autonomy, and then clarify our contribution by reviewing Aizenman *et al*. (2008).

1.1 Outline of Related Literature

We first review the empirical evidence on the relationship between monetary autonomy and currency regimes. For the purpose of investigating whether the choice of currency regimes affects monetary autonomy in practice, the previous studies have so far estimated the sensitivity of local interest rates to changes in international interest rates, examining whether local rates are less sensitive to base interest rate changes under the floating exchange rate regime than under a fixed regime. The existing studies have provided inconclusive evidence.

Hausmann *et al*. (1999) studied the relationship between daily movements in domestic 30-day interest rates and foreign dollar rates on sovereign bonds for Argentina, Venezuela and Mexico for the period September 1997–February 1999. It showed that movements in foreign interest rates have a maximum impact on domestic rates in Mexico (a country that floats), minimal impact in Argentina (a country with a strongly fixed regime) and intermediate effects in Venezuela (a country with limited flexibility). They also ran a similar exercise using monthly data for the 11 countries for the period from 1960 to 1998, reporting that U.S. rates affect domestic rates by 25 percent less in the countries that peg relative to other countries. Thus, they found no evidence to suggest that floating arrangements are better at insulating domestic interest rates from foreign rate movements. Frankel (1999) also reported that the coefficient on U.S. interest rates for floaters, Brazil and Mexico, seems to be higher than that for dollarizers, Panama, Argentina, and Hong Kong for the period 1986 to 1998. This also led to the speculation that emerging market securities might pay substantial risk premium, and these risk premiums might be sensitive to the U.S. government interest rates. Both Hausmann *et al*. (1999) and Frankel (1999) seem to be in line with the "fear of floating" approach.

On the other hand, Borensztein *et al*. (2001), focusing on those countries whose regimes can be clearly defined as either currency boards or floating regimes during the period from early to mid-1990s, found that interest rates in Hong Kong, which has a fixed exchange rate regime, react much more to US interest rates than do interest rates in Singapore, which has a floating exchange rate regime. Shambaugh (2004), by classifying countries as pegged and non-pegged based on the created *de facto* coding system, examined the interest rate behavior of pegged economies compared with that of non-pegged economies on a sample of over 100 developing and industrial countries from 1973 through 2000, and reported that pegs follow base country interest rates more closely than non-pegs. Kim and Lee (2008), based on the analysis for eight East Asian economies on the sample period of January 1987 to April 2002, found that the sensitivity of local interest rates to international interest rates declined in Korea and Thailand after they adopted the floating exchange rate regimes, as well as Japan, with a floating exchange regime, has greater independence in monetary policy than a pegged economy such as Hong Kong. The evidence from Borensztein *et al*. (2001), Shambaugh (2004) and Kim and Lee (2008) appear to be consistent with the traditional view of the "impossible trinity".

Frankel *et al*. (2004) represented the mixed outcomes in a more sophisticated way by examining the long-run transmission of interest rates and their dynamic adjustment by the

error-correction form, using samples of 46 countries (including 18 industrial and 28 developing countries) during the period January 1970 to December 1999. They found that, although the transmission of international interest rates can not be rejected in the long run even for countries with floating regimes (only a couple of large industrial countries can choose their own interest rates in the long run), short-run effects differ across regimes and interest rates of countries with more flexible regimes adjust more slowly to changes in international rates implying some capacity for monetary independence.

With regard to the relationship between monetary autonomy and capital control, Miniane and Rogers (2007) assessed whether capital controls effectively insulate countries from U.S. monetary shocks, examining 26 country experiences including emerging markets and industrialized countries for the period January 1975 to December 1998. They estimated the effect of identified U.S. monetary shocks on the exchange rate and foreign country interest rates using standard estimation tools from the vector auto-regression (VAR), and tested whether countries with less open capital accounts exhibit systematically smaller responses. They found essentially little evidence that the interest-rate response is smaller for countries with high capital controls, and speculated on one reason that controls are hard to enforce and can be evaded at small cost.

1.2 Review of Aizenman *et al*. (2008) and Our Contribution

We now turn to reviewing Aizenman *et al*. (2008), i.e. the latest comprehensive work on the linkage between monetary autonomy and related variables, targeting more than 100 countries during the period of 1970-2006. Aizenman *et al*. (2008) developed new metrics for measuring three components of the trilemma: the degree of exchange rate stability, monetary independence, and capital account openness, and identified the linearity of these indexes in such a way that the weighted sum of the three trilemma policy variables adds up to a constant, validating the notion that a rise in one trilemma variable should be traded-off with a drop of the weighted sum of the other two. They also represented another linkage: that between the three components and the level of international reserves, following Obstfeld, *et al*. (2008). Obstfeld, *et al*. (2008) constructed a financial-stability model, which argued that the size of domestic financial liabilities that could potentially be converted into foreign currency (M2), financial openness, the ability to access foreign currency through debt markets, and exchange rate policy are all significant predictors of international reserve stocks. Aizenman *et al*. (2008) finally summarized their observations in the form of a "Diamond chart", whose four vertices measure monetary independence, exchange rate stability, international reserves hoarding, and financial integration, with

each index normalized between zero and one.

The main observations of Aizenman *et al*. (2008) were illustrated as follows. Industrialized countries, after giving up some exchange rate stability during the 1980s, increased the stability of their exchange rates during the period of 1991-2006 (reflecting the introduction of the euro in 1999). This was accompanied with accelerated financial integration, lower monetary independence and lower international reserves hoarding. In contrast, the group of developing countries moved towards greater exchange rate flexibility and deeper financial integration with higher monetary independence from the early 1970s to the 1990s, and since the millennium, the three trilemma variables have converged towards intermediate levels characterizing managed exchange rate flexibility buffered by sizable international reserves, thus retaining some degree of monetary autonomy. Focusing on the trends in Asian EMEs from the 1990s to the 2000s, which we will target in this paper, monetary independence lowered; financial integration slightly lowered; exchange rate stability slightly rose; and international reserves accumulated at higher level.

Since the 1997-98 currency crises, several East Asian economies have in fact adopted a more flexible exchange regime than before, while they have been exposed to financial integration. Considering this, the outcomes of Aizenman *et al*. (2008) appear to be rather curious in that they record a higher exchange rate stability and lower financial integration in Asian EMEs from the 1990s to the 2000s. It may possibly come from the measurement issues on three components of the trilemma. We herein point out some issues on the methodology to measure each index.

Monetary Independence

Aizenman *et al*. (2008) calculate the extent of monetary independence as the descriptive statistics of the annual correlation of the monthly interest rates between the home country and the base country. The statistics could not, however, remove the problem of spurious correlations without examining the stationarity of each interest rate or the co-integration of the interest rates between the home country and the base country. In this sense, the measurement does not always reveal the real sensitivity of home interest rates to changes in international interest rates. In addition, the discrete way of annual calculation might cloud the change in the sensitivity, for instance, in the middle of year.

Exchange rate Stability

Aizenman *et al*. (2008) calculate exchange rate stability as the annual standard deviations of the monthly exchange rate between the home country and the base country. However, the stability of exchange rate measured by standard deviations is not always linked with currency regime, since even a free floating exchange rate regime can produce a small number of standard deviations on an annual base under stable economic conditions, or since even a pegged regime can create a large number of standard deviations in case of devaluation or revaluation. What is important in the context of the trilemma is not the standard deviation of exchange rate movements, but the choice of currency regime, because monetary independence is affected not by exchange rate fluctuation itself, but by the authority's intervention in foreign exchange rate market, which leads to the changes in money supply. For example, the central bank of India, Reserve Bank of India, claims that the exchange rate of Indian rupee is market determined but RBI actively intervenes in the foreign exchange market to contain exchange rate volatility implying rupee is effectively pegged. This leads to change in money supply and domestic interest rate lowering monetary policy autonomy. Thus, the measurement should reflect the choice of currency regimes. The discrete way of annual calculation might also hide the effect of the mid-year alteration of currency regime.

Financial Openness/ Integration (KAOPEN)

As an index for describing capital account openness, Aizenman *et al*. (2008) use the "KAOPEN" developed by Chinn and Ito (2006, 2008). KAOPEN is calculated on the bases of information in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)*, the restrictions include: the presence of multiple exchange rates, restrictions on current account transactions, on capital account transactions, and the requirement of the surrender of export proceeds.

The first question is whether KAOPEN reflects the reality of restriction and liberalization in capital flows. We herein take an example of Thailand, one of the target countries in our analysis. Kawai (1999) described the progress of the capital account liberalization before the 1997-98 Asian currency crisis as follows: Thailand accepted Article 8 of the IMF's Articles of Agreement in 1990 and removed foreign exchange restrictions on current-account-related transactions; Starting in 1991, it began to relax foreign exchange restrictions on capital-account-related transactions, promoting cross-border capital inflows by financial institutions; In 1993, it established the Bangkok International Banking Facility (BIBF), an offshore banking center. Kawai (1999) also

presented the data for net inflows of private financial account for 1985–1998 in Thailand, signifying about hundred times increase in the net inflows from 5,379 million baht in 1985 to 460,555 million baht in 1996. On the other hand, KAOPEN index does not indicate any changes during the period between 1970 and 2006, thereby not reflecting any progress in financial liberalization in the 1990s.

The second question is whether, even though we could keep track of the reality of restriction and liberalization in capital flows by some index, this index can be suitable method for understanding a component of the trilemma. As Miniane and Rogers (2007) in the previous section suggested, capital controls themselves may not effectively insulate countries from external monetary shocks, probably because controls are hard to enforce and can be evaded at small cost. The international monetary transmission may in fact be affected by actual trends in financial integration rather than by the existence of financial restrictions. Thus, when it comes to the issue of monetary autonomy, alternative measurement apart from KAOPEN should be sought for as an index for financial integration.

Our contribution

This paper basically follows the analytical framework of Aizenman *et al*. (2008) to examine the interaction among the three components of the trilemma (the degree of exchange rate stability, monetary independence, and capital account openness), and the level of international reserves. Then, we extend Aizenman *et al*. (2008), by using alternative indexes for the three components of the trilemma considering the fore-mentioned measurement issues, and by re-estimating the relationship among four variables with monetary independence, an explained variable. Our concern is whether the outcomes of Aizenman *et al*. (2008) – the lower monetary independence, the higher exchange rate stability and the lower financial integration in Asian EMEs from the 1990s to the 2000s– are justified by our re-estimation, and whether the accumulation of international reserves have contributed to the enhancement of monetary autonomy. If we can identify positive correlation between international reserves and monetary autonomy, it may make possible another interpretation of the financial-stability model developed by Obstfeld, *et al*. (2008).

2. Empirics

We now proceed to the empirical analysis. Our analysis targets Asian economies, whose monetary autonomy has became a crucial issue under the rapid progress of financial

globalization. We herein select five countries as samples: Thailand, Korea, Indonesia, the Philippines, and India, considering the availability of necessary data for estimation. Inclusion of India in the analysis is important to see the monetary policy autonomy as it is one country where exchange rate is literally pegged with increased financial integration leading to huge accumulation of international reserves. The estimation periods differ in each economy due to data availability: from the 1st quarter of 1979 to the 4th quarter of 2009 in Thailand, from the 4th quarter of 1976 to the 4th quarter of 2009 in Korea, from the 1st quarter of 1990 to the 1st quarter of 2010 in Indonesia, from the 1st quarter of 1977 to the 1st quarter of 2010 in the Philippines, and from the 1st quarter of 1991 to the 1st quarter of 2009 in India. This section first clarifies the methodology and data, and then shows the estimation results and interprets them.

2.1 Methodology and Data

Aizenman *et al*. (2008) conducted a regression analysis to test whether the three trilemma policy goals (the degree of exchange rate stability, monetary independence, and capital account openness) are linearly related, and examined that the weighted sum of the three trilemma variables adds up to a constant. They also represented another linkage between the three trilemma variables and the level of international reserves. We modified their analyses by using alternative indexes for the three trilemma variables, and also re estimated the relationship among four variables (the three trilemma variables and international reserves). We first specify a regression model following our analytical concerns, and then clarify alternative indexes and data for the four variables.

Regression Model

Since the trends in monetary autonomy are a central part of our concern, we construct a regression model in such a way to explain the trends in monetary autonomy by the levels of financial integration, currency regime and foreign reserves. We materialize the monetary autonomy by a sensitivity of domestic interest rates to changes in U.S. interest rate, which can be defined as a partial differential between domestic interest rates and U.S. interest rate. The equation for estimation is as follows.

$$\partial(\mathrm{DIR})/\partial(\mathrm{UIR}) = \alpha + \beta*\mathrm{FNI} + \gamma*\mathrm{RGF} + \delta*\mathrm{RES} \qquad (1)$$

where DIR is domestic interest rate, UIR is U.S. interest rate, FNI is an index for financial integration, RGF is a dummy variable for currency regime (RGF=1 in case of floating

exchange rate regime, and zero elsewhere), and RES is an index for foreign reserves (The definition of indexes is explained in later section). The framework of "impossible trinity" tells us that the deeper financial integration and/or fixed exchange rate create lower monetary autonomy, i.e. the higher sensitivity of interest rates. Thus, we can expect a positive sign in β, and a negative sign in γ. If foreign reserves contributed to financial stability in a world of increasing financial globalization as Obstfeld, *et al*. (2008) suggested, their accumulation might afford more room for monetary autonomy (less sensitivity of interest rate), where we can expect a negative sign in δ.

Since we can not estimate the equation (1) directly, we modify it by integrating it by UIR. Then, we get the following equation.

$$DIR = \alpha*UIR + \beta*FNI*UIR + \gamma*RGF*UIR + \delta*RES*UIR \qquad (2)$$

We further modify the equation (2) by differentiating it since each time-series variable has a unit root[1]

$$\triangle DIR = \alpha*\triangle UIR + \beta*\triangle(FNI*UIR) + \gamma*RGF*\triangle UIR + \delta*\triangle(RES*UIR) \qquad (3)$$

By estimating equation (3), we can get necessary coefficients of α, β, γ and δ. And by inputting these estimated coefficients in the equation (1), we finally obtain the sensitivity of interest rate $\partial(DIR)/\partial(UIR)$, i.e. the degree of monetary autonomy. By using the equation (1), we can also calculate the contribution of each factor, i.e. financial integration, currency regime, and foreign reserves to the total degree of monetary autonomy.

Estimating the equation (3) above may entail an endogeneity problem, in that domestic interest rates may also affect explanatory variables such as financial integration and foreign reserves. Considering this, OLS or panel estimates may not be appropriate. For obtaining consistent estimation, we herein adopt the Generalized Method of Moments (GMM). This method uses the first differences of the model to eliminate the individual impact and then provides estimates using two or higher period lagged dependent variables. We use the first-differenced endogenous variables with necessary lagged periods as instrumental variables, and then verify instrumental validity by the Sargan test of over-identifying restrictions. (The Sargan test did not suggest rejection of the instrumental validity at conventional levels for any cases estimated in Table 1.)

[1] Test results are not reported here to conserve space. However, results of unit root tests of these relevant variables are available on demand.

Alternative Indexes

We now turn to the discussion on alternative indexes for describing the three trilemma variables (monetary autonomy, financial integration, and currency regime), considering the fore-mentioned measurement issues. Because the monetary autonomy is *a posteriori* derived by the equation (1) in the previous section, we herein focus on the indexes for financial integration and currency regime. As for an index for foreign reserves, we use them as a ratio to GDP as shown in Aizenman *et al*. (2008).

With regard to financial integration, Kose *et al*. (2006) classified its measures into *de jure* measures based on IMF's *AREAER* (just like KAOPEN index), and *de fact* measures based on price differentials such as interest rate parity conditions, or on quantities like volumes of capital flows relative to GDP. Kose *et al*. (2006) also pointed out the shortcomings of *de jure* measures as follows: First, they are partially based on various restrictions; Second, they do not capture the degree of enforcement of capital controls; Third, they do not always reflect the actual degree of integration of an economy into international capital markets. KAOPEN index, one of *de jure* measures, is not an exception in that it has the shortcomings above as stated in Section 2.2. This paper, thus, adopts a *de fact* measure based on quantities as an alternative index.[2] We refer to the indexes constructed by Lane and Milesi-Ferretti (2006 and 2003), which researchers often use as volume-based measures of financial integration.[3] To be specific, we adopt the following one among their measures, which focuses on portfolio equity and FDI (foreign direct investment) holdings:

$$FNI = (PEQA + FDIA + PEQL + FDIL) / GDP \qquad (4)$$

where PEQA (PEQL) denotes the stock of portfolio equity assets and FDIA (FDIL) denotes the stock of direct investment assets (liabilities). Since the stock data for the equation (4) are not available on a quarterly base[4], we construct a cumulative flow measure to simply cumulate U.S. dollar flow amount of portfolio investment and direct investment (Milesi-Ferretti, 2001).[5]

[2] The *de fact* measure based on price differentials is not appropriate, since the monetary autonomy, the explained variable in our analysis, is defined by the sensitivity of interest rates.
[3] For instance, Kose *et al*. (2006) used the volume-based index of Milesi-Ferretti (2006).
[4] The IMF publishes the stock data of external assets and liabilities as the so-called International Investment Position. Its data are, however, available only on the annual base, and in selected countries.
[5] Although Milesi-Ferretti (2001) represented another cumulative flow measure, which requires valuation adjustment, we did not adopt it to avoid the complexity.

As for an index for currency regime, we refer to the classification of Reinhart and Ilzetzki (2009). The IMF represents exchange rate arrangements of the Fund members. However, its classification is often criticized as the one that does not necessarily reflect actual exchange rate arrangements, since it is based on the regime that Fund member formally announced. Many economists, therefore, have often showed their own analysis of the *de facto* exchange rate regimes. One of the famous and recent estimates is that of Reinhart and Ilzetzki (2009), who reclassified exchange rate regimes by employing newly complied monthly data sets on market-determined exchange rates. We watch one of their classifications, named "monthly coarse classification," which is composed of six categories of exchange rate arrangements. And we identify the following two categories as floating exchange rate regime for dummy variable (RGF): One category is named "3" in their classification, which includes "pre-announced crawling band that is wider than or equal to +/-2%", "*de facto* crawling band that is narrower than or equal to +/-5%", "moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)," and "managed floating"; Another category is named "4", indicating "freely floating".

Data

The source of the data used for the estimations and indexes, mostly quarterly data, has been compiled from the International Financial Statistics (IFS) of the International Monetary Fund (IMF).[6] For a cumulative flow measure needed to create an index of financial integration, we use "Direct Investment Abroad" in line 78bdd, "Direct Investment in the Reporting Economy, n.i.e" in line 78bed, "Portfolio Investment Assets" in line 78bfd, and "Portfolio Investment Liabilities" in line 78bgd. The starting point of accumulation differs in each economy due to data availability: the 1st quarter of 1977 in Thailand, the 1st quarter of 1976 in Korea, the 1st quarter of 1981 in Indonesia, the 1st quarter of 1977 in the Philippines, and the 1st quarter of 1975 in India. We adopt "Total Reserves minus Gold" in line 1l.d for foreign reserves, "Gross Domestic Product" in line 99b and "Exchange Rates" in line rf for the GDP denominator on U.S. dollar base, respectively.

2.2 Results and Interpretations

[6] In case that there are vacant data in the IFS, we found the data from other local sources. The GDP data for 1979-1993 in Thailand are from Bank of Thailand, and the India's data of money market rates for 1998-2006 and GDP for 1991-2003 are compiled from Reserve Bank of India and National Accounts Statistics respectively.

Table 1 reports the estimation results of the equation (3). In all economies, we could obtain necessary coefficients with expected signs and at conventional significant levels: The coefficients of financial integration β are significantly positive; those of currency regime γ are significantly negative; those of foreign reserves δ are significantly negative. Figure 2 describes the sensitivities of domestic interest rates to U.S. interest rate (the degree of monetary autonomy) for the past two decades, which we could get by inputting the estimated coefficients above in the equation (1), and this also indicates the contribution of each factor, i.e. financial integration, currency regime and foreign reserves to the totaled sensitivities, signifying monetary autonomy.

We can summarize main findings from Figure 1 as follows. First, Thailand, Korea and Indonesia, who experienced a change in currency regime toward floating regime, have lowered the sensitivities of their interest rates (have raised monetary autonomy) after the regime change. Second, the Philippines, which returned to pegged currency regime, has kept the sensitivity of her interest rates at relatively high level in the 2000s, without its recent decline after 2007 due to the accumulation of foreign reserves. Third, India without any change in currency regime has continued to raise the sensitivities of its interest rates (have lowered monetary autonomy) in line with the rapid progress of financial integration (the details will be described later on). Fourth, in all economies, the accumulation of foreign reserves has contributed to retaining monetary autonomy to some degree in terms of preventing the sensitivities of interest rates from rising.

We can then compare the outcomes of Aizenman *et al*. (2008) with our estimation results. Aizenman *et al*. (2008) reported a lower monetary independence, and a higher exchange rate stability and lower financial integration in Asian economies from the 1990s to the 2000s. Our estimation results show a clear contrast with those of Aizenman *et al*. (2008) as far as Thailand, Korea and Indonesia are concerned: these countries show higher monetary independence, the more flexible exchange rate and the deeper financial integration from the 1990s to the 2000s. This contrast comes from the differences in the used indexes and estimation methodology: For exchange rates, we adopt an index of currency regime referring to Reinhart and Ilzetzki (2009), while Aizenman *et al*. (2008) used an index of actual exchange rate movement defined as the annual standard deviations of the monthly exchange rate. As for financial integration, we adopt the *de facto* measure based on the volumes of capital flows relative to GDP, while Aizenman *et al*. (2008) used the *de jure* measure quantifying the capital controls named KAOPEN. Our study calculates the degree of monetary autonomy *a posteriori* by inserting the alternative

indexes into the estimated equation, while Aizenman *et al*. (2008) described it as the descriptive statistics of the annual correlation of the monthly interest rates between the home country and the base country. We already pointed out the measurement problem of the indexes in Aizenman *et al*. (2008) in Section 2.2, and justified our indexes and estimation methodology in Section 3.1.

We present further comments on each factor contributing to the trends in monetary autonomy as follows.

Currency regimes

We have already showed that the change in currency regime towards a floating regime has resulted in a large impact on the improvement of monetary autonomy in the cases of Thailand, Korea and Indonesia. This outcome is consistent with those of some other previous studies like Aizenman *et al*. (2008), although they took different methodologies from our study's approach.

Kim and Lee (2008) found that the sensitivity of local interest rates to international interest rates declined in Korea and Thailand after they adopted the floating exchange rate regimes. They estimated the following equation (the name of variables are the same as that of the equation (1) :

$$\triangle DIR_t = \alpha + \beta * \triangle UIR_t + \rho * \triangle DIR_{t-1} + \varepsilon_t$$

They investigated whether there is a discernable difference in the coefficient β before and after the structural breaks identified by the regime switching model. And they verified significant and large coefficients before the structural break, and the insignificant and small ones after the break, for Thailand and Korea. Their study could not find a structural break point for Indonesia.

Taguchi (2009) also proved the improvement of monetary autonomy after the change in currency regime toward floating regime in Thailand, Korea and Indonesia. It examined the sensitivity of domestic interest rates to U.S. interest rate, by conducting co-integration tests and by estimating the adjustment speeds through error-correction model, for different *de facto* currency regimes. After identifying the co-integration relationship between domestic and U.S. interest rate, the paper estimated the following error-correction model:

$$\triangle DIR_t = C + \alpha * \triangle UIR_t + \beta * (DIR_{t-1} - UIR_{t-1}) + \varepsilon_t$$

It investigated whether there is a difference in the coefficient β, i.e. an adjustment speed towards long-run equilibrium signifying the long-run sensitivities of interest rates before and after the change in currency regime toward floating regime, and found that the absolute value of the coefficients lessened from the pre-crisis pegged exchange rate regime towards the post-crisis floating regime in Korea, Indonesia and Thailand, and not in the Philippines (see Table 2).

Foreign Reserves

How can we interpret the estimated effect of foreign reserves on retaining monetary autonomy? If foreign reserves contributed to financial stability in a world of increasing financial globalization as Obstfeld, *et al*. (2008) suggested, their accumulation might take a role as an anchor for retaining monetary autonomy.

The greatest difficulty that EMEs are facing in managing macro-economic policies is the issue of "fear of floating", which comes from doubts about the credibility of their currency (see Calvo and Reinhart 2002). The lack of credibility originates from incomplete domestic financial markets, as the "original sin" hypothesis tells us. Eichengreen and Hausmann (1999) explained that the "Original sin" is a situation in which the domestic currency cannot be used to borrow abroad or to borrow long term even domestically. In previous times, EMEs had tackled "fear of floating" by pegging their currencies rigidly to a base currency like U.S. dollar, and/or by regulating external transaction in financial markets. The recent progress of financial integration appears to make the issue of "fear of floating" more acute to EMEs due to possible capital flights or massive inflows. In addition, some of EMEs abandoned their rigidly pegged regimes after currency crises in the 1990s. There has come the impending necessity for EMEs to search for an alternative anchor to cope with "fear of floating". We speculate that accumulating foreign reserves might be an anchor for retaining monetary autonomy under such conditions as deepened financial integration, abandoned rigidly-pegged currency regime, to EMEs facing "fear of floating". It should, however, be noted that most of our analyses is focused on economies in the process of foreign reserve accumulation, and that further investigation, e.g. by including the samples/economies with the process of foreign reserve decline, is needed to identify the anchor role of foreign reserves.

Financial Integration and Its Effects – The Case of India

Our analysis has clarified the increasing trend of financial integration from the 1990s to the 2000s and its contribution to curbing the degree of monetary autonomy, in all sample economies. The case of India has revealed a different story from those of other sample economies on the interaction on the three trilemma variables and foreign reserves, in the sense that her exchange rate is pegged with drastic increase of financial integration leading to huge accumulation of international reserves during the sample periods. The detailed story can be described as follow. During the early nineties when capital inflows increased substantially leading to rupee appreciation, it necessitated RBI to buy dollars. Consequently growth of reserve money accelerated and there was reversal of the phase-out of cash reserve ratio (CRR). Therefore, Indian economy witnessed loosing of monetary policy autonomy in nineties. As a consequence of maintaining exchange rate with growing capital inflows, RBI trading in currency market led to accumulation of huge foreign exchange reserves. The same policy continues till date where exchange rate management takes place with financial integration leading to loss of monetary autonomy and accumulation of foreign reserves. The effect of the accumulation of foreign reserves on retaining monetary autonomy was identified in some degree, but was far exceeded by the effect of financial integration on lessening monetary autonomy, as Figure 1 indicated.

The drastic progress in financial integration in India has been motivated by the comprehensive economic reforms initiated in 1991. India had a system of strong control till 1991 just before the balance of payment crisis. The control of capital flows before 1991 made it possible for India to have a fixed exchange rate and monetary policy autonomy. Since 1991, India's policy has been aimed to invite non-debt creating capital flows viz., FDI and portfolio equity flows resulting in substantial reduction in restrictions on both current and capital account. The post liberalization period has been remarkable for FDI inflows in many ways as it has created a conducive environment for foreign investors. The most important measures facilitating FDI inflows include abolition of industrial licensing, gradual hiking of ceiling, and bringing increasing number of sectors under automatic route and liberalization of foreign exchange regulations. Further, government both at the centre and states have been constantly working for investment facilitation and giving incentives to foreign investors. In case of port-folio investment, government has been reducing restrictions since 1991 which has helped India's large domestic intuitional investors to facilitate the entry of foreign intuitional investors to acquire partial stakes in listed Indian enterprises. The domestic equity market is much more developed with proper regulatory authority[7] and corporate governance which has

[7] For example Securities and Exchange Board of India (SEBI) which protects the interests of investors in security markets through appropriate regulation.

been encouraging foreign institutional investors[8]. Consequently, both FDI and PFI have increased leading to progressive financial integration of the Indian economy.

4. Concluding Remarks

This paper examines the trends in monetary autonomy and its interaction with financial integration, currency regime and foreign reserves for the past two decades in select Asian countries: Thailand, Korea, Indonesia, the Philippines, and India. We extend Aizenman *et al*. (2008) by using alternative indexes considering measurement issues, and by re-estimating the relationship among the four variables. Our main findings, which show some contrast with Aizenman *et al*. (2008), are as follows: First, Thailand, Korea and Indonesia, who experienced the change in currency regime towards a floating regime, have lowered the sensitivities of their interest rates (have raised monetary autonomy) after the regime change, while India without any change in currency regime has continued to raise the sensitivities of its interest rates (has lowered monetary autonomy) in line with the rapid progress of financial integration. Second, in all sample economies, the accumulation of foreign reserves has contributed to retaining monetary autonomy to some degree in terms of preventing the sensitivities of interest rates from rising. We speculate that their accumulation might take the role of an anchor for monetary autonomy in emerging market economies facing "fear of floating".

[8] The major indicator of development of equity market is reflected through debt equity ratio which came down to less than one from 1.82 in 1992-93.

Table 1 Estimation Results of Equation (3)

Explained Variable ⊿DIR	**Thailand**	**Korea**	**Indonesia**	**Philippines**	**India**
⊿UIR	0.771 ***	0.684 ***	2.512 *	0.791 **	-2.105 ***
	(0.121)	(0.115)	(1.307)	(0.374)	(0.731)
⊿(FNI*UIR)	4.143 ***	3.236 ***	9.275 **	2.190 **	33.980 ***
	(1.008)	(0.668)	(3.529)	(0.859)	(9.574)
RGF*⊿UIR	-1.848 ***	-0.683 **	-2.539 **	-1.550 ***	-
	(0.335)	(0.265)	(1.130)	(0.362)	-
⊿(RES*UIR)	-3.602 **	-4.857 ***	-13.636 **	-8.282 ***	-13.560 **
	(1.511)	(1.000)	(5.205)	(1.719)	(6.755)
<Sargan test>	1.00	1.00	1.00	1.00	1.00
Estimation period	1979q1-2009q4	1976q4-2009q4	1990q1-2010q1	1977q1-2010q1	1991q1-2009q1

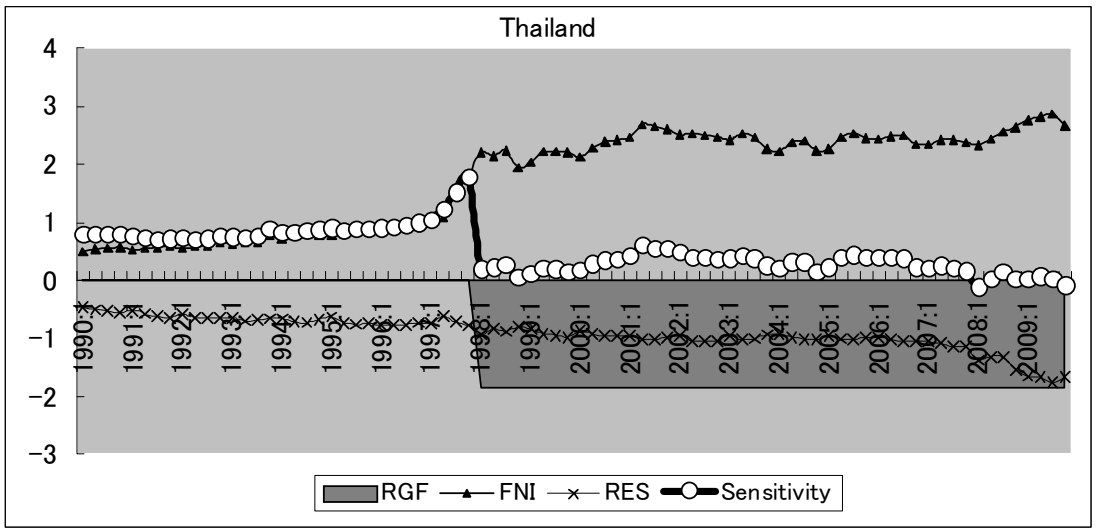
Notes:
1) ***, **, and * indicate that the coefficient is significant at the 90,95,and 99 percent levels, respectively.
2) Standard errors in parenthese.

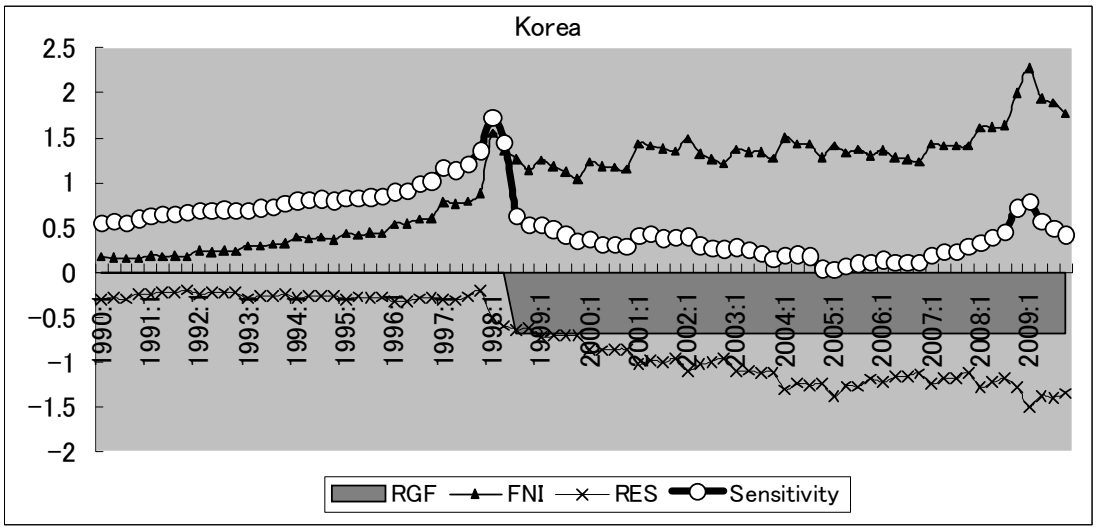
Table 2 Sensitivity of Domestic Interest Rate to U.S. Interest Rate

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 ***
India	90.01-91.07, 95.07-98.05 06.05-07.12	Soft Peg	-0.744 ***

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.

Figure 1 Sensitivity of Domestic Interest Rates and Its Factors





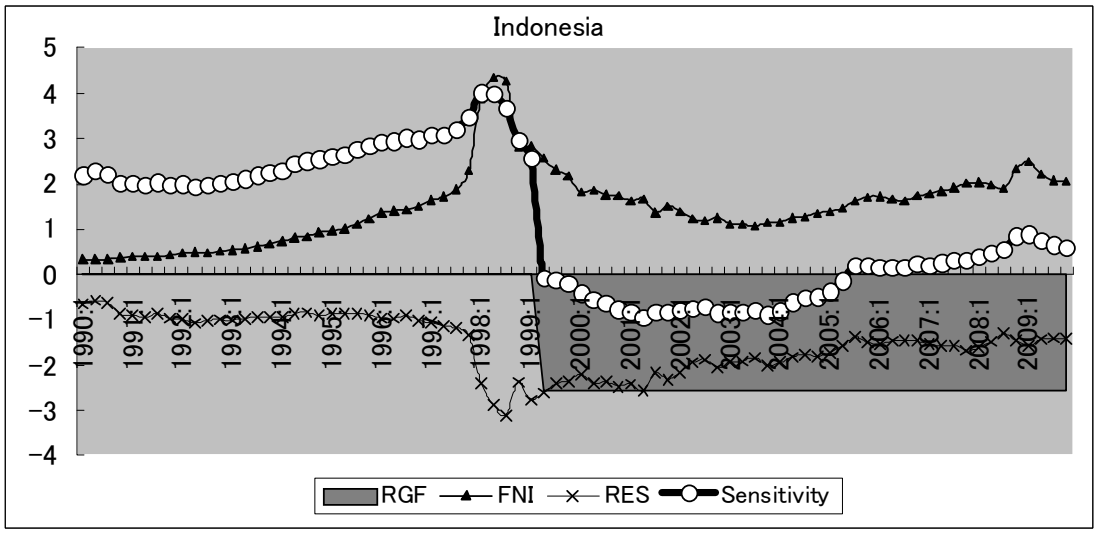
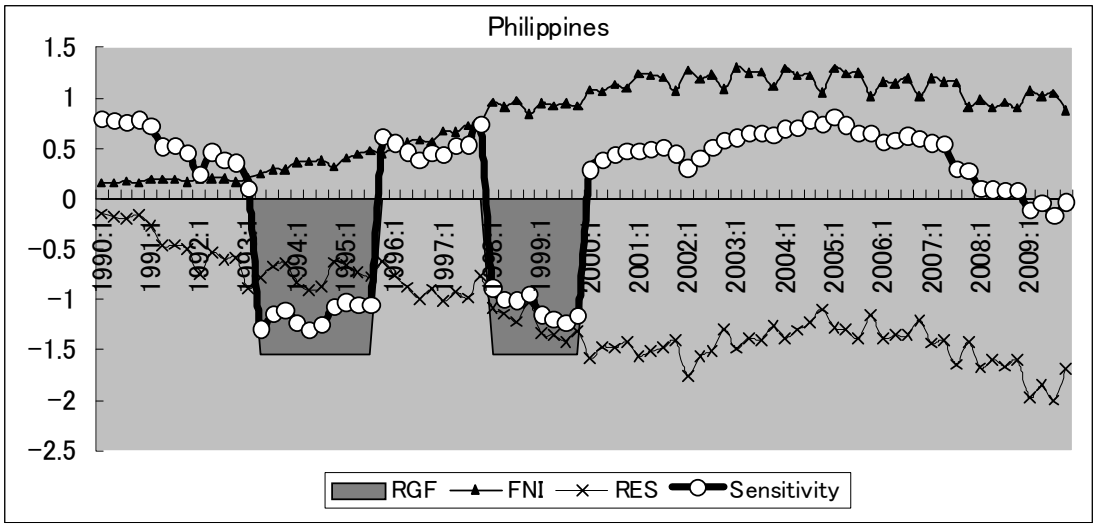
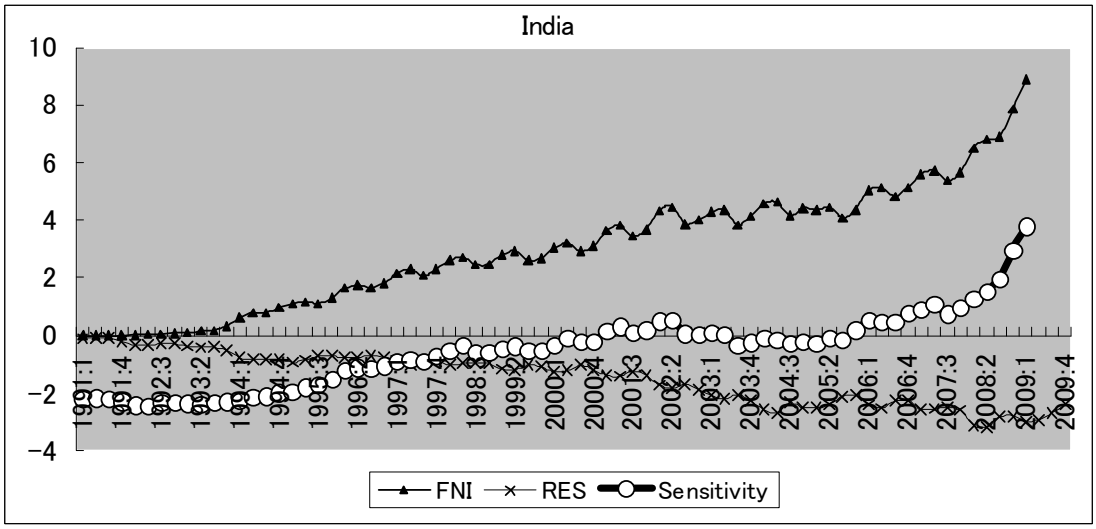


Figure 1 Sensitivity of Domestic Interest Rates and Its Factors (continued)


Philippines
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
1990:1
1991:1
1992:1
1993:1
1994:1
1995:1
1996:1
1997:1
1998:1
1999:1
2000:1
2001:1
2002:1
2003:1
2004:1
2005:1
2006:1
2007:1
2008:1
2009:1
RGF
FNI
RES
Sensitivity


India
10
8
6
4
2
0
−2
−4
1991:1
1991:4
1992:3
1993:2
1994:1
1994:4
1995:3
1996:2
1997:1
1997:4
1998:3
1999:2
2000:1
2000:4
2001:3
2002:2
2003:1
2003:4
2004:3
2005:2
2006:1
2006:4
2007:3
2008:2
2009:1
2009:4
FNI
RES
Sensitivity

References

Aizenman, J., M.D. Chinn, and H. Ito. 2008. "Assessing the Emerging Global Financial Architecture: Measuring the Trilemma's Configurations over Time." National Bureau of Economic Research (NBER) Working Paper Series #14533. (December 2008; revised in April 2009).

Borensztein, E., J. Zettelmeyer, and T. Philippon. 2001. Monetary independence in emerging markets: does the exchange rate make a difference? *IMF Working Paper* WP/01/1.

Calvo, G., and C. Reinhart. 2001. Fixing for your life. *Brookings Trade Forum 2000*: 1–39.

———. 2002. Fear of floating. *Quarterly Journal of Economics* 117 (2): 379–408.

Chinn, M. D. and H. Ito. 2008 "A New Measure of Financial Openness." Journal of Comparative Policy Analysis, Volume 10, Issue 3 (September), p. 309 - 322.

———. "What Matters for Financial Development? Capital Controls, Institutions, and Interactions," Journal of Development Economics, Volume 81, Issue 1, Pages 163-192 (October).

Eichengreen, Barry, and Ricardo Hausmann. 1999. "Exchange Rates and Financial Fragility." NBER Working Paper No. 7418. Cambridge, Massachusetts: National Bureau of Economic Research.

Frankel, J. A. 1999. No Single Currency Regime Is Right for All Countries or at All Times. Princeton Essays in *International Finance* 215. Princeton, NJ: Princeton University Press.

Frankel, J. A., S.L. Schmukler, and L. Serven. 2004. Global Transmission of Interest Rates: Monetary Independence and Currency Regime. *Journal of International Money and Finance* 23: 701–34.

Hausmann, R., M. Gavin, C. Pages-Serra, and E. Stein. 1999. Financial Turmoil and the Choice of Exchange Rate Regime. Inter-American Development Bank.

Kawai, M., and K. Takayasu, 1999. The Economic Crisis and Banking Sector Restructuring in Thailand, *Rising to the Challenge in Asia: A Study of Financial Markets: Volume 11 – Thailand*, the Asian Development Bank.

Kim, C.J., and J.W. Lee. 2008. Exchange Rate Regime and Monetary Policy Independence in East Asia. *Pacific Economic Review* 13(2): 155-170.

Kose, M. A., E. Prasad, K. Rogoff, and S. J. Wei, 2006, "Financial Globalization: A Reappraisal," IMF Working Paper, WP/06/189.

Lane, P.R., and G.M. Milesi-Ferretti. 2001. "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Countries," Journal of International Economics, Vol. 55, pp. 263–94.

———. 2003, "International Financial Integration," IMF Staff Papers, Vol. 50 Special Issue, pp. 82–113 (Washington, D.C.: International Monetary Fund).

———. 2006. "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970-2004," IMF Working Paper 06/69.

Miniane, J., and J.H. Rogers. 2007. Capital Controls and the International Transmission of U.S. Money Shocks. *Journal of Money, Credit and banking*, Vol.39, No.5, pp. 1003-1035.

Obstfeld, M., J. C. Shambaugh, and A. M. Taylor, 2008. "Financial Stability, The Trilemma, and

International Reserves." NBER Working Paper 14217 (August).

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 (September 8, 2010).

Shambaugh, J. C. 2004. The Effect of Fixed Exchange Rates on Monetary Policy. *Quarterly Journal of Economics* 119: 301–52.

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.