Monetary Autonomy in Emerging Market Economies: Role of Foreign Reserves

Hiroyuki Taguchi, Akira Ikawa, and Kensi Tsunemine
Policy Research Institute, Ministry of Finance[1]

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 emerging market economies in Asia and Latin America. Our main findings are: First, most of emerging Asian economies have raised monetary autonomy due to their changes in currency regime toward floating regime and their accumulation of foreign reserves, while emerging Latin American economies have shown mixed results on monetary autonomy reflecting its different trend of each economy. Second, in all sample economies, the accumulation of foreign reserves has contributed to retaining monetary autonomy, probably implying their roles 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, emerging market economies, fear of floating
JEL Classification Codes: E52, F33, F41.

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1. Introduction

The monetary autonomy 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 two of three options – fixed exchange rates, domestic monetary autonomy and capital mobility. Thus, without restrictions on capital flows, fixing exchange rates constrains 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 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 inflow in EMEs under the recovery process from the 2008 global financial crisis has refocused attention on the feasibility of monetary autonomy of their 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. To be specific, suppose that some EME raises her interest rate to cope with inflation pressures as one of exiting strategies. Her behavior attracts capital inflow reflecting interest rate differentials with advanced economies. Capital inflow leads to exchange rate appreciation in the first place. The authority may, then, intervene 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 relatively high level, thereby perpetuating capital inflow. This monetary loop is reflecting nothing more than the policy constraint in terms of endangered monetary autonomy, regardless of any hypothesis, i.e. "impossible trinity" or "fear of floating".

As the economic trends in the past two decades, the EMEs in Asia and Latin America have faced the drastic changes in the component variables of "impossible trinity". They have experienced financial integration in line with the progress of globalization. At the same time, some of their economies suffered from the currency crises such as those in Mexico (1994), East Asia (1997), Brazil (1999), and Argentina (2001). Those crises resulted in the currency regime shift from pegged exchange rate

regime to more flexible regime. In addition, they have accumulated their foreign reserves in the wake of the currency crises, especially in East Asia. Considering these changes in the components of "impossible trinity" and foreign reserves, this paper will examine the trends in monetary autonomy and its interaction with financial integration, currency regime and foreign reserves, focusing on the EMEs in Asia and Latin America, and will critically review the outcomes of Aizenman *et al*. (2008), which is one of previous studies with the same scope and different approaches. The rest of the paper is structured as follows. Section 2 reviews previous studies and clarifies this paper's contribution. Section 3 presents empirical analyses introducing the methodology and data, and discussing the estimate results and their interpretation. Section 4 summarizes the results and concludes.

2. 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 seems, however, to be relatively a few studies that monetary autonomy is examined amid the comprehensive framework of "impossible trinity". Aizenman *et al*. (2008), as an example, presented 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).

2.1 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 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 from 1986 to 1998. This also implied that emerging market securities might pay substantial risk premium, and these risk premium 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 in the 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 by regime switching model 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 that 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 more sophisticated way through 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 of 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. Taguchi (2009) also examined the sensitivity of domestic interest rates to the international interest rate, by conducting co-integration tests and by estimating the adjustment speeds through error-correction model, for different de facto currency regimes and for different types of capital markets, using samples of 47 countries during the period of January 1990 to December 2007. It found that the floating regime shows the less sensitivity of domestic interest rates to the international interest rate (implying the higher monetary autonomy) than the fixed regime does, as far as the cases with open capital markets are concerned, and also proved the improvement of monetary autonomy after the change in currency regime toward floating regime in Thailand, Korea and Indonesia.

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 from 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 as one reason that controls are hard to enforce and can be evaded at small cost.

2.2 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 testing the concept of the trilemma systematically, which includes the analysis on the linkage between monetary autonomy and related variables. 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, by notifying the growing role of international reserves hoarding as a means of self-insurance against exposure to volatile "hot money" subject to frequent sudden stops and reversals (this point will also be discussed in later section). Finally, Aizenman *et al*. (2008) 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), accompanied with accelerated financial integration, lower monetary independence and lower international reserves hoarding. In contrast, the group of developing countries moved toward 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.

The trends of components variables in emerging Asian and Latin American economies from the 1990s to the 2000s, which will be analytical targets in this paper, were also shown in the Diamond chart of Aizenman *et al*. (2008) in the following ways. Regarding emerging Asian economies, monetary independence lowered; financial integration did not change so much (looked like slight decline); exchange rate stability rose; and international reserves/GDP accumulated at higher level. As for emerging Latin American economies, monetary independence lowered; financial integration deepened clearly; exchange rate stability did not change so much (looked like slight decline); and international reserves/GDP accumulated at slightly higher level. These descriptions of Aizenman *et al*. (2008) on the 1990s-2000s trends of emerging economies may, however, give rather curious impressions, especially in the cases of emerging Asian economies, because several East Asian economies have in fact adopted more flexible exchange regime since the 1997-98 Asian currency crises, while they have been continuously exposed to deepening financial integration. It may possibly come from the measurement problem on three trilemma components of Aizenman *et al*. (2008). Thus we herein discuss some issues on the methodology to measure each trilemma index.

Monetary Independence

Aizenman *et al*. (2008) calculated 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, since they did not examine 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

They calculated 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 freely floating exchange rate regime can produce a small number of standard deviations on an annual base under stable economic conditions, or since even 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 actual 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. 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, they used 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),* regarding the restrictions: 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 is reflecting the reality of restriction and liberalization in capital flow. We herein take an example of Thailand, one of targeting countries in our analysis. Kawai and Takayasu (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 flows by financial institutions; In 1993, it established the Bangkok International Banking Facility (BIBF), an offshore banking center, in 1993. Kawai and Takayasu (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 flow by some index, this index can be suitable for 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 the 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 aims at examining the 1990s-2000s trends in monetary autonomy and its interaction with financial integration, currency regime and foreign reserves, focusing on emerging Asian and Latin American economies. In this sense, the scope of our analysis seems to be overlapped with a part of Aizenman *et al*. (2008). However, we intend to critically review the outcomes of 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 great concerns are whether the outcomes of Aizenman *et al*. (2008), especially, the 1990s-2000s trends of trilemma variables of emerging Asian economies– lower monetary independence, higher exchange rate stability and lower financial integration– are justified by our re-estimation, and whether the accumulation of international reserves have contributed to the enhancement of monetary autonomy.

3. Empirics

We now proceed to the empirical analysis. For the purpose of making the comparison with Aizenman *et al*. (2008) possible, we select the same sample economies as Aizenman *et al*. (2008): eight economies for emerging Asia– China (Mainland), Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand; and ten economies for emerging Latin America– Argentina, Brazil, Chile, Colombia, Ecuador, Jamaica, Mexico Peru, Trinidad and Tobago (T&T) and Venezuela.[2] The sample periods are those from the 1st quarter of 1990 to the 2nd quarter of 2010. Based on the sample scope above, we construct the panel data for the period from the 1st quarter of 1990 to the 2nd quarter of 2010 on a quarterly base, both with eight economies for emerging Asia and with ten economies for emerging Latin America, and then conduct panel estimation on each emerging market area. This section first clarifies the methodology and data, and then shows the estimation results and interprets them.

3.1 Methodology and Data

We herein take a different approach from Aizenman *et al*. (2008), by using alternative indexes for the three trilemma variables, and by re-estimating the relationship among four variables (the three trilemma variables and foreign 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 model in such a way to explain the trends in monetary autonomy by the levels of financial integration, currency regime and foreign reserves. We specify 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.

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

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

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[2] Taiwan is included in Aizenman et al. (2008), but not in our empirics due to the lack of data for our estimation.

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 the lower monetary autonomy, i.e. the higher sensitivity of interest rate. Thus, we can expect a positive sign in β, and a negative sign in γ. If foreign reserves took a role of self-insurance against exposure to volatile "hot money" as Aizenman *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 for estimation.[3]

$$DIR = const. + α*UIR + β*FNI*UIR + γ*RGF*UIR + δ*RES*UIR \qquad (2)$$

By estimating the equation (2), we can get necessary coefficients of α, β, γ and δ. Then, by inputting these estimated coefficients in the equation (1), we finally obtain the sensitivity of interest rate $∂(DIR)/ ∂(UIR)$, 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 (2) above may entail an endogeneity problem, in that domestic interest rates may also affect explanatory variables such as financial integration and foreign reserves. For obtaining consistent estimation, we herein adopt the Generalized Method of Moments (GMM). We use the 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 below).

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 problem. Since 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

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[3] The stationarity of each variable is not questioned due to panel estimation.

de jure measures based on IMF's *AREAER* (just like KAOPEN index), and *de facto* 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 exception in that it has the shortcomings above as we stated in Section 2.2. This paper, thus, adopts a *de facto* measure based on quantities as an alternative index.[4] We refer to the indexes constructed by Lane and Milesi-Ferretti (2003 and 2006), which researchers often use as volume-based measures of financial integration.[5] To be specific, we adopt the following one among their measures, which focuses on portfolio equity and FDI (foreign direct investment) holdings:

$$FNI = (PEQA + FDIA + PEQL + FDIL) / GDP \qquad\qquad (3)$$

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 (3) are not available on a quarterly base[6], we construct a cumulative flow measure to simply cumulate U.S. dollar flow amount of portfolio investment and direct investment (Milesi-Ferretti, 2001).[7]

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 resume 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), which 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

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[4] The *de facto* 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.
[5] For instance, Kose *et al*. (2006) used the volume-based index of Milesi-Ferretti (2006).
[6] 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.
[7] Although Milesi-Ferretti (2001) represented another cumulative flow measure, which requires valuation adjustment, we did not adopt it to avoid the complexity.

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". We remove data for an index for currency regime during such crisis periods as those in Mexico (1994), East Asia (1997), Brazil (1999), and Argentina (2001). The crisis periods are identified in their classification as the category named "5" denoting "Freely falling", and the one named "6" representing "Dual market in which parallel market data is missing".

Data

The source of the data used for the estimations and indexes (except currency regime) in quarterly term comes from the International Financial Statistics (IFS) of the International Monetary Fund (IMF). For a cumulative flow measure 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 We adopt "Money Market Rate" in line 60b for interest rate, "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.[8]

3.2 Results and Interpretations

Table 1 reports the results of the panel estimation of the equation (2). In both economies of emerging Asia and emerging Latin America, we could obtain necessary coefficients with expected signs and at conventional significant level: 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 1 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 also indicates the contribution of

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[8] We create quarterly data by dividing annual data, in case that there are not quarterly data but annual data: capital flow data for China, Jamaica and T&T; GDP data for T&T and Venezuela.

each factor, i.e. financial integration, currency regime and foreign reserves to the totaled sensitivities signifying monetary autonomy.[9] Table 2 summarizes the trends of three trilemma variables and foreign reserves by showing the average figure of each variable in each economy (and averaged emerging Asia and Latin America) during both the 1990s and the 2000s.

Main findings from Figure 1 and Table 2 are as follows. Regarding with emerging Asia, the sensitivity of interest rates on sample economies' average fell down from 1.01 in the 1990s to 0.77 in the 2000s, thereby monetary autonomy improving. The main contributors are Indonesia, Korea and Thailand, where currency regime shifted towards floating one after the 1997-98 Asian crises, and this floating shift mostly contributed to the decline of their sensitivities of interest rates by about half level. The financial integration deepened from 0.23 to 0.88 and the foreign reserves accumulated from 0.22 to 0.33 on the average respectively, and these trends are common in all individual economies. To sum up, in emerging Asia on the average, the currency regime shift towards floating one as well as the accumulation of foreign reserves, offsetting the negative effect of financial integration, contributed positively to enhancing monetary autonomy. As for emerging Latin America, although the sample average of the sensitivity of interest rates did not change so much from 1.22 in the 1990s to 1.24 in the 2000s, its trend largely differed by each individual economy: Brazil and Mexico lowered their sensitivities mainly by the currency regime shift to floating one, and T&T did so due to the accumulation of foreign reserves; On the other hand, Argentine, Chile, Jamaica and Peru raised their sensitivities due to deepening financial integration. On the average, the financial integration deepened from 0.29 to 0.61 and the foreign reserves accumulated slightly from 0.10 to 0.13 respectively. To sum up, emerging Latin America showed mixed trends in monetary autonomy with positively contributing economies and negatively contributing ones.

We can then compare the outcomes of Aizenman *et al*. (2008) with our analytical results on the 1990s-2000s trends of the three trilemma variables and foreign reserves (see Table 3). Aizenman *et al*. (2008) reported: the decrease in monetary independence, the increase in exchange rate stability, the little change in financial integration, and the increase in foreign reserves for emerging Asian, and the decrease in monetary independence, the little change in exchange rate stability, the increase in financial integration, and the slight increase in foreign reserves for emerging Latin America. On the other hand, Our estimation results represent: the increase in monetary independence,

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[9] We omit Ecuador and Venezuela in Figure 1, because their time series data are not enough to be described.

the decrease in exchange rate stability, the increase in financial integration, and the increase in foreign reserves for emerging Asian, and the mixed trends in monetary independence, the mixed trends in exchange rate stability, the increase in financial integration, and the slight increase in foreign reserves for emerging Latin America. Thus, clear contrasts between Aizenman *et al.* (2008) and our analysis exist in monetary independence, exchange rate stability and financial integration for emerging Asia. This contrast should come from the differences in the used indexes and estimation methodology. 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. The outcomes of our analysis– the decrease in exchange rate stability and the increase in financial integration for past two decades in emerging Asia, seems to be more realistic description than those of Aizenman *et al.* (2008), if we consider the currency regime shift to floating one after the Asian crisis and the actual financial integration process. And another outcome of our analysis– the positive contribution of the currency regime shift to improving monetary autonomy, is also consistent with some of the previous works with different methodologies from Aizenman *et al.* (2008) and our analysis, e.g. Kim and Lee (2008) and Taguchi (2009) (see Section 2.1).

Role of Foreign Reserves

It should be noted that our analytical outcome is in line with the argument made by Aizenman *et al.* (2008), in that 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 in both economies of emerging Asia and emerging Latin America. We interpret this contribution of foreign reserves as their anchor role for retaining monetary autonomy to emerging market economies (EMEs) facing "fear of floating". 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".

Our interpretation on the role of foreign reserves is consistent with the arguments and empirical outcomes of Aizenman *et al*. (2008) and other previous works. Aizenman *et al*. (2008) emphasized the change in the role of foreign reserves, by arguing that the recent literature has focused on their role as a means of self-insurance against exposure to volatile "hot money" subject to frequent sudden stops and reversals, whereas the earlier literature focused on the role of foreign reserves as a buffer stock for managing pegged exchange rate regimes. In fact, the buffer stock model may has limited capacity to account for the recent accumulation of foreign reserves, since under this model the EME's currency regime shift to floating one for recent decades should have helped reduce reserve accumulation in contrast to the reality. Empirical works also support the changing role of foreign reserves towards financial stability. For instance, Obstfeld, *et al*. (2008), recognizing that a combination of internal drains (runs from bank deposits to currency) and external drains (flight to foreign currency or banks) has placed extraordinary demands on foreign reserves especially for emerging market economies, constructed a financial-stability model which goes far toward explaining reserve holdings in the modern era of globalized capital markets, and proved that the size of domestic financial liabilities, financial openness and exchange rate policy are all significant predictors of international reserve stocks. Aizenman *et al*. (2010) provided empirical evidence that holding massive amounts of foreign reserves allows a country to pursue a higher weighted average of "monetary independence" and "financial openness (KAOPEN)", i.e., relax the trilemma. If we follow this evidence, higher levels of foreign reserves holding should enable a country to pursue higher level of monetary independence with the same level of exchange rate stability and financial openness, which is clearly consistent with our analytical outcome– the positive contribution of foreign reserves to monetary autonomy.

Foreign Reserves and Monetary Base

In this section, we attempt to justify the positive contribution of foreign reserves to monetary autonomy from another aspects– the relationship between foreign reserves and monetary base. The accumulation of foreign reserves directly means the monetary

authority's intervention in foreign exchange rate market in terms of buying foreign currency and selling domestic currency. Thus, this intervention leads to an increase in domestic money supply, thereby damaging monetary autonomy, unless the intervention is sterilized by the monetary authority. In order for accumulation of foreign reserves to be compatible with improving monetary autonomy, therefore, sterilizing the intervention is indispensable in the accumulating process of foreign reserves, which should be shown by the decoupling between foreign reserves and monetary base in that process. Figure 2 indicates the relationship between foreign reserves and monetary base in each sample economy in emerging Asia and Latin America for past two decades. The indexes of 'd(mb)' and 'd(res)' denote the changes in monetary base and foreign reserves (local currency base) compared with the same quarter of previous year.[10] We roughly found that in the phase of a high increase in foreign reserves, monetary base does not always trace up foreign reserve accumulation except the cases of China and Hong Kong with rigid pegged currency regime.[11] A typical example is shown in Thailand, where her foreign reserves have jumped up around since 2005 while her monetary base has kept stability.

We herein put into statistical tests the decoupling relationship between foreign reserves and monetary base in the accumulating process of foreign reserves, in emerging Asia and Latin America economies for the past two decades. We construct a model in such a way that the sensitivity of monetary base to foreign reserves depends on the level of foreign reserves and currency regimes. The specific equation is as follows.

$$\partial(MB)/\partial(RES) = \lambda + \mu*RES + v*RGF \tag{4}$$

where MB is monetary base relative to GDP, RES is foreign reserves relative to GDP, and RGF is a dummy variable for currency regime (RGF=1 in case of floating exchange rate regime, and zero elsewhere, which is the same as the one in the section 3.1). We suppose that the higher level of foreign reserves and floating currency regime bring about the less sensitivity of monetary base relative to foreign reserves.[12] Thus, we can expect a negative sign in μ and v. Since we can not estimate the equation (4) directly, we modify it by integrating it by UIR. Then, we get the following equation for

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[10] The data of monetary base for Figure 2 and the later equation 5 are retrieved from the line 14 named "Reserve Money" in the IFS, and the data for foreign reserves are the same as those in the section 3.1.

[11] According to the currency regime classification of Reinhart and Ilzetzki (2009), China and Hong Kong are classified as the category named "1", i.e. the most rigidly fixed currency regime.

[12] As we see in Figure 2, under fixed currency regime of China and Hong Kong, monetary base and foreign reserves show high correlation.

estimation.

$$MB = const. + \lambda*RES + \mu*RES^2 + \nu*RGF*RES \tag{5}$$

By estimating the equation (5), we can verify the signs and their significance of coefficients of λ, μ, and ν. Just as the section 3.1, we compile the panel data, and conduct panel estimation on emerging Asian and Latin American economies for the period of the 1990s-2000s. For estimation, we also adopt the GMM method. (The Sargan test did not reject the instrumental validity at conventional levels in this estimation, too.) Table 4 reports the estimation results of the equation (5). In both economies of emerging Asia and emerging Latin America, we could obtain the coefficients with expected signs and at conventional significant level: The coefficients of foreign reserves λ are significantly positive; Those of a square of foreign reserves μ are significantly negative; Those of currency regime ν are significantly negative. Thus, we could support the positive contribution of foreign reserves to monetary autonomy, by statistically identifying the decoupling relationship between foreign reserves and monetary base in the accumulating process of foreign reserves.

4. Concluding Remarks

This paper examined the trends in monetary autonomy and its interaction with financial integration, currency regime and foreign reserves, for the past two decades in emerging market economies in Asia and Latin America. We critically reviewed Aizenman *et al*. (2008) by using alternative indexes considering measurement problem, and by re-estimating the relationship among the fore-mentioned four variables. Our main findings, which showed some contrast with Aizenman *et al*. (2008) especially in emerging Asia, were as follows: First, most of emerging Asian economies have raised monetary autonomy due to their changes in currency regime toward floating regime and their accumulation of foreign reserves, while emerging Latin American economies have shown mixed results on monetary autonomy reflecting its different trend of each economy. Second, in all sample economies, the accumulation of foreign reserves has contributed to retaining monetary autonomy, probably implying their roles as an anchor for monetary autonomy to the emerging market economies facing "fear of floating".

Table 1   Estimation Results of Equation (2)

Explained Variable DIR	Emerging Asia	Emerging Latin America
Constant	3.503 *** (0.300)	6.336 *** (0.552)
UIR	1.332 *** (0.168)	2.773 *** (0.484)
FNI*UIR	0.067 ** (0.031)	1.843 ** (0.711)
RGF*UIR	-0.570 *** (0.091)	-2.893 *** (0.504)
RES*UIR	-1.153 *** (0.407)	-11.651 *** (2.432)
<Sargan test>	0.690	0.467
Estimation period	1990q1-2010q2	

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   Trends for 1990s-2000s in Trilemma Variables and Foreign Reserves

	Monetary Autonomy Sensitivities		Currency Regimes RGF: floating		Financial Integration FNI		Foreign Reserves RES	
	1990s	2000s	1990s	2000s	1990s	2000s	1990s	2000s
Emerging Asia								
China	1.17	1.01			0.36	0.37	0.16	0.30
Hong Kong	0.72	0.75			0.46	3.85	0.56	0.73
Indonesia	1.20	0.62		Yes	0.10	0.18	0.08	0.13
Korea	1.18	0.52		Yes	0.16	0.44	0.07	0.24
Malaysia	0.90	0.86			0.03	0.24	0.38	0.42
Philippines	0.97	1.16			0.21	0.52	0.09	0.18
Singapore		-0.11		Yes		3.04		0.93
Thailand	0.93	0.45		Yes	0.30	0.60	0.21	0.31
Average	1.01	0.77			0.23	0.88	0.22	0.33
Emerging Latin America								
Argentina	2.89	3.17			0.45	0.96	0.06	0.12
Brazil	2.30	-0.15		Yes	0.22	0.52	0.06	0.08
Chile	-0.70	0.04	Yes	Yes	0.46	1.13	0.20	0.16
Colombia	-1.02	-0.56	Yes	Yes	0.10	0.40	0.09	0.10
Ecuador	-0.73	2.14	Yes		0.08	-0.03	0.10	0.05
Jamaica	2.09	2.79			0.19	1.03	0.09	0.16
Mexico	1.46	-0.25		Yes	0.30	0.43	0.05	0.08
Peru	1.27	1.47			0.20	0.45	0.16	0.18
T&T	3.15	1.52			0.72	0.87	0.08	0.25
Venezuela	1.47	2.26			0.18	0.30	0.14	0.09
Average	1.22	1.24			0.29	0.61	0.10	0.13

Notes:
1) The average figures in the 1990s and the 2000s are the ones that average the data available in those period.
2) The average figures in energing Asia exclude the one of Singapore, because her data in the 1990s are lacking.
3) The description of floating regime indicates that floating regime is dominant in the 1990s or the 2000s.

Table 3　Comparison of the 1990s-2000s Trends between Our Analysis and Aizenman et al. (2008)

	Monetary Autonomy	Exchange Rate Stability	Financial Integration	Foreign Reserves
Emerging Asia				
Our analysis	Increase	Decrease	Increase	Increase
Aizenman et al. (2008, 2010)	Decrease	Increase	not change so much	Increase
Emerging Latin America				
Our analysis	Mixed	Mixed	Increase	Slightly Increase
Aizenman et al. (2008, 2010)	Decrease	not change so much	Increase	Slightly Increase

Table 4　Estimation Results of Equation (5)

Explained Variable MB	**Emerging Asia**	**Emerging Latin America**
Constant	0.022	0.045 ***
	(0.025)	(0.007)
RES	0.586 ***	0.480 ***
	(0.176)	(0.116)
RES^2	-0.346 **	-0.744 ***
	(0.160)	(0.262)
RGF*RES	-0.142 ***	-0.211 ***
	(0.049)	(0.077)
<Sargan test>	0.577	0.627
Estimation period	1990q1-2010q2	

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

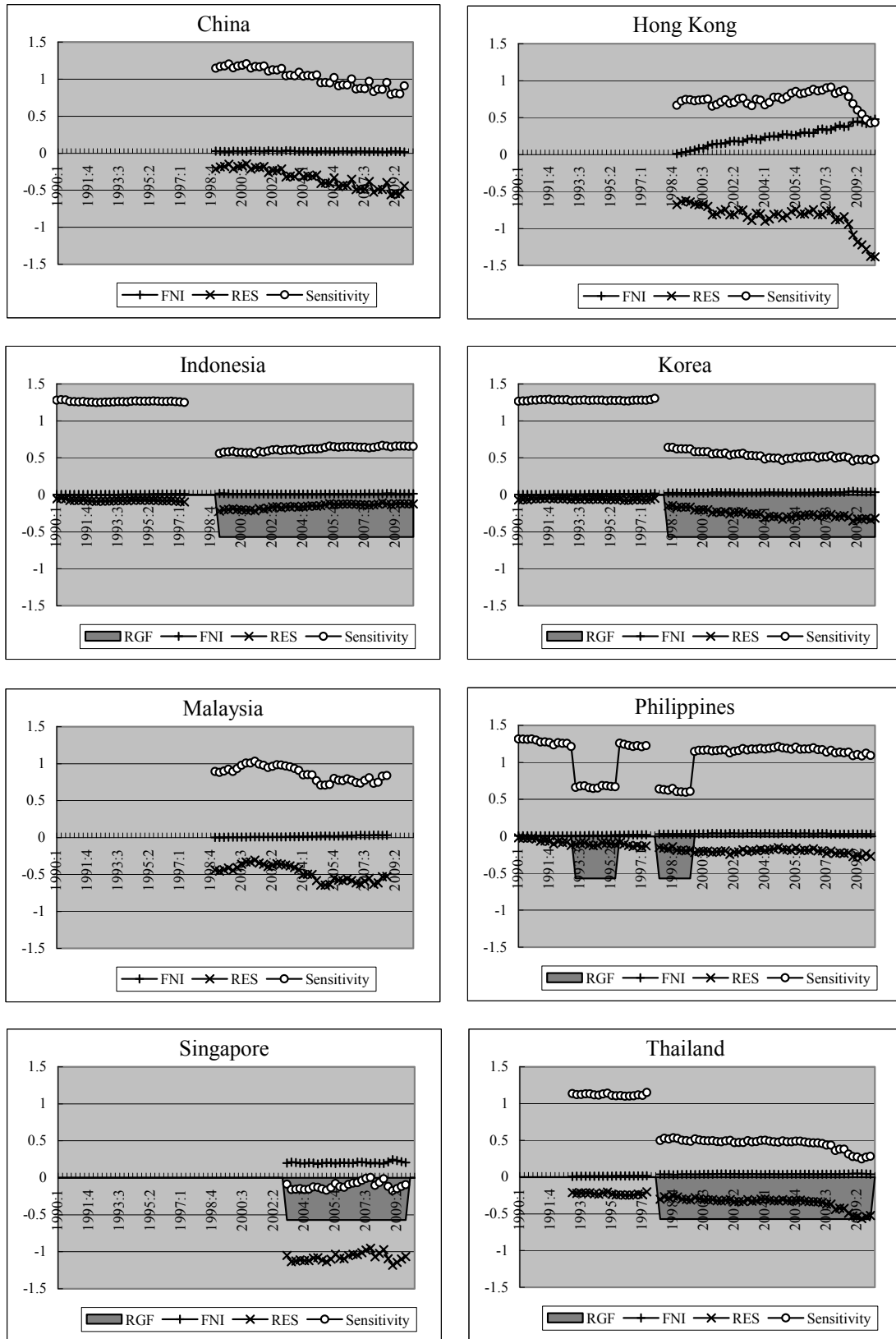Figure 1   Sensitivity of Interest Rates and Its Factors (Emerging Asia)

Figure 1   Sensitivity of Interest Rates and Its Factors (Emerging Latin America)
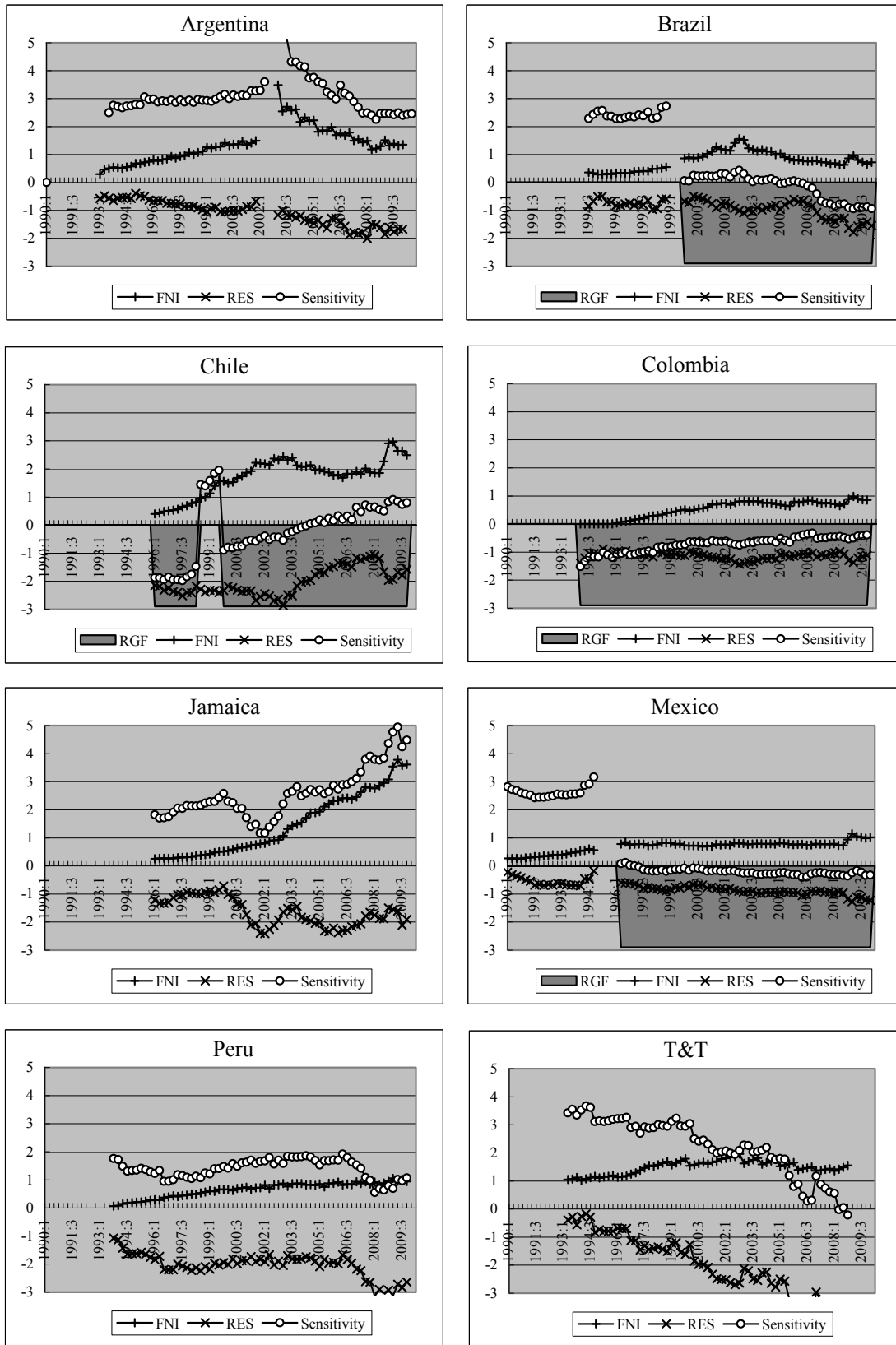
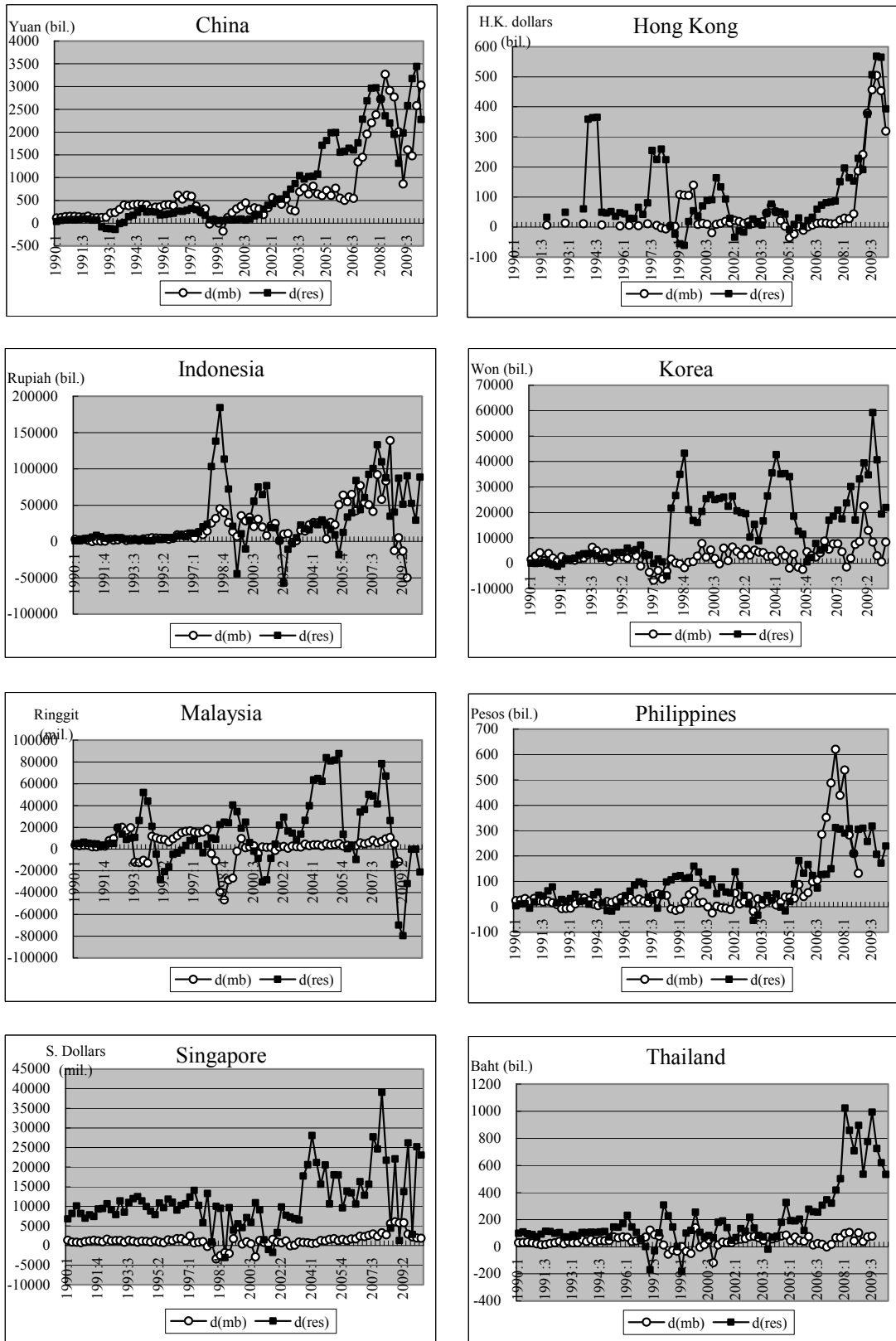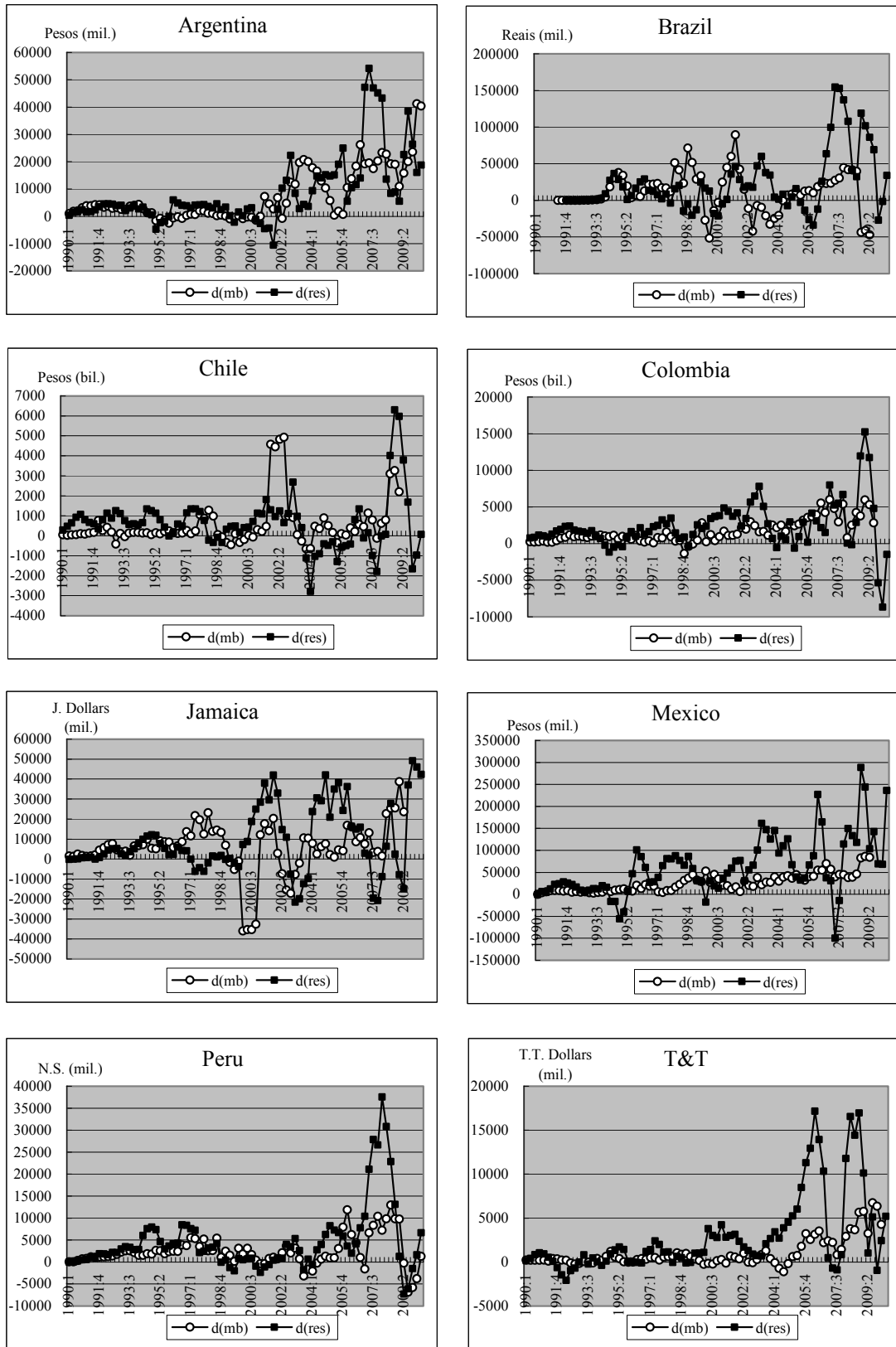Figure 2　Foreign Reserves and Monetary Base (Emerging Asia)

Figure 2　Foreign Reserves and Monetary Base (Emerging Latin America)

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