**Toward Greater Financial Stability in the Asia Region:**
**Measures for Possible Use of Regional Monetary Units for Surveillance and Transaction**

**(Final Draft Report)**

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# EXECUTIVE SUMMARY

Increased economic integration among the ASEAN+3 economies starting in the previous decade has highlighted the benefits from more integration in the East Asian region. As a result, efforts to improve and deepen financial and monetary cooperation aimed towards a healthier financial sector and more stable currencies in the region have been proposed in an effort to avoid the problems encountered during the crisis. One of the most widely discussed initiatives is monetary integration among the ASEAN+3 economies through the introduction of a regional monetary unit (RMU). The creation of an RMU is seen as a tool for regional macroeconomic surveillance and denomination of financial transactions. This of particular interest to Asian economies since the 1997 crisis highlighted the absence of well-developed supranational institutions to provide early warning signals on balance of payments problems, the lack of access to funds that could help economies cope with financial problems, and the absence of a common defensive mechanism to deal with fluctuations in exchange rates. In particular, the issue that needs to be addressed is whether a currency crisis can be detected in advance through key economic and financial variables to enable policymakers to predict the occurrence of a crisis to provide sufficient time to implement appropriate measures to avoid or at least minimize the unfavorable impacts of such an event. This concern has underscored both the need to understand the nature of crisis and to develop an early warning system (EWS) that can detect macroeconomic and financial vulnerabilities in an economy.

Towards this end, the research paper was developed with the objective of addressing the following issues: the appropriate methodology in computing for the regional currency basket and using the RMU as a surveillance tool and the associated deviational or divergence indicators that will be employed in the surveillance process; and exploring venues for ensuring support for the RMU in financial transactions.

In creating an RMU for exchange rate surveillance in the region, selection of the base year was made on the basis of the time period that exhibited the least volatility in effective exchange rates using actual and average trade volume from 2000-2006. In seven (7) (i.e., Brunei dollar, Chinese yuan, Japanese yen, Myanmar kiat, Philippine peso, Singapore dollar, and Vietnamese dong) and eight (8) (i.e., Brunei dollar, Chinese yuan, Japanese yen, Laotin kip, Myanmar kiat, Philippine peso, Singapore dollar, and Vietnamese dong) out of the 13 currencies in the ASEAN+3 using actual and average trade volume, respectively, 2004 emerged as the year with the most stable (equilibrium) conditions. Weights of the numeraire currency against the US dollar and the euro were then determined as a proportion of the average trade volume allocation of the ASEAN+3 countries to the US ($w_1$=66.11) and Europe ($w_2$=33.89) for 2004-2006. Five types of RMUs were constructed using five economic size indicators [i.e., trade volume, nominal GDP, GDP measured at purchasing power parity, international reserves less gold, and composite weights (average of the four economic size indicators] with the RMU using composite weights as the most stable, based on volatility measures (i.e., standard deviation, coefficient of variation, average deviation, etc.) while on the opposite end of the spectrum is the RMU with nominal GDP as the most volatile.

From the RMU estimated with composite weights, deviation indicators for all 13 Asian currencies were then calculated to track changes in the current RMU value for each of the member currencies from its benchmark value in 2004. The resulting deviation indicators showed that the Brunei dollar, Chinese yuan, Singapore dollar, and Malaysian ringgit appear to have the least divergence from their respective benchmark values while the biggest deviations belong to Laotian kip, Korean won, and Myanmar kiat.

Similar to an earlier arrangement by the European Economic Community (EEC), a snake system was devised as another tool for monitoring exchange rate movements within the region. Exchange rate movements for each of the ASEAN+3 currencies against the US dollar was traced vis-à-vis their corresponding snake (or movement along an arbitrary 6% band). Results of the simulation exercise showed that a number of countries experienced sustained and significant deviations from the band (snake) during the sample period (e.g., Philippines). In general, countries that largely fixed their exchange rates were within the snake, as expected while those with significant deviations from the snake are those that have more flexible exchange rate regime and the fixed exchange rate countries THAT have undertaken significant exchange rate adjustment (e.g., Laos). This implies that overall, there may be merit in using the snake system and how each currency deviates from the snake as a tool for monitoring exchange rate alignments in the region.

Use of the deviation indicator as a crisis indicator is then explored. A quantitative model of exchange market pressure (EMP) and cumulative market pressure (cumulative EMP) was developed as a proxy for currency misalignments relative an average value during the base year utilizing three (3) crisis indicators: deviation from real effective exchange rate from trend (current account indicator); ratio of M2 to roreign reserves (capital account indicator); and ratio of domestic credit to GDP (financial indicator). Results of the analysis covering ten (10) countries (i.e., Cambodia, China, Indonesia, Korea, Laos, Malaysia, Philippines, Singapore, Thailand, and Vietnam) from January 2000 to November 2005 showed that countries in the region have different degrees of exchange market pressures. Using the first statistical description to test for a crisis [i.e., changes in exchange rates (including lagged effects), changes in reserves (including lagged effects), and deviation indicators (including lagged effects), thresholds for spikes were different per country and ranged from a low of 0.25 for Malaysia to a high of 9.83 for Indonesia. In many cases, the adjustments were both in the exchange rate and international reserves. Using Korea, Malaysia, the Philippines and Indonesia as illustrations, Indonesia has highest EMP; Malaysia the lowest; and the Philippines and Korea in between.

On the other hand, results of the second statistical description, which includes the use of EMP, cumulative EMP, and the deviation indicator (including changes and lagged effects) to determine crisis episodes showed that in a number of instances, the crisis periods were preceded by both rising EMP and cumulative EMP (e.g., case of the Philippines prior to the crisis in 2001), which suggests that both EMP and cumulative EMP are relatively good predictors of a crisis. However, there were also instances when rising cumulative EMP did not lead to a crisis. Similarly, the results for the deviation indicators were mixed. While there were instances where a crisis was preceded by declining deviation indicator, there were also instances when the declining deviation indicator did not lead to a crisis. Results of the moving average regression showed only five (5) cases where the deviation indicator had significant t-statistics (i.e., Korea, Malaysia, Philippines, Singapore, and Thailand).

In general, the results of the analysis for EMP vis-à-vis the deviation indicator are very mixed (i.e., for countries with relatively flexible exchange rate, the change in deviation indicator explains part of the EMP for countries). This is consistent with the general consensus in the literature, which have observed that there is no good parsimonious EWS model to rely on due primarily to lack of data for crisis probability tests for what the analytical literature highlights (e.g., indicator of financial fragility should be a significant increase in domestic credit in tandem with rising non-performing loans). This suggests that although EMP and deviation indicators seem to have some promise as surveillance tools, more analysis and tests needed. In particular, what is called for is in depth country specific full analysis.

In terms of the use of an RMU for transactions purposes, interviews conducted among selected private sector representatives based in the Philippines have a general positive view of an RMU and are of the opinion that most financial products (e.g., bonds, deposits, derivatives, equities, loans, mutual funds) in the region may be linked with an RMU, most feasible of which would be RMU-linked products (e.g., RMU structured notes or RMU bonds).   However, constraints in the private use of an RMU in financial instruments revolve around the high cost of cross-border financial transactions in the region due to the following:   capital controls (e.g., foreign exchange restrictions); tax policy on cross-border securities transactions (e.g., diverse tax treatment across ASEAN+3 countries, withholding tax on interest income, and capital gains tax); varied economic, legal, and political structures across countries in the region; lack of familiarity on RMUs by the private sector.

In summary the contributions of the research paper include the following:  establishment of 2004 as the base year; the use of the snake system as a tool for surveillance; the use of EMP as a surveillance mechanism for EWS; and comparison of the deviation indicator and crisis periods.  Results of the paper show that the RMU and the snake system may be useful as a tool for macro-economic consultation.  With this, one can show that some countries are way far from the snake, which may merit explanation and further discussion.  Nonetheless, the RMU and deviation indicator are not effective tools for surveillance BY THEMSELVES.  There were many instances of false starts for a crisis occurrence and cases where it does not provide accurate information on a crisis.  It appears that the EMP and the cumulative EMP may be a better alternative surveillance tools, but the problem lies on the setting of an arbitrary threshold, which warrants further analysis.  Although the two have some explanatory power, overall, the degree of explanatory power is small for most countries.

The paper also chose three (3) representative deviation indicators (e.g., real effective exchange rate, ratio of M2 to foreign reserves and ratio of domestic credit to GDP) in developing a parsimonious model.  With and without changes in the deviation indicator, more things must be done in explaining which variables could be good indicators of a crisis.  Results indicate that deviation indicators cannot be relied heavily as an effective surveillance mechanism.  Similarly, parsimonious models are not effective predictors of crises.  Therefore, the deviation indicator needs to be used in tandem with other economic and financial indicators in an in depth country analysis.  Moreover, further studies need to be done on the dynamics of an economy and the analysis of various country specific indicators that can provide signal for early warning signals and an effective surveillance mechanism.

For the use of RMU for market transactions, synthetic form of selected financial products (e.g., structured note or a currency basket bond) was identified as most feasible type of financial instrument.  Private sector involvement in using RMU-based financial instruments is likely to be constrained by the following issues: capital controls; tax treatment; weak market infrastructure; limited hedging instruments; diverse economic and political structures; and lack of information about RMU.  This implies that unlike the case of RMU use for regional surveillance which will immediately involve all Asian currencies, RMU for transaction purposes will have to start with currencies whose home country has well-developed capital markets with no controls in both current and capital account transactions, such as Japanese yen, Korean won, Hong Kong dollar and Singaporean dollar.  Inclusion of other currencies in the basket will hinge on the ability of their respective countries to address the issue of eliminating exchange controls.

# CHAPTER 1
## INTRODUCTION

The 1997 financial crisis increased interest among policymakers in exploring avenues to achieve exchange rate stability in the region.  This happened as most economies abandoned in a way the de facto exchange rate that was pegged against the dollar, which was previously utilized to help stabilize the exchange rates in Asian economies.  The experience of the financial crisis served as an important lesson to most economies in the region of the dangers attached to a de facto dollar peg and that a common currency with linkages to a currency basket (as opposed to a single major currency, such as the dollar) is more appropriate.  In addition, the switch by a number of economies from a quasi-fixed to floating exchange rate regime further strengthened interest in exploring alternative exchange rate systems that could provide stability to intra-Asian exchange rates to allow for the expansion of trade and capital mobility within the region.  A regional currency arrangement is believed to provide the needed flexibility with regard to major global currencies, such as the dollar, euro, and yen.  A number of studies indicate that a regional currency arrangement can be attractive, especially for the ASEAN region, since its trade is highly diverse and there is no single currency against which to peg.

Increased economic integration among the ASEAN+3 economies starting in the previous decade has highlighted the benefits from more integration in the East Asian region.  As a result, efforts to improve and deepen financial and monetary cooperation aimed towards a healthier financial sector and more stable currencies in the region have been proposed in an effort to avoid the problems encountered during the crisis.  One of the most widely discussed initiatives is monetary integration among the ASEAN+3 economies.

Towards this end, one of the proposed solutions that has gained momentum in recent years is the introduction of a regional monetary unit (RMU).  The creation of an RMU will be particularly useful for macroeconomic surveillance[1] and denomination of financial transactions, which is of particular interest to Asian economies since the 1997 crisis highlighted the absence of well-developed supranational institutions to provide early warning signals on balance of payments problems, the lack of access to funds that could help economies cope with financial problems, and the absence of a common defensive mechanism to deal with fluctuations in exchange rates (Wilson, 2002).  In particular, the question of whether a currency crisis can be detected in advance through key economic and financial variables to enable policymakers to predict the occurrence of  a crisis, and thus provide them with sufficient time to implement appropriate measures to avoid or at least minimize the unfavorable impacts of such an event.  This concern has underscored both the need to understand the nature of crisis and to develop an early warning system that can detect macroeconomic and financial vulnerabilities in an economy.  A number of early warning systems have been developed thus far.  However, the development of a perfect forecasting method for determining the timing of currency crisis still remains an elusive goal until the present time.

An RMU for surveillance will facilitate monitoring of excessive currency fluctuations to help prevent the occurrence of future financial crises and could provide a framework for crafting exchange rate objectives and promoting effective regional exchange rate policy coordination.  In addition, an RMU can also be employed for private use to diversify assets as in the case of the European Currency Unit (ECU), which has

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[1] The surveillance process is one the highlight agreements under the Chang Mai Initiative to prevent future currency crises in the ASEAN+3 Region.

the same functional characteristics of money and can be used for international commercial and financial transactions.

Given these perceived benefits, the idea of an RMU has increased wide interest among policymakers as a possible effective tool for the promotion of regional integration. Some of the recent initiatives to this effect include the ASEAN+3 Finance Ministers Meeting in May 2006 at Siem Reap, Cambodia, which endorsed further studies on the proposed RMU and ASEAN+3 Finance Ministers' Meeting in May 2007, which reaffirmed the importance of RMUs and the necessity of strengthening cooperation on regional surveillance, as well as the need to explore ways on how to link initiatives with strengthened surveillance within the region.

The establishment of an RMU is seen as an intermediate step that could eventually lead to an Asian Monetary Unit (AMU) in the long-run. The RMU could promote the joint objectives of an orderly exchange rate structure, greater regional cooperation, and the ability of currencies in the region to move against other major world currencies (such as the dollar and euro) without experiencing serious intraregional shifts in competitiveness. Also, it can promote diversification among investors and operators whose trade or financial flows are mostly within the region. The diversification can be in the form of working balances denominated in the RMU rather than in other international currencies. In addition, an RMU can be used as a unit of account for pricing and denominating invoices within and around the ASEAN+3 economies. This is particularly beneficial for multinationals that operate mainly within the region. Moreover, firms who will use the RMU as a unit of account and instrument to denominate their invoices can use it as an instrument for settlement, opening accounts, and for seeking financing.

As seen from the European experience, the ECU gained popularity because it was used by importers, exporters, and financial market participants. European banks started using ECUs in order to handle deposits of member state institutions and governments. This facilitated the development of interbank and private ECU deposits as a multilateral clearing system was established for ECU deposits. Due to the increase in ECU deposits, the issuance of ECU bonds became attractive and medium-term ECU notes started to appear in 1988. This also led to the development of a market in ECU commercial paper.

Learning from the experience of the ECU, the establishment of an RMU may likewise offer increased business for the private sector, particularly those in financial institutions through the following: First, the RMU can be used as a hedging instrument for trade. Private exporters or importers in the region may hedge their exposure by using foreign exchange forward transactions of the RMU, reducing transactions costs for regional business firms. Because the RMU will serve as a composite of major currencies, market makers could develop long-term forward exchange rates against a country's local currency rather easily and economically. This may be particularly beneficial to the private sector in countries where long-term forward rates of the home currency are difficult to obtain. Second, the RMU may offer good possibilities for funding at lower rates compared to domestic sources since in the RMU market, it would be possible for issuers of bonds in the ASEAN+3 countries to obtain long-term funds with less foreign currency risks. In addition, an RMU may also offer better yields and less foreign currency fluctuations, which would directly benefit the growing number of investors in the region.

In this light of the above, there is a need to continue the exploring the applicability of RMUs in the region, specifically as a surveillance and transactions tool. Among the issues that need to be addressed include the following: the appropriate methodology in computing for the regional currency basket and using RMUs as a surveillance tool; the associated deviational or divergence indicators that will be employed in the

surveillance process; and ensuring private and public support for RMUs in financial transactions. Hence, this paper is organized as follows: After the introduction, the paper will discuss the different measures in calculating and utilizing an RMU for surveillance in the region. Selection criteria will be developed to determine the base year where ideally, the various currencies in the region are in equilibrium or that will maximize the use of the deviation indicator. The selected base year will then be used to demonstrate how economic and financial stability can be strengthened by minimizing exchange rate volatility and currency misalignment in the region. Section 3 will address the issue of whether the use of an RMU for surveillance contributes to the financial and economic stability in the region. Quantitative analysis using simulation techniques, which includes RMU deviation indicators as one of the determinants of financial stability in the region, will be carried out using live exchange rate and economic size indicators data for the region covering the period from January 1, 2000 to December 31, 2007 (for exchange rates) and 2000 to 2006 (for economic size indicators), in order to assess the reliability of including RMU indicators in improving the forecasting power of the Early Warning System (EWS) or for measuring the likelihood of a financial crisis or in detecting signs of financial instability in the region. Section 4 will focus on the suitable roles of both private and public sectors to strengthen the use of RMU-denominated financial products in financial market transactions. Discussions in this section will draw inputs from a survey conducted by the team on financial products denominated in RMUs or RMU-like currencies that are currently used by major players in the region's financial market. Finally, the paper will identify the prerequisites needed for successful private use of an RMU in the ASEAN+3 and will discuss specific measures to promote and stimulate government support for increase private sector use of RMUs for transaction purposes.

# CHAPTER 2
## AN APPROPRIATE RMU ARRANGEMENT FOR SURVEILLANCE IN THE ASEAN+3 REGION

This section of the paper will focus on the key role of RMUs (i.e., for macroeconomic surveillance). After which, discussion will address the issue of determining the most appropriate methodological arrangements of establishing the regional currency basket and the associated deviational or divergence indicators that will be employed in the surveillance process.

### 2.1    Properties of ASEAN+3 Regional Monetary Units (RMUs)

As a regional currency basket, an RMU for the ASEAN+3 region is a weighted average of the ten (10) ASEAN currencies [i.e., Brunei dollar (BND), Cambodian riel (KHR), Indonesian rupiah (IDR), Laotian kip (LAK), Malaysian ringgit (MYR), Myanmar kyat (MMK), Philippine peso (PHP), Singaporean dollar (SGD), Thai baht (THB), and Vietnamese dong (VND)] and the currencies of the 3 East Asian economic giants [Japanese yen (JPY), Chinese yuan (CNY), and Korean won (KRW)]. Such currency basket is entirely virtual and has no physical manifestations as in the case of notes and coins (Adams and Chow, 2007). The weights associated with each currency could be fixed or continuously changing, with the fixed weight being more popularly utilized in the literature and thus, will be adopted in the present study.

The value of an ASEAN+3 RMU is generally anchored on an international currency (e.g., US dollar, euro, or yen) or may be a weighted average of these currencies, which then serves as the numeraire[2] currency in estimating the RMU. RMU weights are generally based on certain economic size indicators that signify the relative importance of the currency with respect to certain economic effectiveness criteria. Some of these economic size indicators include: trade volume, nominal gross domestic product, gross domestic product (GDP) based on purchasing power parity, international reserves less gold, foreign direct investment, and money supply over foreign reserves.

Theoretically, an RMU for the $k^{th}$ economic size indicator at time $t$ for the ASEAN+3 region may be represented by the following formula:

$$RMU_t^{(k)} = \sum_{j=1}^{13} q_j^{(k)} \sum_{i=1}^{r} \varpi_i P_{ijt} \qquad (1)$$

where:

$RMU_t^{(k)}$ : RMU value at time $t$ computed using the $k^{th}$ economic size indicator

$P_{ijt}$ : Bilateral exchange rate between the $i^{th}$ component of the numeraire currency and currency $j$ at time $t$ (expressed as $i^{th}$ component currency price per unit value of currency $j$)

$\varpi_i$ : Weight of the $i^{th}$ component of the numeraire currency

$q_j^{(k)}$ : RMU weight of the $j^{th}$ currency using the $k^{th}$ economic size indicator

$r$ : Number of component currencies in the numeraire (if r =1, the numeraire is said to be pegged to a single international currency, with $\varpi_i = 1$).

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[2] This term which is liberally used in this study means standard of comparison or benchmark.

By virtue of its linear construction, equation (1) has the desirable property of being homogeneous in degree one, which implies that the RMU's equi-proportional appreciation (depreciation) to the same proportional increase (decrease) in the value of all component currencies in the basket [i.e., if all the component currencies in the basket increase (or decrease) $m$ times, the RMU likewise increases (or decreases) by the same proportion]. However, the effect of the individual movements of the currencies on the RMU will depend on their respective basket weights $q_j^{(k)}$.

The fixed (i.e., time invariant) nature of the RMU weight $q_j^{(k)}$ requires that it be constructed on the basis of the allocation proportion afforded by the $k^{th}$ economic size indicator as well as "benchmark" values of the component currencies in the RMU basket. The latter values serve as reference "exchange rates" of the currencies vis-à-vis the numeraire currency during the "base period." This property of the RMU weight will have important implications on the behavior of the currency basket and the resultant deviational indicators that will be used extensively in the surveillance process. RMU weights will have to be revised periodically to reflect changing economic size allocations of participating countries and shifts in the base period. It is important to note that the base period has to be appropriately chosen in order to come up with meaningful and effective indicators.

The above arrangement was originally used by the European Monetary System (EMS) in establishing the ECU during the time it was utilized as a parallel currency in Europe before the onset of the euro (Kawai 2002). The same procedure is utilized by researchers from the Japanese Research Institute of Economy, Trade and Industry (RIETI) in providing regular estimates of ASEAN+3 currency baskets and deviation indicators for monitoring exchange rates misalignments in the region (Ogawa and Shimizu, 2005). Other researchers, notably Tanaka and Jin (2003),[3] used the same methodology in pursuing similar objectives for other regional groupings.

## 2.2    Methodology and Data

From the general equation (Equation 1) that will be adopted in the study, the next section of the paper will discuss the detailed methodology and the appropriate data sets needed in the computation of an RMU. Spreadsheet macro program/s were utilized to facilitate the voluminous calculations involved in computing for an RMU.

### 2.2.1   Establishment of the Base Period

A crucial element in the creation of the RMUs for surveillance is the establishment of a base period that will serve as a reference point with which currency movements will be measured. Ideally, the base period is the year within the sample time horizon when intra-regional trade volumes and other exchange-rate-linked economic variables are in steady state or in equilibrium. However, the choice of a base period may not be clearly justified given that there is no existing analytical procedure that can be used to determine the collective equilibrium point of these variables.

In this study, a simple procedure for identifying the base period is proposed where the base period is the reference year within the sample horizon 2000-2006 when most currencies in the region exhibit the least

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[3] Mentioned in Ogawa and Shimizu (2005).

volatile effective exchange rates.  The justification for this is that under the most stable (i.e., less volatile) exchange rate regime, international trade, balance of payments, and other related macroeconomic variables are more or less under equilibrium state.  Presented in Tables 1a and 1b are yearly volatilities of the currencies, proxied by the standard deviation of the currencies' effective exchange rates with the United States and the European Union under two different weighing schemes (i.e., actual trade weight of each country for each year and the average trade weight for each country for the entire horizon).  Results highlight the emergence of **2004** as the base year for the study.

**Table 1a. Volatilities of Effective Exchange Rates of ASEAN+3 Currencies (Using Actual Trade Volume), 2000-2006**

(Values are standard deviations of effective exchange rates.)

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Minimum | Year |
|------|------|------|------|------|------|------|------|---------|------|
| BND | 0.909882 | 0.967866 | 0.588498 | 1.160109 | 0.083651 | 1.633697 | 1.397257 | 0.083651 | **2004** |
| KHR | 0.000642 | 0.00054 | 0.000613 | 0.00079 | 0.00007 | 0.000492 | 0.000027 | 0.000027 | **2006** |
| CNY | 0.293403 | 0.400769 | 0.322189 | 0.294495 | 0.108937 | 0.456511 | 0.124429 | 0.108937 | **2004** |
| IDR | 0.000559 | 0.00014 | 0.00013 | 0.000126 | 0.000348 | 0.000212 | 0.00025 | 0.000126 | **2003** |
| JPY | 0.00038 | 0.000454 | 0.000109 | 0.000084 | 0.00002 | 0.000324 | 0.00024 | 0.00002 | **2004** |
| KRW | 0.000004 | 0.00174 | 0.000277 | 0.002195 | 0.00179 | 0.004146 | 0.002378 | 0.000004 | **2000** |
| LAK | 0.000118 | 0.00029 | 0.000313 | 0.000394 | 0.000119 | 0.000379 | 0.000184 | 0.000118 | **2000** |
| MYR | 0.638274 | 0.875682 | 0.687163 | 0.628827 | 0.204207 | 1.013871 | 0.502739 | 0.204207 | **2004** |
| MMK | 2.652757 | 0.509945 | 0.359021 | 0.274404 | 0.146882 | 0.241257 | 0.053185 | 0.053185 | **2006** |
| PHP | 0.050858 | 0.050465 | 0.068804 | 0.061201 | 0.019634 | 0.081255 | 0.04014 | 0.019634 | **2004** |
| SGD | 0.917409 | 0.947506 | 0.598947 | 1.176613 | 0.023958 | 1.629552 | 1.323867 | 0.023958 | **2004** |
| THB | 0.01902 | 0.066518 | 0.050636 | 0.011135 | 0.013651 | 0.048061 | 0.086654 | 0.011135 | **2003** |
| VND | 0.000112 | 0.000087 | 0.000188 | 0.000167 | 0.000025 | 0.000224 | 0.000053 | 0.000025 | **2004** |

Note: Effective exchange rates = Weighted average of US and EU bilateral rates with the ASEAN+3 currencies using actual trade volume weights for each year.

**Table 1b. Volatilities of Effective Exchange Rates of ASEAN+3 Currencies (Using Average Trade Volume Weights), 2000-2006**

(Values are standard deviations of effective exchange rates.)

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Minimum | Year |
|------|------|------|------|------|------|------|------|---------|------|
| **BND** | 0.922776 | 1.035024 | 0.590122 | 1.130356 | 0.081473 | 1.623276 | 1.460522 | 0.081473 | **2004** |
| **KHR** | 0.00065 | 0.000569 | 0.000614 | 0.00077 | 0.000068 | 0.000489 | 0.000029 | 0.000029 | **2006** |
| **CNY** | 0.297457 | 0.416121 | 0.322822 | 0.286967 | 0.1055 | 0.45365 | 0.130233 | 0.1055 | **2004** |
| **IDR** | 0.000566 | 0.000164 | 0.000131 | 0.000123 | 0.000337 | 0.00021 | 0.000261 | 0.000123 | **2003** |
| **JPY** | 0.000371 | 0.000482 | 0.000098 | 0.00009 | 0.000026 | 0.000332 | 0.000231 | 0.000026 | **2004** |
| **KRW** | 0.000002 | 0.001982 | 0.000278 | 0.002139 | 0.001736 | 0.00412 | 0.002486 | 0.000002 | **2000** |
| **LAK** | 0.000119 | 0.000305 | 0.000314 | 0.000384 | 0.000116 | 0.000377 | 0.000192 | 0.000116 | **2004** |
| **MYR** | 0.647093 | 0.895757 | 0.68852 | 0.612749 | 0.19774 | 1.007529 | 0.525625 | 0.19774 | **2004** |
| **MMK** | 2.687398 | 0.529676 | 0.359754 | 0.267348 | 0.14225 | 0.239644 | 0.055894 | 0.055894 | **2006** |
| **PHP** | 0.051495 | 0.05288 | 0.06893 | 0.059643 | 0.019017 | 0.08075 | 0.041962 | 0.019017 | **2004** |
| **SGD** | 0.930405 | 1.045456 | 0.600586 | 1.146441 | 0.022826 | 1.619147 | 1.383909 | 0.022826 | **2004** |
| **THB** | 0.019233 | 0.069273 | 0.050741 | 0.010833 | 0.013214 | 0.047746 | 0.090548 | 0.010833 | **2003** |
| **VND** | 0.000114 | 0.000094 | 0.000188 | 0.000162 | 0.000024 | 0.000223 | 0.000055 | 0.000024 | **2004** |

Note: Effective Exchange Rates = Weighted average of US and EU bilateral rates with the ASEAN+3 currencies using average trade volume weights.

### 2.2.2   The Composition of the Numeraire Currency

Exchange rate linked transactions of the different countries belonging to the ASEAN+3 Region were traditionally dominated only by the G3 countries (i.e., United States, European Union, and Japan).  Hence, this paper will base the proposed RMU on the bilateral exchange rates of the participating economies in the region to the currencies of these economic giants[4], with the exception of Japan, which is a regional insider.  Thus, the numeraire is a composite of the US dollar and the euro with weights proportional to the average trade volume allocation of the United States and the European Union during the last three years (2004, 2005, and 2006).  Table 2 presents the trade data from which the weights of the numeraire ($\varpi_1 = $**66.11%** for US dollar, and $\varpi_2 = $**33.89%** for the euro) were estimated (Table 3).  These were the values utilized in the simulation exercises in Section 2.4.

**Table 2. Total Trade Volume of ASEAN+3 Countries, 2000-2006 (Billions US Dollars)**

| Country | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Brunei | 4,588.40 | 4,650.90 | 5,069.89 | 5,763.14 | 6,149.90 | 7,301.56 | 8,767.42 |
| Cambodia | 2,547.07 | 2,751.44 | 3,163.41 | 3,503.00 | 4,262.23 | 5,562.08 | 6,546.72 |
| China | 474,383.00 | 510,276.00 | 621,184.00 | 851,200.00 | 1,154,780.00 | 1,422,555.00 | 1,761,077.00 |
| Indonesia | 95,632.70 | 87,279.20 | 88,443.10 | 93,561.70 | 118,074.10 | 143,322.50 | 206,206.40 |
| Japan | 857,938.00 | 752,598.00 | 753,961.00 | 854,859.00 | 1,020,620.00 | 1,110,081.00 | 1,225,473.00 |
| Korea | 332,738.00 | 291,534.00 | 314,433.00 | 372,632.00 | 478,201.00 | 545,548.00 | 578,539.00 |
| Laos | 1,080.86 | 1,095.03 | 1,108.06 | 1,246.29 | 1,591.21 | 1,962.05 | 2,765.01 |
| Malaysia | 180,358.10 | 161,558.60 | 172,899.30 | 187,702.50 | 230,813.00 | 254,586.00 | 291,141.00 |
| Myanmar | 5,018.43 | 5,287.44 | 5,721.57 | 5,993.28 | 6,610.84 | 7,270.21 | 8,164.08 |
| Philippines | 72,706.90 | 65,207.10 | 70,634.50 | 73,735.90 | 83,719.30 | 88,629.30 | 98,508.20 |
| Singapore | 272,679.00 | 237,846.00 | 241,702.00 | 296,400.00 | 371,391.00 | 429,644.00 | 510,839.00 |
| Thailand | 84,599.20 | 81,330.30 | 88,594.60 | 105,573.50 | 128,211.00 | 147,152.00 | 177,089.90 |
| Vietnam | 76,406.00 | 77,076.80 | 81,425.50 | 95,967.70 | 120,894.70 | 150,599.90 | 170,292.20 |

**Table 3a. Proportions of ASEAN+3 Trade Volume with G3 Countries, 2000-2006**

| ASEAN + 3 Trade Volume Proportions to/from G3 Countries 2000-2006 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Including Japan | | | | Excluding Japan | | |
| Year | EU | Japan | USA | Year | EU | Japan | USA |
| 2000 | 34.03% | 27.96% | 38.01% | 2000 | **29.29%** | **34.41%** | **36.30%** |
| 2001 | 34.78% | 28.13% | 37.09% | 2001 | 31.05% | 33.54% | 35.41% |
| 2002 | 34.31% | 28.30% | 37.39% | 2002 | 31.18% | 33.10% | 35.71% |
| 2003 | 35.58% | 29.10% | 35.32% | 2003 | 32.53% | 33.28% | 34.18% |
| 2004 | 36.12% | 29.27% | 34.61% | 2004 | 33.46% | 32.91% | 33.64% |
| 2005 | 36.23% | 28.52% | 35.25% | 2005 | 34.16% | 31.64% | 34.20% |
| 2006 | 37.21% | 27.11% | 35.68% | 2006 | 35.48% | 29.86% | 34.66% |
| **Average** | **35.47%** | **28.34%** | **36.19%** | **Average** | **32.45%** | **32.68%** | **34.87%** |

Source of Basic Data: Direction of Trades Statistics, IMF.

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[4] The currency basket being maintained by RIETI used as numeraire a weighted average of US dollar and euro with allocation proportions 65% and 35%, respectively (Ogawa and Shimizu, 2006b).

**Table 3b. Proportions of ASEAN+3 Trade Volume with G3 Countries, 2004-2006**

| ASEAN + 3 Trade Volume Proportions to/from G3 Countries 2004-2006 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Including Japan | | | | Excluding Japan | | |
| Year | EU | Japan | USA | Year | EU | Japan | USA |
| 2004 | 36.12% | 29.27% | 34.61% | 2004 | 33.46% | 32.91% | 33.64% |
| 2005 | 36.23% | 28.52% | 35.25% | 2005 | 34.16% | 31.64% | 34.20% |
| 2006 | 37.21% | 27.11% | 35.68% | 2006 | 35.48% | 29.86% | 34.66% |
| **Average** | **36.52%** | **28.30%** | **35.18%** | **Average** | **33.89%** | **31.77%** | **34.34%** |

Source of Basic Data: Direction of Trades Statistics, IMF.

### 2.2.3 Determining the RMU Weight of a Currency

The RMU formula given in equation (1) defined $q_j^{(k)}$ as the RMU weight of the $j^{th}$ currency using the $k^{th}$ economic size indicator, where $k = 1$ (trade volume); $k = 2$ (nominal GDP); $k = 3$ (GDP measured at purchasing power parity); $k = 4$ (international reserves less gold); and $k = 5$ (composite weights or the average of the four economic size indicators). The value of this fixed quantity depends on the relative importance of the country with respect to a specific economic size criterion, as well as the country's base period numeraire-adjusted exchange rate. More specifically, if $T_j^{(k)} = j^{th}$ country's total for the $k^{th}$ economic indicator for the last three years (2004-2006) and $X_t^{(j)} =$ average numeraire-adjusted exchange rate value of currency $j$ during the base year $t^*$, the RMU weight of currency $j$ may be computed using the following formula:

$$q_j^{(k)} = \frac{1}{X_{t^*}^{(j)}} \cdot \frac{T_j^{(k)}}{\sum_{j=1}^{13} T_j^{(k)}} = \frac{S_j^{(k)}}{X_{t^*}^{(j)}} \tag{2}$$

where $S_j^{(k)} = j^{th}$ country's share of the regional $k^{th}$ economic size indicator over the last three (3) years.

### 2.2.4 Determining the Daily RMU Value of a Currency and the Deviation Indicators

In order to utilize the currency basket scheme for surveillance, the observed daily bilateral exchange rates of each of the ASEAN+3 countries vis-à-vis the US dollar and euro will have to be converted into the daily RMU value of each participating member country's currency (for example, peso value of 1 RMU). These RMU values will then be compared to the benchmark RMU figures in order to detect any excessive movements[5] of the currencies away from their respective benchmark value. Using the economic size indicator $k^*$ deemed most appropriate, the RMU value of currency $j$ during time $t$ can be determined using the formula presented below:

$$RMU_{jt}^{(k)} = \frac{RMU^{(k)}}{\sum_{i=1}^{r} \varpi_i P_{ijt}} \tag{3}$$

---

[5] Identifying the divergence thresholds is not within the scope of the present study.

The benchmark RMU value can be computed by using the same formula above, evaluated at the base period $t^*$. The resulting RMU values for time $t$ and for the benchmark time $t^*$ will serve as input to the estimation of the deviation indicators[6] $D_{jt}$, where $D_{jt}$ = percentage by which the current RMU value of the currency deviates from its benchmark value. Such indicator may have positive/negative algebraic sign depending on whether the currency is depreciating/appreciating vis-à-vis its benchmark value. Computationally, the deviation indicators can be established using the formula:

$$Djt = \frac{-\left(RMU_{jt} - RMU_{jt^*}\right)}{RMU_{jt^*}} \bullet 100\% \quad , \text{for } j = 1, 2, ..., 13 \quad\quad (4)$$

where $RMU_{jt}$ = RMU value of currency $j$ at time $t$; and $RMU_{jt^*}$ = average daily RMU value of currency $j$ during the base year $t^*$ (or the benchmark value of currency $j$).

## 2.3     Data Description and Sources

To implement the study, counterfactual simulation exercises were undertaken using the equations (1) to (4) on two different sets of data. The first set utilized annual data consisting of economic size indicators (Tables 2 to 6) while the second data set consists of the daily bilateral exchange rates of the US dollar and euro vis-à-vis the ASEAN+3 countries. Most of the data in the first set were extracted from either the International Financial Statistics (IFS) or the Direction of Trade Statistics (DTS) data bases, both of which are from the International Monetary Fund (IMF). Other sources of information for the first data set include the Asian Development Bank (ADB) and the World Bank (WB). The time period covered for the annual data is from 2000 to 2006, while the daily data includes the period January 1, 2000 to December 31, 2007.

Due to difficulty in obtaining market determined exchange rates, such as those reported by Reuters, Datastream, Bloomberg and other financial news entities, this paper used interbank foreign exchange rates from the extensive real-time data base maintained by Oanda Corporation (www.oanda.com). The exchange rate data available at this site are used extensively by tourists, accountants, financial analysts, financial consultants, and government and academic researchers worldwide. The advantage of using interbank exchange rates over market determined data, aside from its being available online (at real time) without charges, is that information is based on **calendar days** (not working days) unlike those reported by financial news services. Hence, the exchange rate data matrices of the second data set are perfectly rectangular with similar dimensions.

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[6] These deviation indicators are in nominal terms and are therefore not adjusted to inflation rate differentials.

**Table 4. Nominal GDP of ASEAN+3 Countries, 2000-2006 (Billions US Dollars)**

| Country | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Brunei | 6.001 | 5.601 | 5.843 | 6.557 | 7.872 | 9.531 | 11.561 |
| Cambodia | 3.653 | 3.986 | 4.288 | 4.662 | 5.338 | 6.293 | 7.272 |
| China | 1198.478 | 1324.814 | 1453.833 | 1640.963 | 1931.646 | 2243.687 | 2644.642 |
| Indonesia | 165.521 | 160.657 | 195.593 | 234.834 | 257.005 | 286.957 | 364.239 |
| Japan | 4668.786 | 4097.958 | 3925.113 | 4234.917 | 4608.136 | 4557.105 | 4366.459 |
| Korea | 511.961 | 481.979 | 547.856 | 608.337 | 681.227 | 791.572 | 888.267 |
| Laos | 1.735 | 1.769 | 1.83 | 2.149 | 2.508 | 2.887 | 3.437 |
| Malaysia | 90.32 | 88.001 | 95.266 | 103.992 | 118.461 | 130.835 | 148.945 |
| Myanmar | 8.905 | 6.478 | 6.778 | 10.467 | 10.786 | 12.183 | 13.123 |
| Philippines | 75.912 | 71.216 | 76.814 | 79.634 | 86.93 | 98.718 | 117.562 |
| Singapore | 92.717 | 85.485 | 88.068 | 92.35 | 107.405 | 116.704 | 132.155 |
| Thailand | 122.725 | 115.536 | 126.877 | 142.64 | 161.349 | 176.222 | 206.338 |
| Vietnam | 31.196 | 32.504 | 35.148 | 39.63 | 45.548 | 53.053 | 60.995 |

Source: World Economic Outlook Database, IMF (October 2007).

**Table 5. GDP Based on Purchasing-Power-Parity (PPP) Valuation, 2000-2006 (Billions International Current Dollars Billions)**

| Country | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Brunei | 7.164 | 7.537 | 7.966 | 8.372 | 8.656 | 8.97 | 9.729 |
| Cambodia | 23.685 | 26.218 | 28.437 | 31.513 | 35.758 | 41.823 | 47.788 |
| China | 4959.759 | 5500.278 | 6105.572 | 6859.019 | 7768.879 | 8853.992 | 10147.33 |
| Indonesia | 624.526 | 662.809 | 704.725 | 754.123 | 814.833 | 888.966 | 967.317 |
| Japan | 3271.404 | 3356.061 | 3423.611 | 3545.874 | 3747.916 | 3942.212 | 4155.548 |
| Korea | 760.549 | 808.674 | 880.144 | 926.709 | 998.439 | 1073.967 | 1163.191 |
| Laos | 8.289 | 8.975 | 9.672 | 10.481 | 11.469 | 12.684 | 14.074 |
| Malaysia | 205.294 | 210.887 | 223.911 | 241.199 | 266.082 | 288.85 | 315.583 |
| Myanmar | 53.851 | 61.398 | 69.983 | 81.366 | 95.059 | 111.477 | 129.601 |
| Philippines | 305.138 | 317.944 | 337.888 | 362.089 | 396.262 | 428.984 | 466.632 |
| Singapore | 96.692 | 96.636 | 102.411 | 107.845 | 120.714 | 132.865 | 147.855 |
| Thailand | 385.775 | 403.59 | 432.473 | 473.209 | 517.382 | 558.06 | 604.575 |
| Vietnam | 158.133 | 173.091 | 188.582 | 206.733 | 229.243 | 256.605 | 286.39 |

Source: World Economic Outlook Database, IMF (October 2007).

**Table 6. Reserve Minus Gold of ASEAN+3 Countries, 2000-2006**

| Country | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Brunei | 408.341 | 391.418 | 437.775 | 481.544 | 505.111 | 494.204 | 523.287 |
| Cambodia | 501.681 | 586.809 | 776.147 | 815.533 | 943.21 | 952.978 | 1,157.25 |
| China | 168,278.00 | 215,605.00 | 291,128.00 | 408,151.00 | 614,500.00 | 821,514.00 | 1,068,490.00 |
| Indonesia | 28,501.90 | 27,246.20 | 30,970.70 | 34,962.30 | 34,952.50 | 33,140.50 | 41,103.10 |
| Japan | 354,902.00 | 395,155.00 | 461,186.00 | 663,289.00 | 833,891.00 | 834,275.00 | 879,682.00 |
| Korea | 96,130.50 | 102,753.00 | 121,345.00 | 155,284.00 | 198,997.00 | 210,317.00 | 238,882.00 |
| Laos | 138.968 | 130.931 | 191.589 | 208.589 | 223.247 | 234.294 | 326.87 |
| Malaysia | 28,329.80 | 29,522.30 | 33,360.70 | 43,821.70 | 65,881.10 | 69,850.10 | 82,132.30 |
| Myanmar | 222.988 | 400.459 | 469.988 | 550.224 | 672.134 | 770.731 | 1,235.56 |
| Philippines | 13,090.20 | 13,476.30 | 13,329.30 | 13,654.90 | 13,116.30 | 15,926.00 | 20,025.40 |
| Singapore | 80,170.30 | 75,677.00 | 82,221.20 | 96,245.50 | 112,579.00 | 116,172.00 | 136,260.00 |
| Thailand | 32,015.90 | 32,354.80 | 38,046.40 | 41,076.90 | 48,664.00 | 50,690.70 | 65,291.40 |
| Vietnam | 3,416.51 | 3,674.57 | 4,121.05 | 6,224.18 | 7,041.46 | 9,050.56 | 13,384.10 |

## 2.4 Implementation of the Proposed Methodology

The methodology and equations presented in the previous section is applied to the extensive data base of the study. Excel spreadsheet macros templates were developed to carry out repetitive calculations. Tables and charts are constructed using Microsoft Word. The results of the implementation are presented in the proceeding subsections.

### 2.4.1 Computation of RMU Basket Weights of the Component Currencies

Before setting into motion the actual estimation of the RMUs, it is important to establish the different RMU weight for each component currency using the identified economic criteria. The basic data needed to set up the RMU basket weight include information shown in Tables 2 to 6 plus the daily exchange rates during the base year. Table 7 shows the allocation proportions to be assigned to each currency and to each economic size indicator, as well as the resulting RMU weights. Also reflected in Table 7 is the numeraire adjusted benchmark exchange rate for each currency. These benchmark figures were computed using the daily exchange rate data of the currencies during the base year and the trade-related importance weights of US dollar and euro mentioned in subsection 2.2.2.

To represent the different allocation proportions for the economic size indicators, a three-dimensional bar chart is constructed (Figure 1, p. 18). The chart reveals the sheer dominance of the East Asian giants (i.e., Japan, China, and Korea), which collectively accounted for at least three-quarters of the economic size magnitudes for the region. To temper the dominance of these countries, an additional criterion (i.e., composite criterion which is actually the average of the other criteria), was introduced. Apparently, the composite criterion resulted in an allocation proportion that balanced out the overwhelming dominance of China and Japan in other economic size criteria.

**Table 7. Economic Size Indicators of RMU Weights and the Computed RMU Basket Weight for Different ASEAN+3 Currencies**

| Economic Size Indicator | BND | KHR | CNY | IDR | JPY | KRW | LAK | MYR | MMK | PHP | SGD | THB | VND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Allocation Proportions | | | | | | | | | | | | |
| Trade Volume Share | 0.17% | 0.13% | 33.16% | 3.57% | 25.65% | 12.25% | 0.05% | 5.93% | 0.17% | 2.07% | 10.03% | 3.46% | 3.38% |
| Nominal GDP Share | 0.11% | 0.07% | 26.77% | 3.57% | 53.12% | 9.27% | 0.03% | 1.56% | 0.14% | 1.19% | 1.40% | 2.14% | 0.63% |
| Share of GDP Based on PPP | 0.05% | 0.25% | 53.47% | 5.34% | 23.66% | 6.46% | 0.08% | 1.74% | 0.67% | 2.58% | 0.80% | 3.36% | 1.54% |
| Share of Reserve Less Gold | 0.02% | 0.05% | 37.70% | 1.64% | 38.35% | 9.76% | 0.01% | 3.28% | 0.04% | 0.74% | 5.49% | 2.48% | 0.44% |
| Composite (Average) | 0.09% | 0.12% | 37.77% | 3.53% | 35.19% | 9.43% | 0.04% | 3.13% | 0.26% | 1.64% | 4.43% | 2.86% | 1.50% |
| Benchmark Basket FX Rate | 0.55057 | 0.00023 | 0.11303 | 0.0001 | 0.00866 | 0.00081 | 0.00012 | 0.24641 | 0.14961 | 0.01667 | 0.55404 | 0.02325 | 0.00006 |
| | RMU Basket Weights (Currency Value Per Dollar-Euro RMU) | | | | | | | | | | | | |
| Trade Volume | 0.00308 | 5.42459 | 2.93347 | 340.8222 | 29.60689 | 150.3197 | 4.17752 | 0.24084 | 0.01126 | 1.24175 | 0.18096 | 1.48737 | 583.0046 |
| Nominal GDP | 0.00207 | 3.21722 | 2.3686 | 340.0094 | 61.31392 | 113.7737 | 2.99942 | 0.06344 | 0.00947 | 0.71399 | 0.02524 | 0.9184 | 108.1782 |
| GDP at PPP | 0.00099 | 10.85706 | 4.73079 | 508.8318 | 27.3111 | 79.33422 | 6.60574 | 0.07056 | 0.04488 | 1.54791 | 0.01447 | 1.44341 | 266.343 |
| Reserve Less Gold | 0.00042 | 1.99266 | 3.33522 | 156.7508 | 44.26638 | 119.766 | 1.02145 | 0.13308 | 0.00269 | 0.44304 | 0.09916 | 1.06598 | 76.60934 |
| Composite (Average) | 0.00164 | 5.37288 | 3.34202 | 336.6036 | 40.62457 | 115.7984 | 3.70103 | 0.12698 | 0.01708 | 0.98667 | 0.07996 | 1.22879 | 258.5338 |

**Figure 1. Size Allocation of ASEAN+3 Currencies for Different Economic Size Criteria**
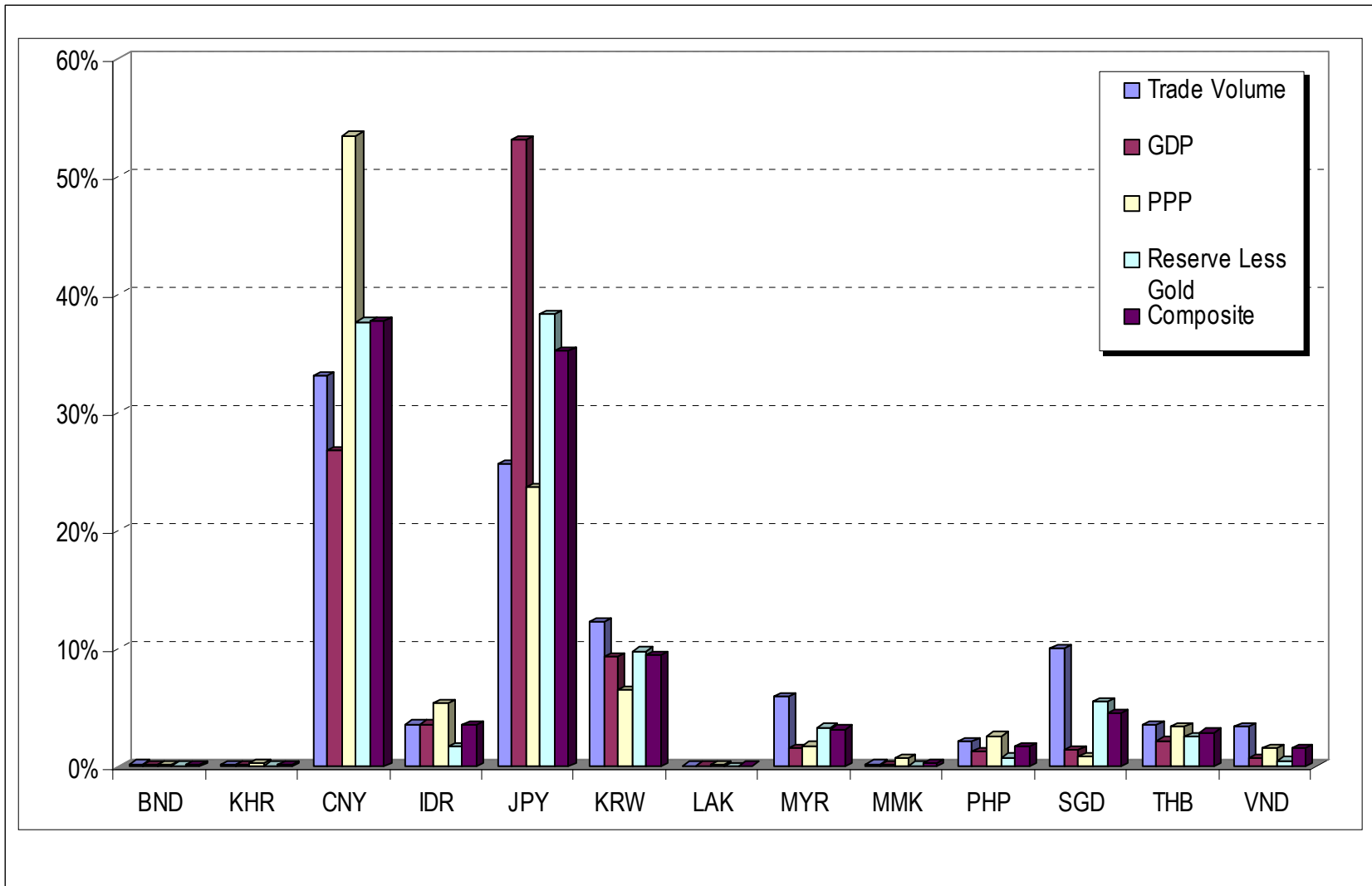
### 2.4.2    Estimated RMUs Using Different Economic Size Indicators

After implementing equations (1) and (2), subsequent to the identification of the benchmark period as discussed in section 2.2.2, five alternative regional monetary units (RMUs) were estimated, representing each of the $k$ economic indicators across the uninterrupted period starting from January 1, 2000 to December 31, 2007.  As seen in Figure 2 (p. 19), the behavior of these RMUs over the indicated time horizon demonstrates that the various RMUs follow each other closely across time, with the ensemble not diverging far away from the supposed benchmark value equal to one.  On the other hand, Figure 2 also shows the varying volatilities of the RMUs, with the nominal GDP measure as the most volatile RMU arrangement and composite weights of the four economic size indicators as the most stable RMU.

Figure 3 (p. 20) presents a line graph of the computed regional RMUs based on US dollar, euro, and US dollar-euro under the composite allocation scheme.  From among the three alternatives, the dollar-euro RMU exhibited more stationary behavior, which provides clear justification for the use of the dollar-euro as the numeraire currency in RMU computation.  On the desirability of the composite weighing scheme, careful examination of the volatility measures (i.e., coefficient of variation, average deviation, and the range for all RMUs) presented in Table 8 shows that all volatility indicators appear to converge to the values given by the composite weight RMU.  This implies that the most stable or least volatile RMU was generated using composite weights.

**Table 8. Summary Statistics of the Various Simulated RMUs, January 1, 2000 to December 31, 2007**

| Summary Statistics | Alternative RMU Computed Using | | | | |
|---|---|---|---|---|---|
| | Trade Volume | GDP Nominal | GDP at PPP | Reserve Less Gold | Composite (Average) Weight |
| Average | 1.03491 | 1.01256 | 1.03611 | 1.02421 | 1.02695 |
| Standard Deviation | 0.03509 | 0.04024 | 0.03752 | 0.03433 | 0.0329 |
| Coefficient of Variation | 3.39% | 3.97% | 3.62% | 3.35% | 3.20% |
| Maximum | 1.14363 | 1.14484 | 1.14319 | 1.13801 | 1.14242 |
| Minimum | 0.98524 | 0.96196 | 0.99056 | 0.97336 | 0.97863 |
| Range | 0.15839 | 0.18288 | 0.15262 | 0.16465 | 0.16379 |
| Average Deviation | 0.02599 | 0.02847 | 0.03018 | 0.02532 | 0.02469 |

**Figure 2. Alternative RMUs Estimated Using Different Economic Size Indicators**
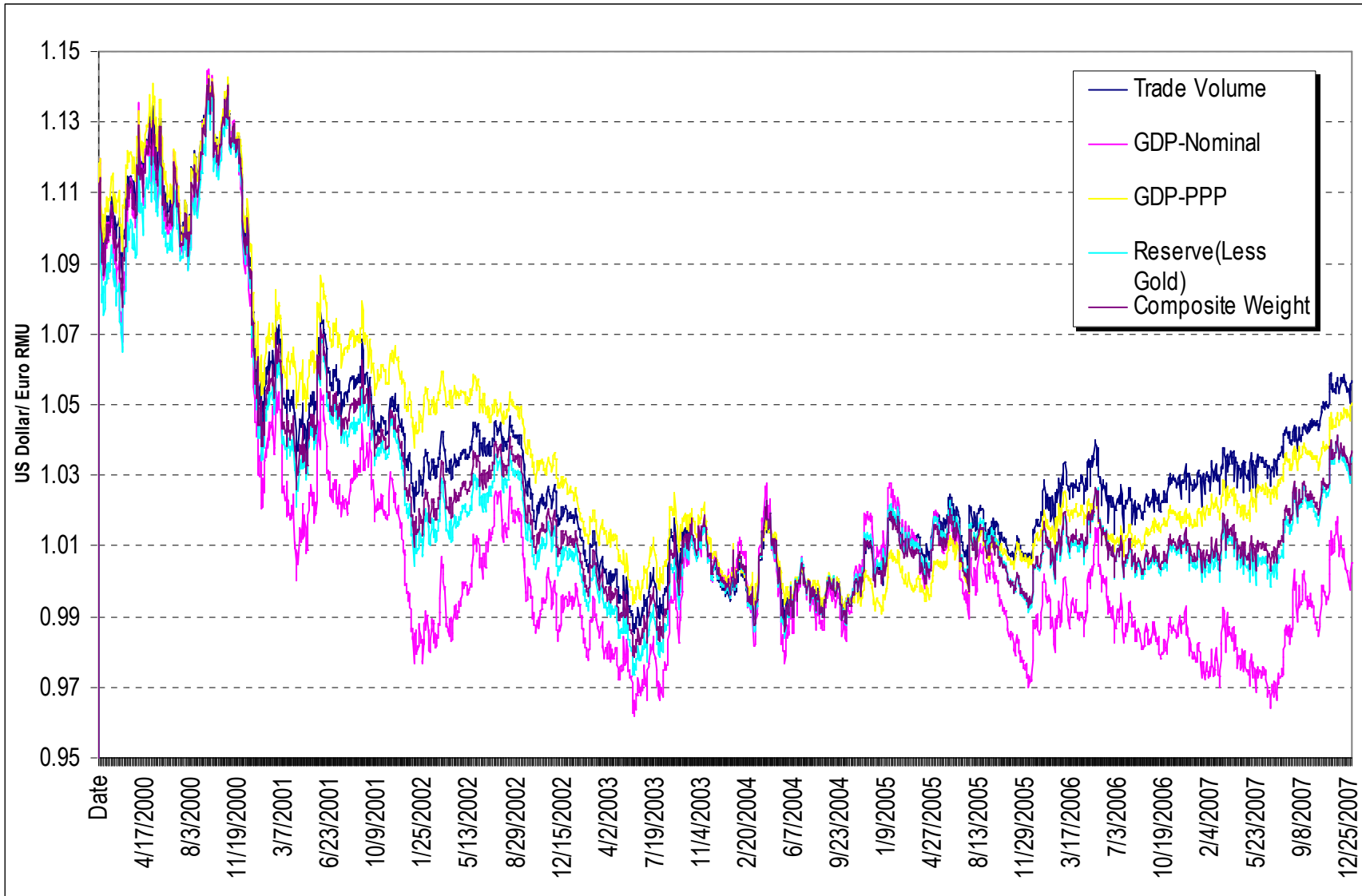
**Figure 3. Alternative RMUs Based on Composite Allocation Weights and Different Anchor Currencies**
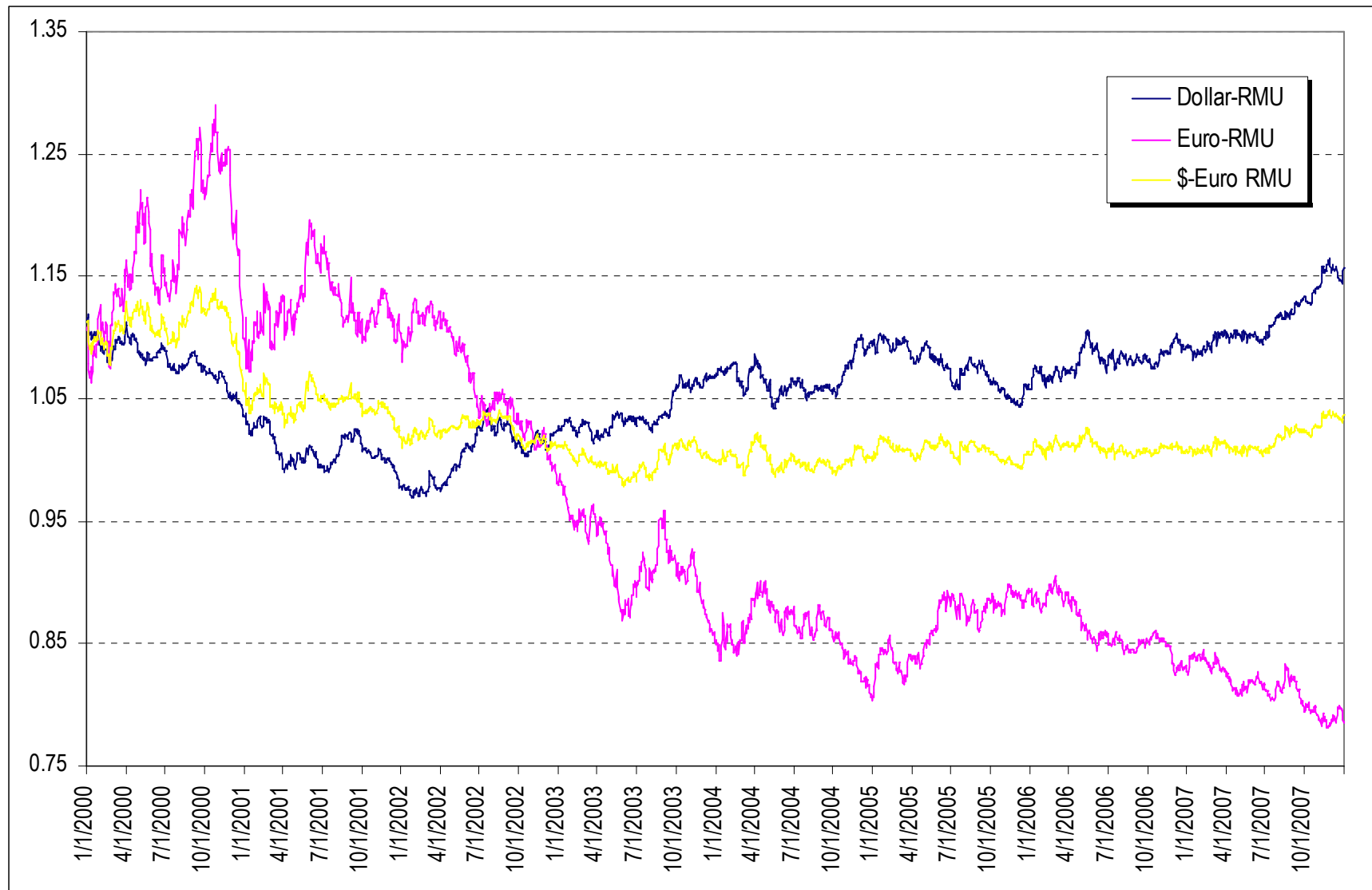
### 2.4.3    The RMU Deviation Indicators

From the RMU estimated with composite weights, deviation indicators for all currencies were calculated using equations (3) and (4).    Summary statistics of the deviation indicators are presented for different sample periods in Table 9.    Standard and average deviations were utilized as relevant descriptive measures of the relative stability of the various currencies in the region in terms of their respective benchmark values.    Results show that from among the 13 currencies in the region, the Singapore dollar, Malaysian ringgit, Chinese yuan, and Brunei dollar appear to have the least divergence from their respective benchmark exchange rates as evidenced by their relatively small deviation statistics over the full sample period.    On the opposite end of the spectrum however are the currencies that exhibited the most deviation from their respective benchmark values.    These are the Laotian kip, Korean won, and Myanmar kyat.

Figures 4-8 (pp. 33-37) show that indicators for a number of currencies reveal obvious misalignments.    In the case for example of the Korean won and the Laotian kip, after convergence during practically the entire base period (2004), both currencies reveal a tendency to diverge widely from their respective benchmark values.    The Korean won moved in an upward spiral immediately after 2004, which continued on until the last day of the sample period.    The highest positive deviation was observed before the third quarter of the current year with about 13.5% deviation from its benchmark value.    On the other hand, the Laotian kip, exhibited stable daily deviational statistics for most of the sample period and then dropped abruptly to -37.17% on April 23, 2005 or a more than ten fold reduction from its value the day before (Figure 7).    This trend persisted around that figure, deviating only within a narrow band since then.    The drop is obviously a manifestation of a structural change in the currency, which was captured by the proposed deviation indicator system.

Towards the end of the sample period (2007), four currencies registered double digit positive deviations from their respective benchmark values, led by the Philippine peso and Thai baht (the other two currencies include the Korean won and the Brunei dollar).    Meanwhile, four currencies likewise posted double digit negative deviations from their respective benchmark values, headed by Laotian kip, followed by the Japanese yen, and then by the Indonesian rupiah, and Myanmar Kyat.    The rest of the currencies [i.e., Chinese yuan, Malaysian ringgit, Singapore dollar, Cambodian reil, and Vietnamese dong (in order of their stability) posted single digit positive or negative deviations.

### 2.5    Using the Snake System as an Indicator of Currency Misalignment

As an additional means of checking for the misalignment of currencies from their respective base period values, a variation of the so-called "Snake System" is proposed in this study.    The snake is an arrangement set up by members of the European Economic Community (EEC) to stabilize intra-currency movements among the members' bilateral exchange rates and was historically used in Europe after the end of the of the Bretton Woods System and prior to the onset of the European Monetary System (EMS).    Each member agrees of the EEC to limit fluctuations of its currency against the currencies of other members within a certain pre-determined band around a target value.    The maximum divergence from the currency's target rate with another currency in the EEC was set at 2.25%, except for the Italian lira which was pegged at 6%.    Misalignments from the snake constitute a sufficient signal for affected countries to undertake calibrated market interventions.

In this study, the snake for currency $j$ is the RMU estimated value of currency $j$ for each unit value of US dollar during time $t$, as determined by the formula:

$$Snake_{jt} = RMU_{jt^*} \, x \left( RMU_{US\,dollar,t} \right)^{-1} \qquad (5)$$

The values of $RMU_{jt^*}$ and $RMU_{USdollar,t}$ are estimated using equation (3) via the composite economic size weights. Note that $RMU_{jt^*}$ is the average RMU value of currency $j$ during base year $t^*$ (i.e., fixed at the 2004 value) while $RMU_{USdollar,t}$ is changing across $t$.

The study looked into the movement of the actual bilateral exchange rates of the thirteen (13) regional currencies against the US dollar vis-à-vis their corresponding snake along the 6% band. Currencies falling outside the band of their corresponding snake may be considered misaligned from their benchmark values. Results show obvious misalignments both in the upward and downward direction may be observed in the following currencies: Laotian kip, Thai baht, Korean won, Myanmar kyat, Philippine peso, Japanese yen, and Indonesian rupiah. Figure 9 to Figure 21 present the movements of the actual bilateral exchange rates of the 13 regional currencies against the US Dollar vis-à-vis their corresponding Snakes along with their 6% bands.

**Figure 9:**

**Figure 10:**



Actual Cambodian Riel vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

**Figure 11:**



Actual Chinese Yuan vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

**Figure 12:**



Actual Indonesian Rupiah vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

**Figure 13:**



Actual Japanese Yen vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

**Figure 14:**



Actual Korean Won vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

**Figure 15:**



Actual Laotian Kip vs US Dollar Vis-a-vis RMU Estimated Rate with 6% Band

**Figure 16:**

**Actual Malaysian Ringgit vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band**

**Figure 17:**

**Actual Myanmar Kyat vs US Dollar Vis-a-vis RMU Estimated Rate with 6% Band**

**Figure 18:**



Actual Philippine Peso vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

**Figure 19:**



Actual Singapore Dollar vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

**Figure 20:**



Actual Thai Baht vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

**Figure 21:**



Actual Viet Dong vs US Dollar vis-a-vis RMU Estimated Rate with 6% Band

## 2.6 Summary

This section of the paper explored the most appropriate arrangement for the surveillance process in the ASEAN+3 Region, in line with the Chang Mai Initiative, where RMUs will play a critical role. From among five (5) alternative RMUs considered in the study, the weighted average of the currencies of countries in the region based on the composite allocation proportion (i.e., average of the four economic size indicators) emerged as the the most stable currency basket. Using the same allocation proportion and the numeraire-adjusted benchmark values of the currencies in the region, the RMU weights for the different currencies in the basket were established. Using these weights, virtual currencies for the different countries were generated over the daily time horizon from January 1, 2000 to December 31, 2007, which in turn were employed in creating deviation indicators for use in the surveillance process.

Because of the difficulties in clearly justifying the choice of an analytically determined base period, the paper used a simple procedure of locating the benchmark year to anchor the surveillance process. The study also proposed the use of readily available interbank call rates instead of the official market determined bilateral exchange rates of the component currencies of the RMU basket vis-à-vis the US dollar and the euro. This innovation afforded a means of producing uninterrupted daily exchange rates time series covering the entire sample period for all currencies in the basket.

The resulting deviation indicators reveal sizeable misalignments of certain currencies from their respective benchmark values. These divergence statistics also showed the relative stability of a good number of the regional currencies, indicating sound monetary programming. The capability of this paper's proposed RMU arrangement to pinpoint potential sources of currency troubles in the region underscores its feasibility as an effective system of surveillance that is needed in coordinating monetary policies of the different countries in the region.

**Table 9. RMU Deviation Indicators from Benchmark Rates During Various Sample Periods**

| Full Sample | BND | KHR | CNY | IDR | JPY | KRW | LAK | MYR | MMK | PHP | SGD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 3.75% | 1.30% | 2.48% | -1.95% | -5.67% | 3.89% | -6.42% | 2.48% | 0.10% | 9.52% | 1.15% |
| Standard Deviation | 3.27% | 5.97% | 2.70% | 6.75% | 4.82% | 8.03% | 17.90% | 2.90% | 4.23% | 6.23% | 2.95% |
| Maximum | 13.83% | 45.50% | 9.21% | 17.66% | 2.78% | 17.43% | 82.68% | 9.19% | 46.15% | 26.81% | 8.60% |
| Minimum | -3.73% | -8.58% | -4.78% | -25.92% | -17.77% | -10.43% | -37.91% | -5.65% | -13.88% | -3.59% | -5.53% |
| Average Deviation | 2.84% | 5.12% | 2.38% | 5.95% | 4.00% | 7.07% | 15.87% | 2.59% | 6.44% | 6.00% | 2.40% |
| **January 1, 2001 to December 31, 2007** | | | | | | | | | | | |
| Mean | 3.20% | 0.91% | 3.00% | -2.92% | -6.35% | 4.38% | -8.21% | 3.01% | -3.00% | 7.99% | 1.79% |
| Standard Deviation | 3.13% | 6.06% | 2.67% | 6.88% | 4.77% | 8.22% | 18.12% | 2.88% | 4.32% | 6.10% | 2.79% |
| Maximum | 13.83% | 45.50% | 9.21% | 11.46% | 2.78% | 17.43% | 82.68% | 9.19% | 4.65% | 21.24% | 8.60% |
| Minimum | -3.73% | -8.58% | -3.32% | -25.92% | -17.77% | -10.43% | -37.91% | -5.65% | -13.88% | -3.59% | -2.86% |
| Average Deviation | 2.63% | 5.42% | 2.09% | 5.51% | 3.85% | 7.65% | 16.77% | 2.39% | 3.70% | 5.27% | 2.33% |
| **January 1, 2002 to December 31, 2007** | | | | | | | | | | | |
| Mean | 2.81% | -0.54% | 2.56% | -1.98% | -6.39% | 6.11% | -11.46% | 2.58% | -3.41% | 6.99% | 2.10% |
| Standard Deviation | 3.15% | 5.23% | 2.59% | 6.23% | 5.11% | 7.59% | 17.16% | 2.85% | 4.51% | 5.95% | 2.86% |
| Maximum | 13.83% | 45.50% | 9.21% | 11.46% | 2.78% | 17.43% | 11.00% | 9.19% | 4.65% | 21.24% | 8.60% |
| Minimum | -3.73% | -8.58% | -3.32% | -20.82% | -17.77% | -6.29% | -37.91% | -5.65% | -13.88% | -3.59% | -2.86% |
| Average Deviation | 2.63% | 5.43% | 2.10% | 5.54% | 3.86% | 7.65% | 16.80% | 2.40% | 3.73% | 5.28% | 2.34% |

**Table 9. RMU Deviation Indicators from Benchmark Rates During Various Sample Periods (cont.)**

| January 1, 2003 to December 31, 2007 | BND | KHR | CNY | IDR | JPY | KRW | LAK | MYR | MMK | PHP | SGD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 2.74% | -2.06% | 1.88% | -2.72% | -5.90% | 7.75% | -15.37% | 1.92% | -4.12% | 5.71% | 2.44% |
| Standard Deviation | 3.44% | 4.30% | 2.13% | 6.33% | 5.35% | 7.20% | 16.16% | 2.52% | 4.50% | 5.57% | 3.01% |
| Maximum | 13.83% | 45.50% | 5.55% | 11.46% | 2.78% | 17.43% | 7.63% | 7.94% | 2.40% | 21.24% | 8.60% |
| Minimum | -3.73% | -8.58% | -3.32% | -20.82% | -17.77% | -5.52% | -37.91% | -5.65% | -13.88% | -3.59% | -2.86% |
| Average Deviation | 2.99% | 3.50% | 1.81% | 5.11% | 4.54% | 6.65% | 15.77% | 2.03% | 4.18% | 4.73% | 2.73% |
| **January 1, 2004 to December 31, 2007** | | | | | | | | | | | |
| Mean | 3.53% | -3.57% | 1.68% | -5.04% | -6.30% | 9.93% | -20.47% | 1.72% | -5.11% | 5.65% | 3.12% |
| Standard Deviation | 3.33% | 3.19% | 2.22% | 4.68% | 5.79% | 6.33% | 13.94% | 2.67% | 4.45% | 6.05% | 2.96% |
| Maximum | 13.83% | 45.50% | 5.55% | 6.33% | 2.78% | 17.43% | 2.07% | 7.94% | 2.40% | 21.24% | 8.60% |
| Minimum | -2.24% | -8.58% | -3.32% | -20.82% | -17.77% | -5.22% | -37.91% | -5.65% | -13.88% | -3.59% | -1.55% |
| Average Deviation | 2.96% | 2.41% | 1.88% | 3.58% | 5.18% | 5.21% | 12.83% | 2.11% | 4.14% | 5.27% | 2.74% |

**Figure 4. Deviation Indicators Using RMUs Estimated Via Trade Volume Weights**
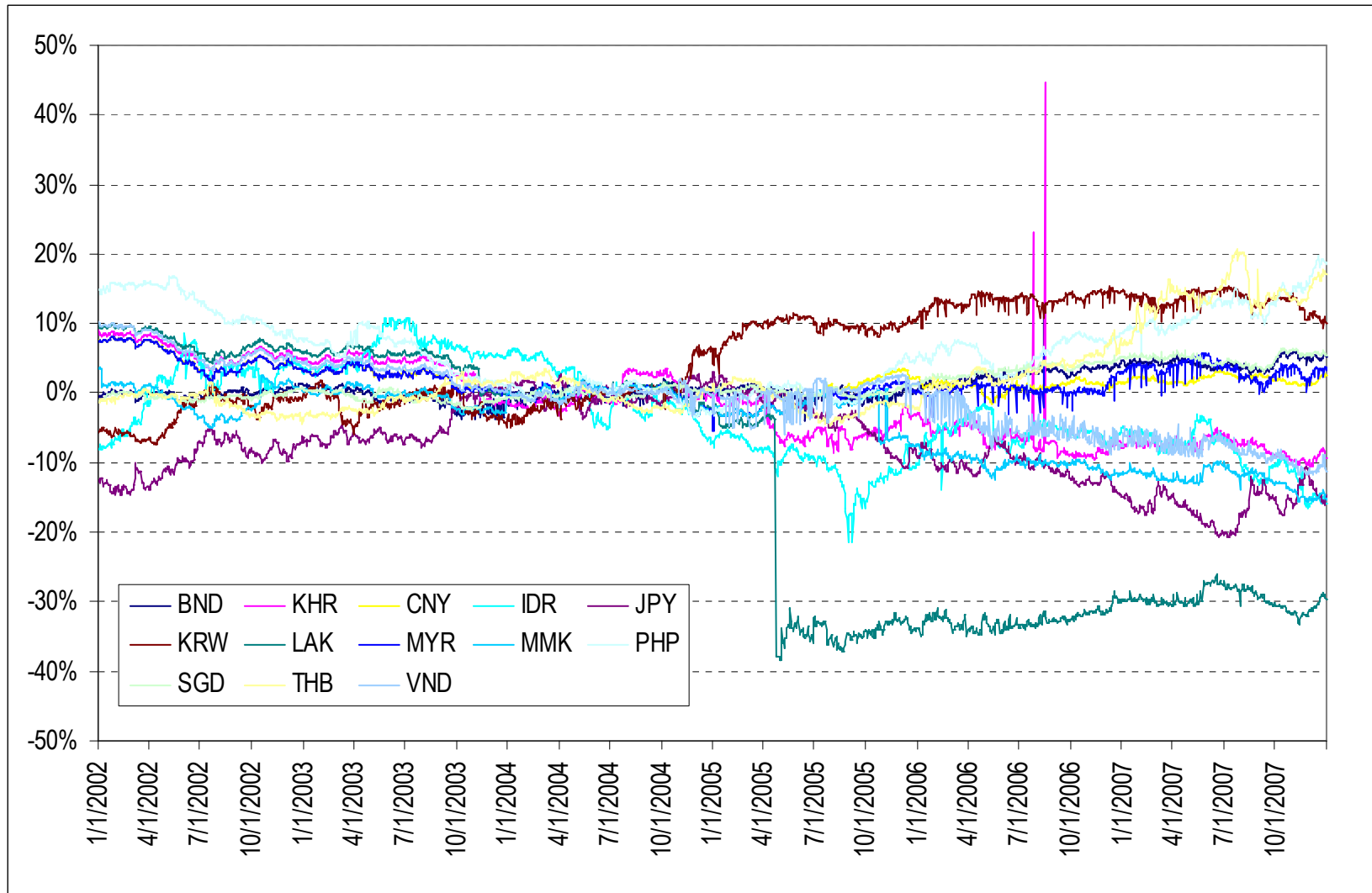
**Figure 5. Deviation Indicators Using RMUs Estimated Via Nominal GDP Weights**
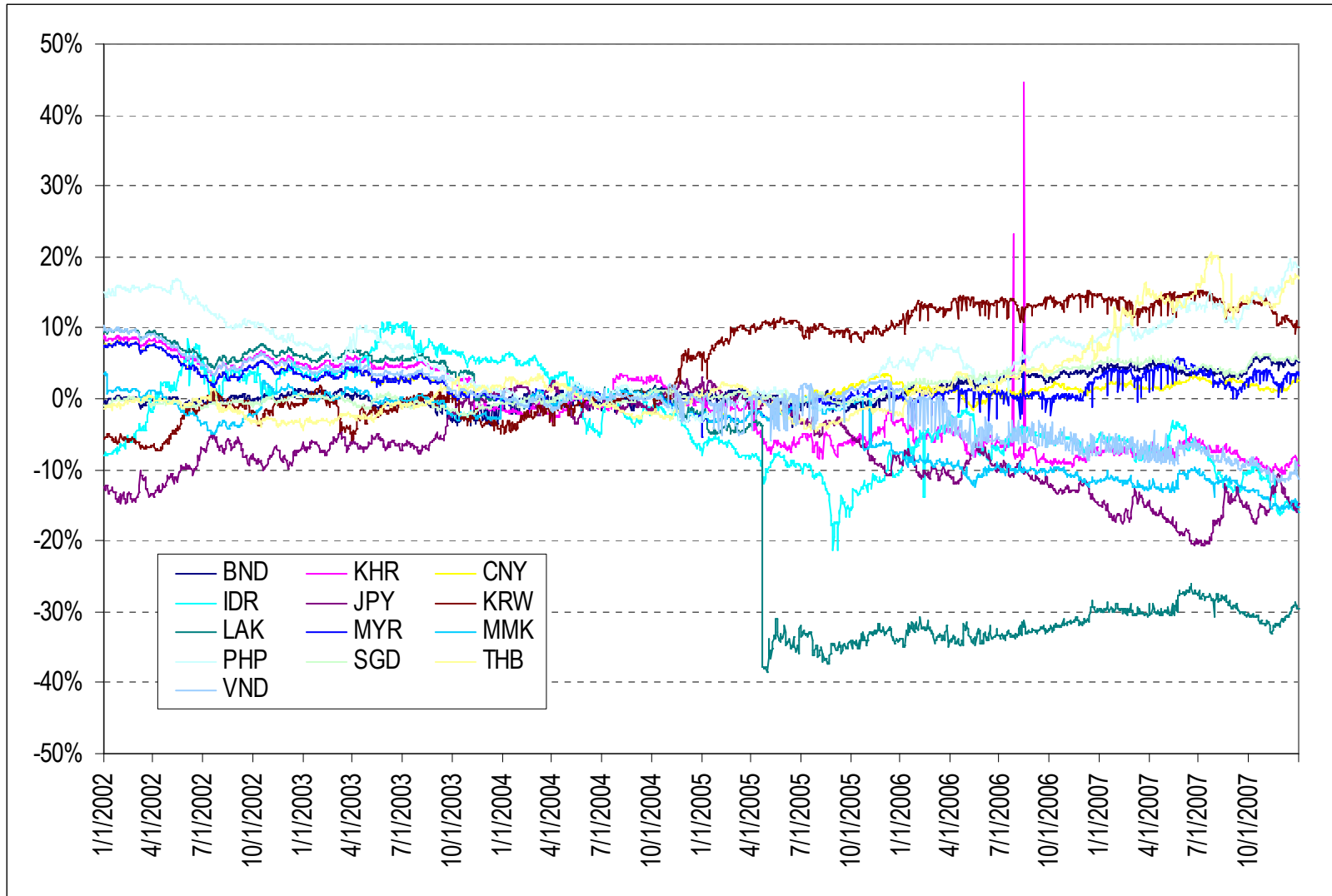
**Figure 6. Deviation Indicators Using RMUs Estimated Via GDP Measured at PPP Weights**
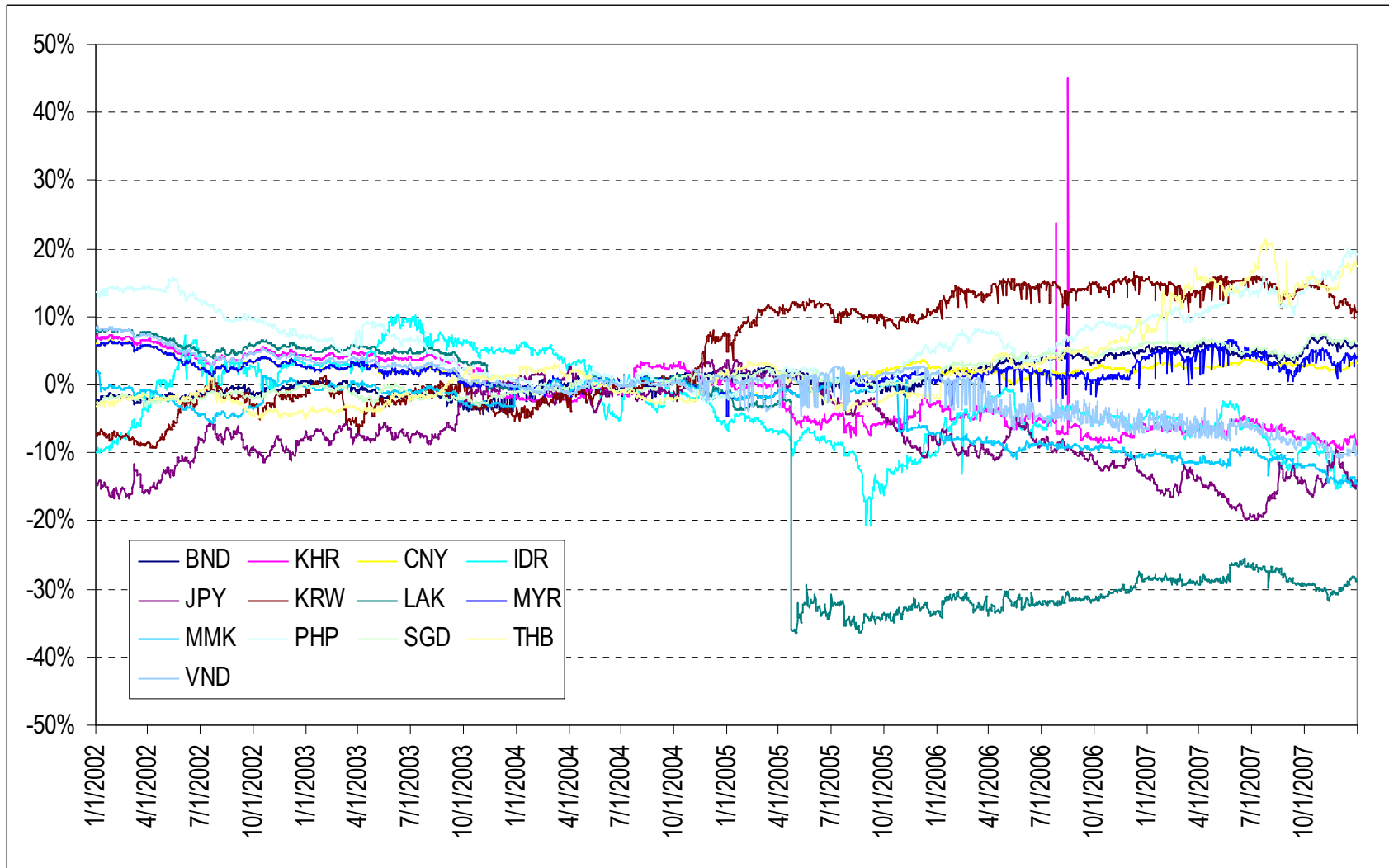
**Figure 7. Deviation Indicators Using RMUs Estimated Via Reserve (Less Gold) Weights**
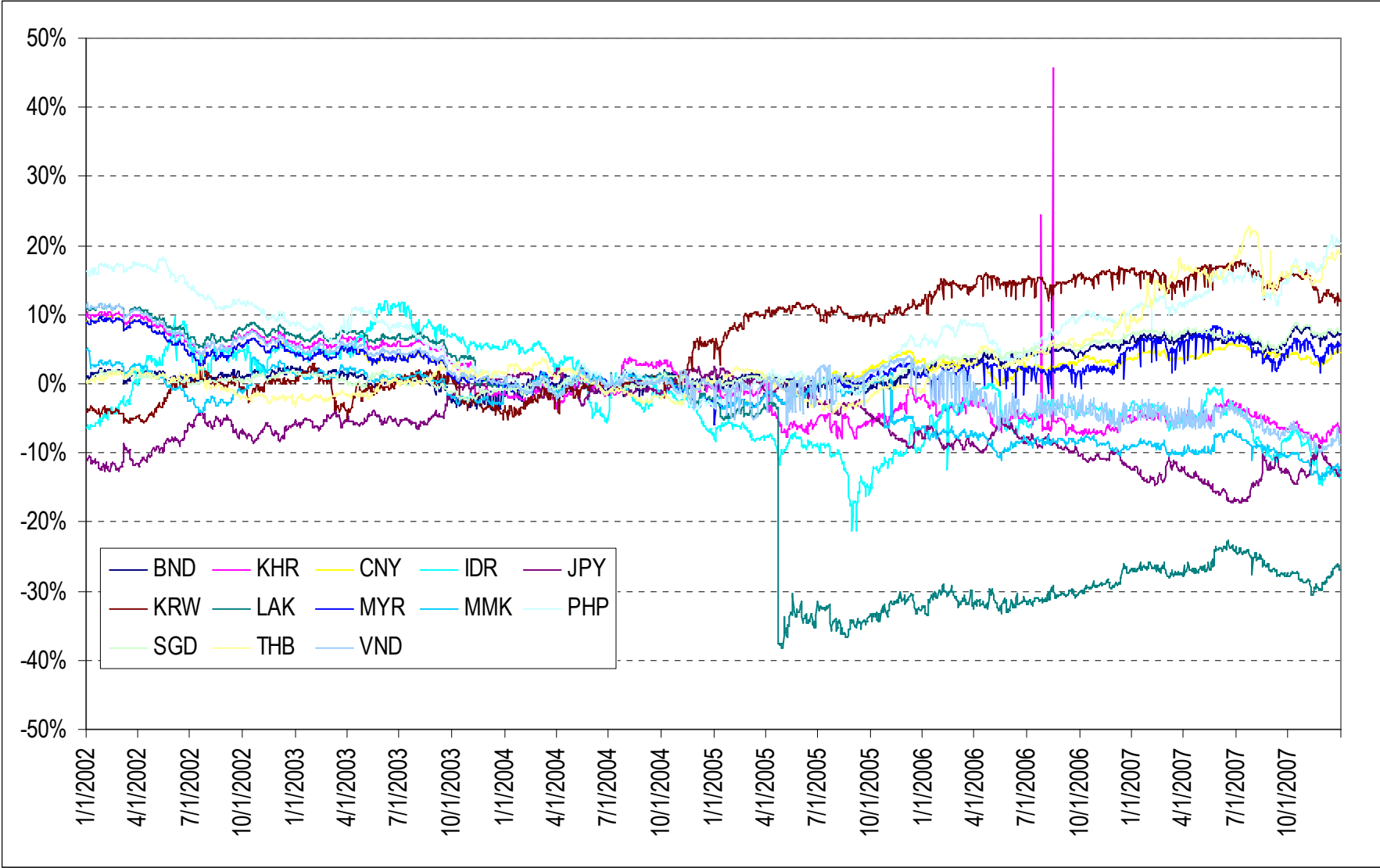
**Figure 8. Deviation Indicators Using RMUs Estimated Via Composite Weights**



Legend: BND, KHR, CNY, IDR, JPY, KRW, LAK, MYR, MMK, PHP, SGD, THB, VND
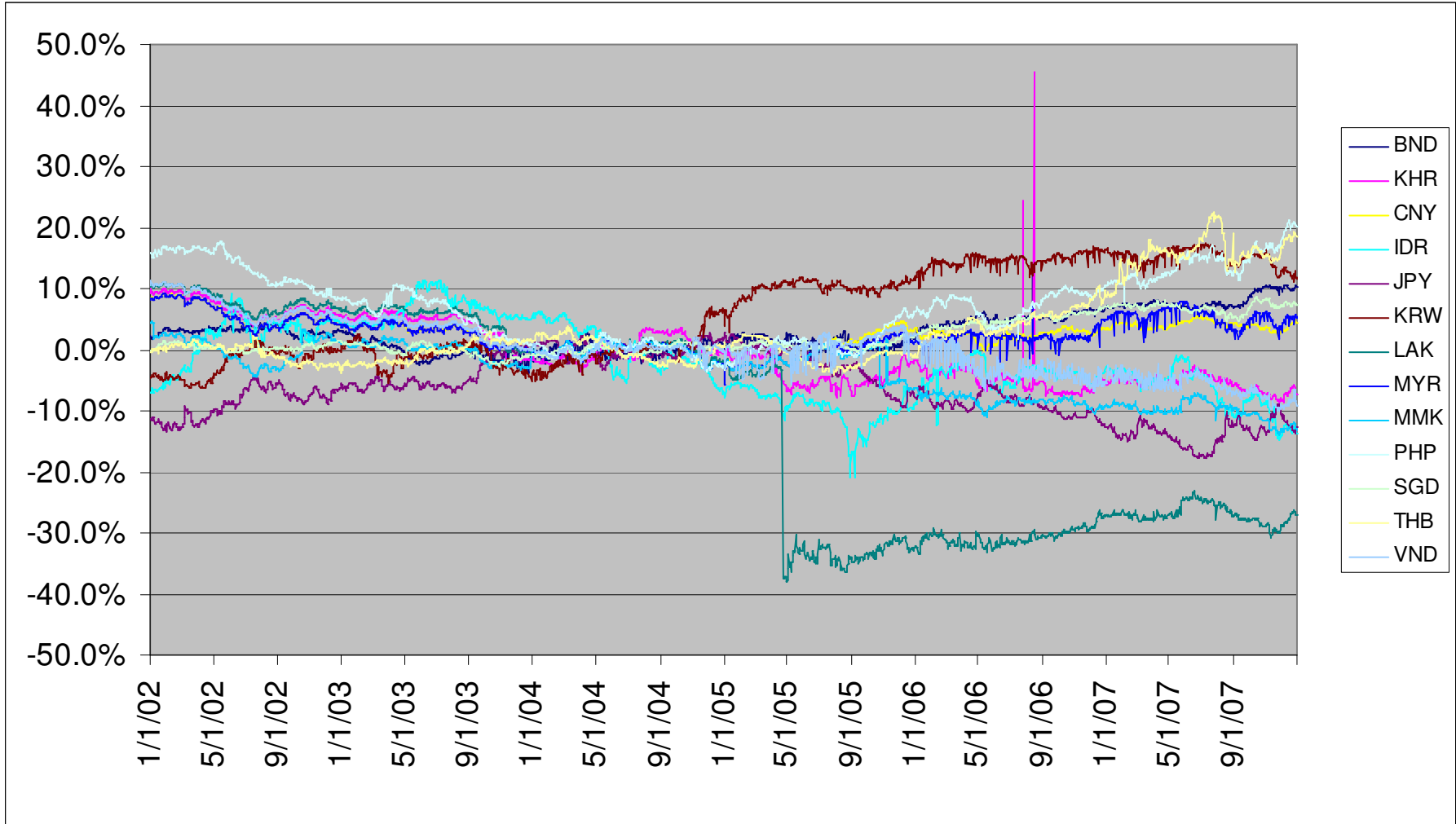
**Figure 9. Monthly Nominal Deviation Indicators Using Composite Weights**
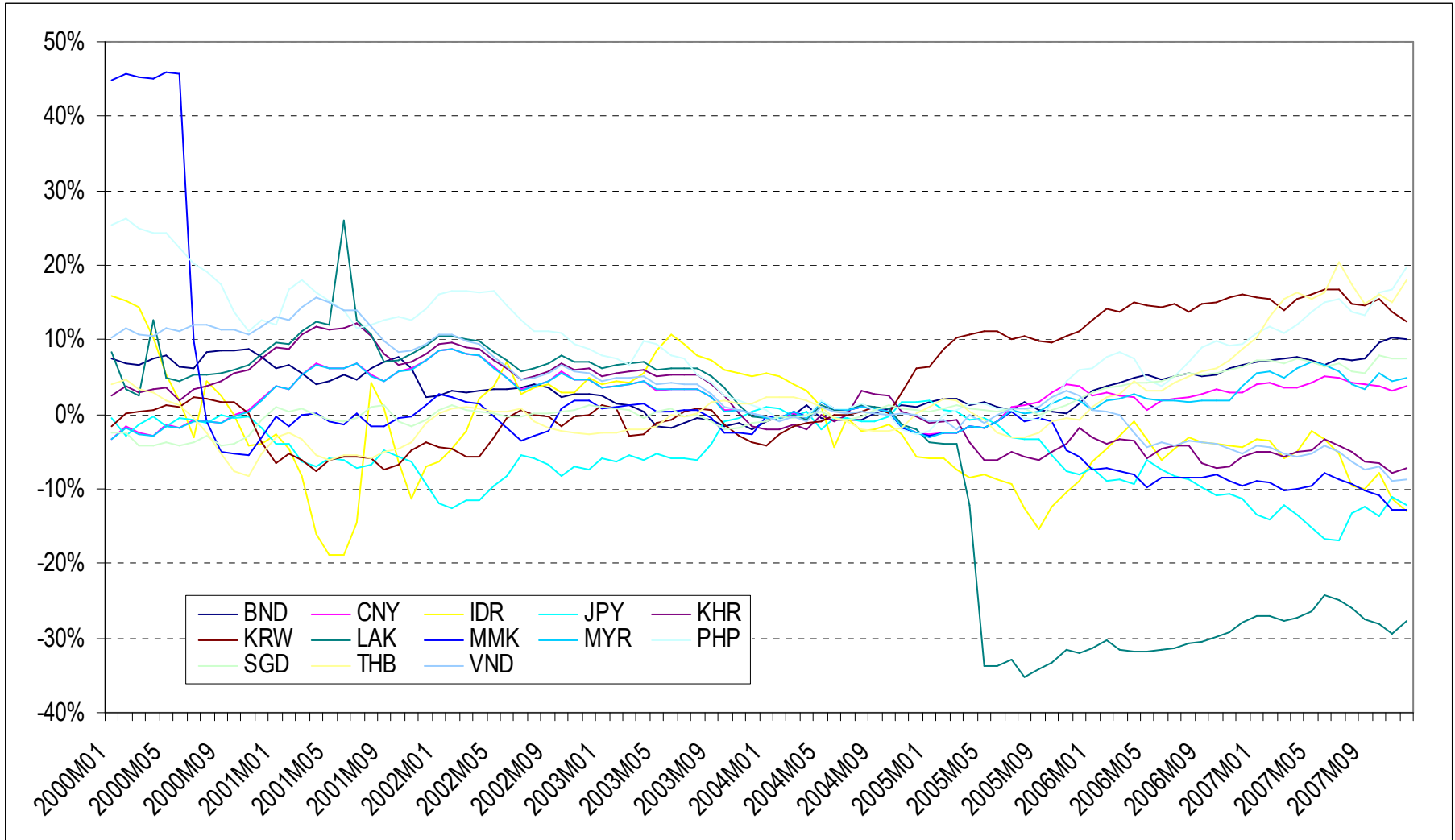
**CHAPTER 3**
**EXPLORING THE USE OF EXCHANGE MARKET PRESSURE AND THE RMU DEVIATION INDICATOR FOR EARLY WARNING SYSTEM IN THE ASEAN+3 REGION**

This section will explore how the exchange market pressure (EMP) and the RMU deviation indicators can be used as an early warning signal of an impending crisis. Based on the lessons learned from the International Monetary Fund (IMF), the European Union (EU), and related literature, the paper will likewise explore possible scenarios on whether an RMU, through the deviation indicator in particular or the EMP, can be used as a better surveillance mechanism in promoting economic and financial stability in the region.

## 3.1    Review of Literature

### 3.1.1   Macroeconomic and Financial Market Developments on the Use of the Warning System (EWS)

The use of the Early Warning System (EWS) model has become popular particularly in detecting a crisis in an economy. There are various types of financial crises discussed in the literature, such as a currency crisis, banking crisis, sovereign debt crisis, private sector debt crisis, and equity market crisis. The focus of this paper will be primarily on currency crises. Kaminsky and Reinhart (1996) posit that a currency crisis often coincides with other types of crisis, such as a banking, which is commonly called "twin crises."

The most popular among the various surveillance mechanisms is the early warning system (EWS). The EWS is a statistical way of detecting instability in an economy through the use of macroeconomic, financial, and other important information. In other words, surveillance of macroeconomic and financial market developments is utilized as a method of assessing the vulnerability to an economic to certain shocks. Although the EWS does not have perfect forecasting accuracy, it offers a systematic method of predicting a crisis within a specific time horizon. In recent years, the IMF has included the EWS models into its surveillance process (i.e., Developing Country Studies Division model[7] and the Policy Development and Review (PDR) model). Other institutions that use EWS models include the US Federal Reserve, the European Central Bank, and the Bundesbank (Schnatz, 1998; Kamin, Schindler, and Samuel 2001; Bussiere and Fratzscher, 2002).

In the private sector, EWS were also designed for explicit use in advising on foreign currency strategies, assessing values and risks in emerging market currencies, and in providing economic forecasts to investors. Although the use of EWS model varies from company to company, most firms in the private sector use the EWS model only in instances where a crisis is in the daily headlines. Institutions that utilize EWS include the following: Goldman Sachs's GS-watch, Credit Suisse First Boston's Emerging Markets Risk Indicator, Deutsche Bank's Alarm clock, Moody's Macro Risk model, and Morgan Stanley Dean Witter EWS (Ades, Masih, and Tenengauzer, 1998; Garber, Lumsdaine, and Longato, 2001; Roy, 2001; Gray, Merton, and Bodie, 2003). The Asian Development Bank (ADB) has also adopted a EWS model for ASEAN+3 countries. On the other hand, a number of private institutions have abandoned the use of EWS in their operation, such as: Lehman Brothers' Currency Jump Probability model, Citicorp's EWS for balance of payments crisis in Latin America, and the JP Morgan's Event Risk Indicator model (Berg, Borensztein and Pattillo, 2004).

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[7] A variation of the Kaminsky, Lizondo and Reinhart model.

### 3.1.1.1 Probit-Logit Model

One of the most widely discussed EWS models is the limited dependent variable estimate using probit-logit model, the signals approach by Kaminsky, Lizondo and Reinhart (1998) and more recently, the Markov switching model. The probability model is based on regression estimates using limited dependent variables. The advantage of this approach is that it summarizes all information into one useful number, which is the probability of a crisis. Also, the approach considers all variables simultaneously and disregards other factors that do not contribute information that is independent from those provided by other variables in the analysis (Kaminsky et al., 1998). Lastly, it is easy to run on standard statistical software and statistical testing.

On the other hand, the model also has several weaknesses. First, it is unable to rank indicators on the basis of forecasting accuracy since it only results in a regression that is either significant or not. Second, measures of statistical significance cannot distinguish between an indicator that is good at predicting a crisis or one that merely sends few false signals. Lastly, the nonlinear nature of the model makes it difficult to assess the marginal contribution of an indicator to the probability of a crisis.

### 3.1.1.2 Signals Approach

The signals approach was developed by Kaminsky, Lizondo and Reinhart (1998) to serve as basis for the design of an early warning system and to address the shortcomings of the probability approach. The signals approach compares the behavior of selected variables during the period preceding a crisis (control group) and identifies variables that have distinct behavior that can used to assess the likelihood of a crisis. This entails monitoring of economic indicators that tend to systematically behave differently before the occurrence of a crisis.

A crisis as defined by Kaminsky et al. (1998) is a situation in which an attack on a currency leads to a sharp depreciation of the currency, a large decline in international reserves, or a combination of the two. A crisis also includes both successful and unsuccessful attacks on the currency. The definition is comprehensive enough to include not only currency attacks under fixed exchange rate but also under other exchange rate regimes. Vulnerability to a crisis is signaled when one or more "indicator variable" deviates significantly from its behavior during non-crisis periods. The signals approach identifies the variables that have distinctive behavior that could be used to assess the likelihood of a crisis.

The effectiveness of indicators is based in terms of the matrix presented below (Table 10). The most favorable distribution for an early warning system occurs when all signals are in Sections A (i.e., signal was issued and a crisis eventually takes place) and D (i.e., no signal was transmitted in crisis-free times). However, two possible sources of error are shown in Section C (i.e., crisis occurs but no signal was sent beforehand) and B (i.e., signal was transmitted without any crisis occurring).

**Table 10. Matrix of Crisis Indicator Effectiveness Using the Signals Approach**

| Description | Crisis (within 24 months) | No Crisis (within 24 months) |
|---|---|---|
| Signal was issued | A (Good Signal) | B (False Signal) |
| No signal was issued | C (Missed Signal) | D (Good Silence) |

Source: Kaminsky, Lizondo, and Reinhart (1998).

The advantage of using the signals approach is that it indicates very clearly the variables that are behaving abnormally. This approach provides policymakers with an easier way to detecting a problem in the economy and can provide some indication of how widespread the problem is by noting the number of variables that are deviating from its normal trend. However, the signaling approach also has its disadvantages. First, it does not look at marginal contributions only. This implies that there will be a lot of common information contained in variables that one cannot take into account. Two or more variables that move closely together will tend to send signals simultaneously. Although they contain the same information, they count as two separate variables with equal weights. Second, it does not lend itself to statistical testing. Thus, it is difficult to assess how well this approach works relative to other approaches or models.

### 3.1.1.3 Markov-Switching Approach

Markov-Switching model with time-varying transition probabilities can be used as an EWC for currency crises. It is said to be appropriate for modeling variables that display sudden and dramatic shifts in behavior, as in the case of a currency crisis. Compared to the two approaches mentioned earlier (i.e., probit-logit and the signals models), the advantage of using Markov-Switching approach is that it does not require a priori dating of crisis periods and otherwise. In fact, given the data, this information is something that the model estimates. Thus, the problem of arbitrary thresholds used in dating crisis is eliminated. In addition, the model can reveal information about the dynamics of a crisis, not just when they tend to occur, but also how long the crisis is likely to last, and what factors can address the problem. Lastly, since the byproduct of estimating a Markov-switching approach is the use of one-step ahead probability of a crisis occurring, it lends itself naturally for use as an early warning system (Abiad, 1999).

### 3.1.2 Monitoring Economic and Financial Indicators through EWS

Several studies share the idea that it is possible to identify economic and financial indicators as determinants of a financial crisis. The most popular of which is the study by Kaminsky et al. in 1998, which used 15 indicator variables that can be grouped into four (4) major categories namely: current account, capital account, real sector, and financial indicators. The variables were selected based on theoretical considerations and information availability on a monthly basis. The list of variables considered is shown in Table 11.

However, criticisms did not escape the initial study by Kaminsky et al. (1998). These revolved around the exclusion of essential financial and economic indicators in the detection of a crisis. The empirical literature suggests that an effective EWS should consider a broad variety of indicators since a currency crisis often takes place after multiple economic, political, and even social problems has occurred. These indicators are shown in Table 12.

**Table 11. Economic and Financial Indicators of a Financial Crisis**

| Indicator | Interpretation |
|---|---|
| 1) Current account indicators | |
| Real exchange rate | An overvalued exchange rate may lead to higher probability of financial crisis. |
| Export growth | Declining export growth may be caused by an overvalued domestic currency and hence a proxy for currency overvaluation. On the other hand, if export growth slows due to reasons unrelated to the exchange rate, this may cause devaluation pressure. In both cases, declining export growth can be a leading indicator for a sizeable devaluation. |
| Import growth | Huge import growth could lead to worsening in the current account and have been often related with a currency crisis. |
| **2) Capital account indicators** | |
| Ratio of M2 to foreign exchange reserves | Captures to what extent the liabilities of the banking system are backed by foreign reserves. In the event of a currency crisis, individuals may rush to convert their domestic currency deposits into foreign currency, so that this ratio captures the ability of the central bank to meet their demands. |
| Growth of foreign exchange reserves | Declining foreign reserves is a reliable indicator that a currency is under devaluation pressure. A drop in reserves is not necessarily followed by devaluation; central bank may be successful in defending a peg, spending large amounts of reserves in the process. On the other hand, most currency collapses are preceded by a period of increased efforts to defend the exchange rate, which are marked by declining foreign reserves. Total values of foreign reserves are also used as indicators of a country's financial difficulty dealing with debt repayment. |
| Domestic real interest rate | Real interest rate can be considered as proxy of financial liberalization, in which the liberalization process itself tends to lead to high real rates. Also, high real interest rates may increase chances of loan defaults. |
| Lending and deposit rate spread | An increase of this indicator above some threshold level possibly reflects deterioration in credit risk as banks are unwilling to lend or decline in loan quality. |
| **3) Real sector indicators** | |
| Growth of industrial production | Lower output growth indicates a deceleration. Recessions often precede a financial crisis. |
| Changes in stock prices | A decline in the growth rate of asset prices may lead to loan defaults. It also signals loss of investor confidence. A burst of asset price bubbles often precede a financial crisis. |

**Table 11. Economic and Financial Indicators of a Financial Crisis (cont.)**

| Indicator | Interpretation |
|---|---|
| **4) Financial indicators** | |
| M1 and M2 growth | These indicators are measures of liquidity. High growth of these indicators might indicate excess liquidity which may fuel speculative attacks on the currency thus leading to a currency crisis. |
| M2 money multiplier | A higher multiplier indicates higher growth in money supply which may lead to higher inflationary expectations and expectations of a future devaluation of the currency. |
| Ratio of domestic credit to GDP | Very high growth of domestic credit may serve as a crude indicator of the fragility of the banking system. This ratio usually rises in the early phase of the banking crisis. It may be that as the crisis unfolds, the central bank may be injecting money to the bank to improve their financial situation. |
| Excess real M1 balance | Reflects excess money supply which may put pressure on the exchange rate and lead to currency crisis. |
| Commercial bank deposits | A decline in the deposit base may increase the chances of domestic bank run and capital flight to occur as crisis unfolds. |

### 3.1.3    Surveillance and the Early Warning System

### 3.1.3.1  IMF Surveillance

Under the Articles of Agreement, the main function of the IMF is to supervise the international monetary system.  This includes 1) surveillance over the monetary and exchange rate policies of the members; 2) issuing policy recommendations; and 3) granting credit to members with temporary balance of payments difficulties, subject to certain IMF conditions.  Also, the IMF has a mechanism to enhance the international supply of liquidity through the allocation of special drawing rights (SDRs).  The IMF has three broad areas of activity:  surveillance, programs supported by financing arrangements, and technical assistance.  Given its responsibilities, the IMF is tasked to oversee the international monetary system and the code of conduct to which member countries have subscribed.  Moreover, it is in charge of promoting dialogues among member countries on different issues ranging from economic to financial policies that impact on national and international levels.

### 3.1.3.1.1  Economic Surveillance

The IMF has authority under Article IV of its Articles of Agreement to exercise surveillance over the exchange rate polices of its members to ensure the effective operation of the international monetary system.   The objective of surveillance is to help member countries achieve financial stability and sustainable economic growth.   Although the objectives of surveillance are still the same today, the framework for surveillance has significantly changed to promote the benefits and respond to the expansion of international capital flows.  The scope of surveillance covers a wide area of economic policies that differ in accordance with a country's individual circumstance.

**Table 12. Suggested Crisis Indicators**

| Indicator | Interpretation | Reference |
|---|---|---|
| **1) Global indicators** | | |
| G-7 output | Higher foreign output growth should strengthen exports and thus, reduce the probability of a crisis. | Edison (2000); Eichengreen and Arteta (2000) |
| US output | US recession often precedes a crisis. | Edison (2000) |
| US interest rate | Rate increases is often associated with capital outflows. | Edison (2000); Eichengreen and Arteta (2000) |
| Oil prices | High oil prices are associated with recessions. | Edison (2000) |
| **2) Current account indicators** | | |
| Ratio of the current account to GDP | A rise in ratio is generally associated with large external capital inflows that are intermediated by the domestic financial system and could facilitate asset price and credit booms. Increases in current account surplus are expected to indicate a diminished probability to devalue and thus, to lower the probability of a crisis. | Berg and Pattillo (1999) |
| **3) Real sector indicators** | | |
| Ratio of fiscal balance to GDP | Higher deficits are expected to raise probability of crisis, since deficits increase vulnerability to shocks and reduce investor confidence. | Dermirgűe-Kunt and Detragiache (2000); Eichengreen and Arteta (2000) |
| Ratio of public debt to GDP | Higher indebtedness is expected to raise vulnerability to a reversal in capital inflows, therefore raising the probability of a crisis. | Eichengreen and Arteta (2000) |
| Inflation rate | Inflation rate is likely to be associated with high nominal interest rates and may be an alternative measure of macroeconomic mismanagement, which affects the economy in general. | Dermirgűe-Kunt and Detragiache (1997) |
| GDP per capita | Deterioration of economic activity is expected to increase the probability of a banking crisis. | Dermirgűe-Kunt and Detragiache (2000); Eichengreen and Arteta (2000) |
| **4) Financial indicators** | | |
| Ratio of bank reserves to bank assets | Unfavorable macroeconomic shocks are less likely to lead to a crisis in countries where the banking system is liquid. | Dermirgűe-Kunt and Detragiache (1997) |

IMF collects information required for surveillance during regular consultation between the IMF, and dialogues between the authorities and Fund management and staff. It also collects information through discussions held in connection with its multilateral surveillance activities. From the viewpoint of the IMF, surveillance can help prevent or minimize negative externalities through sound policy coordination among members and can potentially benefit both the international community and individual member countries.

The following are considered areas of concern for surveillance of the IMF:
- Exchange rate, monetary and fiscal policies: Considered as the heart of IMF surveillance. IMF provides advice on issues ranging from exchange rate regime and the stance of fiscal and monetary policies;
- Structural policies: Includes international trade, labor markets, and power sectors;
- Financial sector issues: Increase in emphasis was brought about the series of banking crises in both industrial and developing countries in the 1990s;
- Institutional issues: Includes central bank independence, financial sector regulation, corporate governance, and policy transparency, and accountability; and
- Assessment of risks and vulnerabilities: Resulting from large and volatile capital flows in industrial and developing countries.

Generally, the objective of IMF is the consistency of macroeconomic policies implemented by member countries with a viable and sustainable external payments situation. It must guarantee that countries adjust macroeconomic policies in a timely manner to prevent crisis. On the monetary policy, the main concern of the IMF is to keep the level of inflation to a minimum. On fiscal policy, the IMF is working towards ensuring transparency of public finances and completeness of public sector accounts; containing fiscal deficits; developing and clarifying the concept of quasi-fiscal deficit, such as central bank operating losses; and analyzing structural and cyclical factors in government finance. In terms of exchange rate policy, surveillance focuses on the appropriate exchange rate system and level. The IMF allows the adoption of the fixed and flexible exchange rate systems for as long as the country's macroeconomic policy is consistent with the system. Also, the IMF has also been involved in addressing structural and institutional issues, especially those involving the labor markets and financial systems.

### 3.1.3.1.2 Economic Surveillance and Policy Dialogue

Traditionally, the IMF has two levels of surveillance: bilateral and multilateral. However, in response to the integration of Europe into a single market (i.e., the European Union), IMF surveillance has evolved into a regional approach. The regional surveillance approach was likewise highlighted by the crises in Mexico and Asia.

- Bilateral Surveillance

    Bilateral consultation refers to discussions undertaken by the Fund with individual member countries leading to policy advice. The level of surveillance focuses on policy implementation and monitoring as it aims to gather information and provide policy discussion and advice. The most common indicators used by the IMF for bilateral surveillance are found in Table 13.

**Table 13. Bilateral Surveillance Indicators Used by the IMF**

| Sector | Indicator |
|---|---|
| Real | Real domestic final demand, real exports and imports, growth rate, inflation, unemployment, savings, and investments |
| Public Finance | Budget, revenue, expenditure, public sector balance |
| Money and credit | Money supply and growth, and domestic credit and growth |
| Interest rates | Short- and long-term rates |
| Balance of payments | Trade balance, current account, and reserves |
| Exchange rates | Exchange rate regime, nominal rates, and real effective rates |
| External liabilities | External debt and external liabilities |

Source: IMF website (http://www.imf.org)

- Multilateral Surveillance

  Multilateral surveillance is geared towards analysis of recent world developments, projections of future development, identification of risks of instability in the international economic system, and the proposing of ensuing policy recommendations. The primary vehicle for multilateral surveillance is the *World Economic Outlook*, produced twice a year, which provides a comprehensive set of economic forecast for the world economy. It usually covers the broad areas of the world economic situation, global economic prospects, and related policy issues, especially policy stances in industrial countries. There is also more emphasis on financial and foreign exchange markets and external payments, financing, and debt. Special attention is devoted to developments in exchange rates, trade, and capital flows, which are the principal elements of international interaction, as well as the broad range of economic policies underlying them.

- Regional Surveillance

  The IMF is also involved in surveillance at the regional level. The framework used for regional surveillance takes place twice a year, which includes policy discussions with European Union institutions responsible for common policies in the euro area, including the European Central Bank. Discussions are focused on the common monetary policy, exchange rate implications, and the fiscal position of the euro area as a whole. The European Central Bank was given an observer status on the IMF Executive Board. Nonetheless, members of the European Union still continue their Article IV consultation on an annual basis. Also, the Fund has been active in providing inputs to other regional mechanisms for policy considerations, such as APEC, ASEAN, and currency unions, such as the West African Economic and Monetary Community, and the Eastern Caribbean Currency Board.

### 3.1.3.2 IMF Early Warning System

The Early Warning System (EWS) model of the IMF was developed to tailor-fit specific needs of the institution. While EWS models are systematic, objective, and follow a consistent method for predicting crisis, the IMF uses the result as an input into its surveillance process. The three models implemented by

the IMF are the: Kaminsky-Lizondo-Reinhart (KLR) model; the Developing Country Studies Division (DCSD) model; and the Policy Development and Review (PDR) model. The KLR model is used to determine indicators that signal a crisis when it crosses a certain threshold. The model tries to predict the probability of crisis within the next 24 months when there are extreme changes in the weighted average of the monthly exchange rate depreciation and reserve loss. In the case of IMF, the KLR model is supplemented with other additional variables. The next EWS model used by IMF is the DCSD model which has the same crisis definition and prediction probability as the KLR model. However, the KLR approach includes a multivariate probit regression to determine the probability of the occurrence of a crisis, the same approach developed by Berg and Pattillo (1999). The last model used by IMF is the PDR model in which the EWS model includes balance sheet variables and proxies for standards to the DCSD model developed by Mulder, Perrelli and Rocha (2001).

A number of vulnerability indicators are used by IMF to determine the susceptibility of member countries to a financial crisis. These indicators are used as input for IMF surveillance and lending, as well as its Financial Sector Assessment Program. Vulnerability indicators cover a number of areas including government, financial, household, and corporate sectors. When economies are under stress, problems in one sector often spread to other sectors. For instance, problems concerning a country's fiscal deficit may lead to a run on the exchange rate or may undermine the confidence of banks holding government debt, thereby initiating a banking crisis. A detailed discussion of the different vulnerability indicators is presented below.

### 3.1.3.2.1 External and Domestic Debt Indicators

Debt indicators include external and domestic debt indicators, debt maturity profiles, repayment schedules, interest rate sensitivity, and currency composition. The ratios of external debt to exports and to GDP are useful indicators of trends in debt and repayment capacity. Where public sector borrowing is significant, the ratio of debt to tax revenue is particularly important in gauging a country's repayment capacity. Table 14 summarizes the different debt indicators and their purpose.

### 3.1.3.2.2 Reserve Adequacy Indicators

Reserve adequacy indicators are used to determine a country's ability to avert liquidity problems. The ratio of reserves to short-term debt in particular is key in determining the vulnerability of countries with significant but uncertain access to capital markets. Table 15 summarizes the different reserve adequacy indicators and their purpose.

### 3.1.3.2.3 Financial Soundness Indicators

Financial soundness indicators are used to determine the strengths and weaknesses of a country's financial sector. This includes capital adequacy of financial institutions, the quality of assets and off-balance sheet positions, profitability and liquidity, and the pace and quality of credit growth. For example, financial soundness indicators are used to assess the sensitivity of financial systems to market risks, including changes in interest rates and exchange rates. Table 16 summarizes the financial soundness indicators and their purpose.

**Table 14. Debt-Related Indicators and Their Use**

| Debt-Related Indicators | Use |
|---|---|
| 1) External Debt over Exports | Best used in the context of medium term scenarios, tested under alternative assumptions. |
| 2) External Debt over GDP | Useful indicator of trend in debt that is closely related to the repayment capacity of the country. |
| 3) Average Interest Rate on External Debt | Useful indicator of terms. A key indicator for assessing the debt return when used conjunction with debt ratios and growth outlook. |
| 4) Average Maturity | Useful for homogeneous categories, such as non-concessional public sector debt, to track shortening of maturities or efforts to limit future vulnerability. |
| 5) Share of Foreign Currency External Debt in Total External Debt | Useful indicator of the impact of exchange rate changes on debt (balance sheet effect), especially in conjunction with information on derivatives that transform the effective currency composition. |

**Table 15. Reserve Adequacy Indicators and Their Use**

| Reserve Adequacy Indicators | Use |
|---|---|
| 1) Ratio Reserves to Short Term External Debt | Single most important indicator of reserve adequacy in countries with significant but uncertain access to capital market. |
| 2) Ratio of Reserves to Imports | Useful measure for reserve needs for countries with limited access to capital markets, and comparison across a wide range of countries. |
| 3) Ratio of Reserves to Broad Money | Measure of the potential impact of loss of confidence in the domestic currency. Useful if banking sector is weak and risk of capital flight exists. |

### 3.1.3.2.4 Corporate Sector Indicators

Corporate sector indicators are essential in determining the possible impact of exchange rate and interest changes on corporate sector balance sheets. Indicators related to corporate leverage, profitability, cash flow, and financial structure are also relevant indicators in the corporate sector. Table 17a-c summarizes various indicators in the corporate, public, and financial sectors, and their respective purpose.

**Table 16. Financial Soundness Indicators and Their Use**

| Financial Soundness Indicators | Use |
|---|---|
| 1) Deposit-taking institutions <br> Capital adequacy | · Regulatory capital to risk-weighted assets <br> · Regulatory Tier I capital to risk-weighted assets |
| 2) Asset quality | · Nonperforming loans to total gross loans <br> · Nonperforming loans net of provisions to capital <br> · Sectoral distribution of loans to total loans <br> · Large exposures to capital |
| 3) Earnings and profitability | · Return on assets <br> · Return on equity <br> · Interest margin to gross income <br> · Noninterest expenses to gross income |
| 4) Liquidity | · Liquid assets to total assets (liquid asset ratio) <br> · Liquid assets to short-term liabilities |
| 5) Sensitivity to market risk | · Duration of assets <br> · Duration of liabilities <br> · Net open position in foreign exchange to capital |
| 6) Deposit-taking institutions | · Capital to assets <br> · Geographical distribution of loans to total loans <br> · Gross asset position in financial derivatives to capital <br> · Gross liability position in financial derivatives to capital <br> · Trading income to total income <br> · Personnel expenses to non-interest expenses <br> · Spread between reference lending and deposit rates <br> · Spread between highest and lowest interbank rate <br> · Customer deposits to total (non interbank) loans <br> · Foreign currency-denominated loans to total loans <br> · Foreign currency-denominated liabilities to total liabilities <br><br> · Net open position in equities to capital |
| 7) Market liquidity | · Average bid-ask spread in the securities market <br> · Average daily turnover ratio in the securities market |
| 8) Nonbank financial institutions | · Assets to total financial system assets <br> · Assets to GDP |
| 9) Corporate sector | · Total debt to equity <br> · Return on equity <br> · Earnings to interest and principal expenses <br> · Corporate net foreign exchange exposure to equity <br> · Number of applications for protection from creditors |
| 10) Households <br><br> 11) Real estate markets | · Household debt to GDP <br> · Household debt service and principal payments to income <br> · Real estate prices <br> · Residential real estate loans to total loans <br> · Commercial real estate loans to total loans |

**Table 17a. Corporate Sector Indicators and Their Use**

| Corporate Sector Indicators | Definition | Use |
|---|---|---|
| 1) Net Foreign Currency Cash Flow over Total Cash Flow | Net Foreign Currency Cash Flow: Prospective cash inflows in foreign currency minus prospective cash outflows in foreign currency. | Key indicator for unhedged foreign currency exposure. |
| 2) Net Foreign Currency Debt over Equity | Book value of debt over equity. | Indicator for balance sheet effect of exchange rate changes. |
| 3) Interest over Cash Flow | Total prospective interest payments over operational cash flow (i.e. before interest and taxes). | Key cash flow indicator for general financial soundness. |
| 4) Leverage | Book value of debt over equity. | Key indicator of sound financial structure. High leverage aggravates vulnerability to other risks. |
| 5) Short-Term Debt over Total-Term Debt | | In combination with leverage, indicator of vulnerability to temporary cut-off from financing. |
| 6) Return on Assets (Before Tax and Interest) | Profit before tax and interest payments over total assets. | Indicator of general profitability. |

**Table 17b. Public Sector Indicators and Their Use**

| Public Sector Indicators | Definition | Use |
|---|---|---|
| 1) Public Sector Debt Service over Exports | Public Sector Debt Service: Sum of interest and amortization payments on public external debt. | Useful indicator of willingness to pay and transfer risk. |
| 2) Public Debt over GDP or Tax Revenues | This indicator can be defined for total debt or for external debt. | Solvency indicator of public sector. |
| 3) Average maturity of Non-Concessional Debt | | Measure of maturity that is not biased by long repayment terms for concessional debt. |
| 4) Foreign Currency Debt over Total Debt | Foreign currency debt including foreign currency indexed debt. | Indicator of the impact of a change in the exchange rate on debt. |

**Table 17c. Financial Sector Indicators and Their Use**

| Financial Indicators | Definition | Use |
|---|---|---|
| 1) Open Foreign Exchange Position | Foreign currency assets minus liabilities plus net long positions in foreign currency stemming from off-balance sheet items. | Indicator for foreign exchange risk, but normally small because of banking regulations. |
| 2) Foreign Currency Maturity Mismatch | Foreign currency liabilities minus foreign currency assets as percent of these foreign currency assets at given maturities. | Indicator for pressure on central bank reserves in case of a cut-off of financial sector from foreign currency funding. |
| 3) Foreign Currency Quality Mismatches | Impact on credit and counterparty risk of changing exchange rate. | Indicator for vulnerability of financial sector to a depreciation of the exchange rate. |
| 4) Gross Foreign Currency Liabilities | | Useful indicator to the extent assets is not usable to offset withdrawals in liquidity. |

### 3.1.4   European Experience

The European Monetary System (EMS) began in the early 1970s when problems with the international monetary mechanism forced the European Union to find ways to ensure greater monetary stability and trade growth.  The EU established the EMS and introduced the European Currency Unit (ECU) as a unit of account for the EMS.  The ECU was created in 1979 under the EMS to strengthen the coordination of monetary and economic policies among the members of the Community, in which the eventual goal was towards the monetary unification of Europe.  A simultaneous agreement between the central banks in the EU set forth the operating procedures, the EMS mechanisms, and the features of the ECU.

The EMS facilitated the interdependence of European economies by providing a tool for exchange rate stabilization and for encouraging convergence of economic and monetary policies. This tool was called the Exchange Rate Mechanism (ERM), which consists of four major components:  the ECU, the parity grid, the divergence indicator, and the credit facilities.

The ECU was envisioned to function like a currency unit consisting of specified amounts of the currencies of the Member States of the European Communities.  The value of the ECU is equal to the sum of the following elements:  the number of units by which a currency is represented in the ECU and converted into that currency at the going exchange rate, and the amounts of the other ECU components.  The weights are determined by a country's share in the community-wide GDP, intra-community trade, and total quota of EMS financial support.  The amount of the currencies are not fixed and is re-examined every five years.  It is worth noting that the re-examination does not necessarily follow an actual revision of the weights.  It is done to assess whether or not a revision is needed, considering the size of the discrepancy between the weights of the currencies in the ECU and the relative economic importance of the Member States.  A re-examination can also be done upon the request from Member States if the weight of any currency has changed by 25 percent or more.  Actual revision has to be mutually accepted by a unanimous decision by the Council of Ministers of the Community and upon consultation with the Monetary Committee and the Board of Governors of the European Monetary Cooperation Fund.  In effect, revisions are not based on

actual changes but on the agreement of the Council. In its history, actual revisions were only made in 1984 and 1989 as the Maastricht Treaty in November 1993 indicated a no revision policy in preparation for the introduction of a single currency. Newer members, such as the Austria schillings were not added to the ECU composition after 1993. The ECU Commission also announces the exchange rate on a daily basis.

In general, the ECU established a central rate of 2.25% as an indicator of divergence on currencies needing more room for flexibility because of domestic economic weaknesses. However, the flexibility of up to 6% of the exchange rate was made for the Italian lira, British pound, and Spanish peseta. Under the system, central banks would be required to intervene to support the weak currency/ies and to sell the strong currency/ies when any cross rate approached the allowed limit of fluctuation. Should any currency become individually too strong to stay within the system, then a realignment of the central rates would be made possible.

The divergence indicator was intended to give a country a warning signal when its currency was nearing the allowed deviation from the ECU central rate. When the divergence indicator crossed a certain threshold, the country is expected to respond to this signal in a variety of ways, such as intervention in the currency markets, improvements in domestic monetary policy, changes in central parity, or other general measures of economic policy.

There are three financing facilities in the EMS: the Very Short Term Financing Facility (VSTF), the Short Term Monetary Support (STMS), and the Medium Term Financial Assistance (MTFA). The first two facilities were administered by the central banks and the third by the EU council of ministers.

### 3.1.4.1 Surveillance System

The multilateral surveillance takes the form of the adoption by the Council of the Broad Economic Policy Guidelines (BEPG) against which each country's performance can be assessed. The Stability and Growth Pact programs are implanted in the BEPG. Annual reports are submitted by each government and the Pact defines what excessive means. These reports are examined by the Commission whose conclusions are then submitted to the ECOFIN Council. The Council approves country-specific assessments and may issue warnings (i.e., peer pressure) and impose fines for violations of the Stability and Growth Pact.

In order to provide comparable statistics at the EU level, the European Statistical System (ESS) was established. The ESS consists of the Eurostat and the statistical offices, ministries, agencies, and central banks that collect official statistics from EU Member States, Iceland, Norway, and Liechtenstein. Member States collect data and compile statistics for national and EU purposes. The ESS functions as a network in which Eurostat's role is to lead the way in harmonizing statistics in close cooperation with the national statistical authorities. The ESS also coordinates its work with international organizations, such as the OECD, UN, the IMF, and the World Bank.

### 3.1.4.2 Economic and Financial Indicators

The EU uses different economic and financial indicators for surveillance purposes. Table 18 presents the different key indicators used in the euro area for surveillance purposes:

**Table 18. List of Key Indicators for the Euro Area**

| No. | Indicator | Note | Source |
|---|---|---|---|
| 1 | **Output** | | |
| 1.1 | Industrial confidence indicator | Industry survey, average of balances to replies on production expectations, order books, and stocks (the latter with inverted sign) | ECFIN |
| 1.2 | Industrial production | Volume, excluding construction, working day adjusted | Eurostat |
| 1.3 | Gross domestic product | Volume (1995), seasonally adjusted | Eurostat |
| 1.3.1 | Gross domestic product & divergence | From 1992 until 1996 the minimum and maximum is based on BE, DE, ES, FR, IT, NL, PT and FI; from 1996 it includes also AT | Eurostat |
| 1.3.2 | Gross domestic product and forecast range | Volume (1995), seasonally adjusted; the forecast is based on confidence indicators, real and financial variables (see also ECFIN Economic Papers No 154, June 2001) | ECFIN / Eurostat |
| 1.3.3 | Gross domestic product and standard deviation | From 1992 until 1996 the standard deviation is based on BE, DE, ES, FR, IT, NL, PT and FI; from 1996 it includes also AT | ECFIN / Consensus Forecasts |
| 1.4 | Economic sentiment indicator | Composite of indicators for industry, construction, retail trade and consumers (1995 =100) | ECFIN |
| 2 | **Private consumption** | | |
| 2.1 | Consumer confidence indicator | Consumer survey, average of balances to replies to four questions (financial and economic situation, unemployment, savings over next 12 months) | ECFIN |
| 2.2 | Retail sales | Volume, excluding motor vehicles, working day adjusted | Eurostat |
| 2.3 | Private consumption | Volume (1995 prices), seasonally adjusted | Eurostat |
| 3 | **Investment** | | |
| 3.1 | Capacity utilization | In percent of full capacity, manufacturing, seasonally adjusted, survey data (collected each January, April, July and October). | ECFIN |
| 3.2 | Gross fixed capital formation | Volume (1995 prices), seasonally adjusted | Eurostat |
| 3.3 | Change in stocks | In percent of GDP, volume (1995 prices), seasonally adjusted | Eurostat |

**Table 18. List of Key Indicators for the Euro Area (cont.)**

| No. | Indicator | Note | Source |
|---|---|---|---|
| 4.1 | Unemployment | In percent of total workforce, ILO definition, seasonally adjusted | Eurostat |
| 4.2 | Employment | Number of employees, partially estimated, seasonally adjusted | ECB / Eurostat |
| 4.3 | Shortage of labour | Percent of firms in the manufacturing sector reporting a shortage of labour (unfilled job openings) as a constraint to production, seasonally adjusted | ECFIN |
| 4.3.1 | Beveridge curve | Relationship between the unemployment rate and shortage of labour as defined in 4.3 | ECFIN / Eurostat |
| 4.4 | Wages | Not a fully harmonised concept, but representative for each Member State (mostly hourly earnings) | ECFIN |
| 4.4.1 | Labour productivity | Difference between GDP growth and employment growth | ECFIN |
| 4.4.2 | Hourly earnings industry | Nominal values, seasonally adjusted | Eurostat |
| **5** | **International transactions** | | |
| 5.1 | Export order books | Industry survey; balance of positive and negative replies, seasonally adjusted | ECFIN |
| 5.2 | World trade | Volume, 1998=100, seasonally adjusted | CPB** |
| 5.3 | Exports of goods | Bn. EUR, excluding intra euro area trade, fob, seasonally and working day adjusted | Eurostat |
| 5.4 | Imports of goods | Bn. EUR, excluding intra euro area trade, cif, seasonally and working day adjusted | Eurostat |
| 5.4.1 | Intra trade | Bn. EUR, intra euro area trade, seasonally and working day adjusted | Eurostat |
| 5.5 | Trade balance | Bn. EUR, excluding intra euro area trade, fob-cif, seasonally and working day adjusted | Eurostat |
| 5.6 | Exports of goods and services | Volume (1995 prices), including intra euro area trade, seasonally adjusted | Eurostat |
| 5.7 | Imports of goods and services | Volume (1995 prices), including intra euro area trade, seasonally adjusted | Eurostat |
| 5.8 | Current account balance | Bn. EUR, excluding intra euro area transactions; before 1997 partly estimated | ECB |
| 5.9 | Direct investment (net) | Bn. EUR, excluding intra euro area transactions | ECB |
| 5.10 | Portfolio investment (net) | Bn. EUR, excluding intra euro area transactions | ECB |

**Table 18. List of Key Indicators for the Euro Area (cont.)**

| 6 | **Prices** | | |
|---|---|---|---|
| 6.1 | HICP | Harmonised index of consumer prices, national CPI until 1996 | Eurostat |
| 6.2 | Core HICP | Harmonised index of consumer prices, excluding energy and unprocessed food | Eurostat |
| 6.3 | Producer prices | Without construction | Eurostat |
| 6.3.1 | Selling price expectation | Industry survey; balance of positive and negative replies, seasonally adjusted | ECFIN |
| 6.4 | Import prices | Import unit values index for goods, 2000=100 | Eurostat |
| 6.4.1 | Oil prices | Brent light; USD/barrel and EUR/barre | Datastream |
| 6.4.2 | Non-fuel commodities prices | Index of market prices for non-fuel commodities, 1995=100, in USD terms | IMF |
| 7 | **Monetary and financial indicators** | | |
| 7.1 | Interest rate | Percent p.a., 3-month interbank money market rate, period averages | Datastream |
| 7.1.2 | Real short-term interest rates | 3-month interbank money market rate (period averages) minus annual percentage change of HICP (CPI before 1996) | Datastream/Eurostat |
| 7.2 | ECB repo rate | Percent p.a., minimum bid rate of the ECB, end of period | Datastream |
| 7.3 | Bond yield | Percent p.a., 10-year government bond yields (before 1995 long-term bond yield available) lowest level prevailing in the euro area, period averages | Datastream |
| 7.3.1 | Real long-term interest rates | 10-year government bond yields (lowest level prevailing in the euro area, period averages) minus annual percentage change of HICP (CPI before 1996) | Datastream / Eurostat |
| 7.4 | Stock markets | DJ Euro STOXX50 index, period averages | Datastream |
| 7.5 | M3 | Seasonally adjusted, three-month moving average (attributed to middle month): from 1997 onwards corrected for holdings by non-residents | ECB |
| 7.6 | Credit to private sector (loans) | MFI loans to euro area residents excluding MFIs and general government, monthly values: month end values, annual values: annual averages | ECB |
| 7.7 | Exchange rate USD/EUR | Period averages, until December 1998: USD/ECU rates | ECB |
| 7.7.1 | Exchange rate JPY/EUR | Period averages, until December 1998: JPY/ECU rates | ECB |
| 7.8 | Nominal effective exchange rate | Against 13 other industrialized countries, double export weighted, 1995 = 100, increase (decrease): appreciation (depreciation) | ECFIN |

**Table 18. List of Key Indicators for the Euro Area (cont.)**

| No. | Indicator | Note | Source |
|---|---|---|---|
| 8 | **Public finance** | | |
| 8.1 | General government balance | In percent of GDP, net lending (+) or net borrowing (-) general government, ESA 79 up to 1994, ESA 95 as of 1995, 2004 estimates are based on ECFIN Autumn 2004 forecasts* | ECFIN |
| 8.2 | Primary balance | In percent of GDP; net lending/borrowing minus interest payment; ESA 79 up to 1994, ESA 95 as of 1995; incl. 2000 and 2001 one-off proceeds relative to UMTS licences, 2004 results are based on ECFIN Autumn 2004 forecasts | ECFIN |
| 8.3 | Cyclically adjusted primary balance | In percent of GDP; primary balance corrected for the influence of the cycle; ESA 79 up to 1994, ESA 95 as of 1995, proceeds from UMTS licences excluded, 2003 results are based on ECFIN Autumn 2004 forecasts | ECFIN |
| 8.4 | General government expenditure and receipts | In percent of GDP, ESA 79 up to 1994, ESA 95 as of 1995; proceeds from UMTS licences booked as expenditure with negative sign; tax burden: taxes on production and imports (incl. taxed paid to EU) + current taxes on income and wealth + actual social contri | ECFIN |
| 8.5 | Cyclically adjusted balance | In percent of GDP, general government balance corrected for the influence of the cycle; ESA 79 up to 1994, ESA 95 as of 1995, proceeds from UMTS licences excluded, 2004 results are based on ECFIN Autumn 2004 forecasts | ECFIN |
| 8.6 | General government debt | In percent of GDP, ESA 79 up to 1994, ESA 95 from 1995 ownwards, 2004 results are based on ECFIN Autumn 2004 forecasts | ECFIN |

Notes:

1) The euro area includes 12 countries (BE, DE, EL, ES, FR, IE, IT, LU, NL, AT, PT, FI).

2) mom % ch., qoq % ch., yoy % ch.: monthly, quarterly and annual percentage change respectively.

3) For further information see: http://www.cpb.nl/eng/general/org/program/ic/trademonitor.html.

Source: European Commission (2007).

## 3.2    EMP as Crisis Indicator

This section will test whether the EMP can be used as a surveillance mechanism for the region.  The model is estimated using monthly data from January 2000 to November 2005 for ten countries namely: Cambodia, China, Indonesia, Korea, Laos, Malaysia, Philippines, Singapore, Thailand, and Vietnam.  Data was collected from International Financial Statistics of the IMF as well as country data from national sources.  Data were processed using the ADB VIEWS standard for EWS model.  The dependent variable in our model is the Exchange Market Pressure $(EMP)$, where

$$EMP = \%\Delta\,ER - \left(\frac{\sigma_{\Delta ER}}{\sigma_{\Delta FOREX}}\right) \bullet \%\Delta\,FOREX \qquad\qquad (6)$$

Based on the set of indicators used by the IMF, EU, and the various literatures on early warning system, the model will use the most common indicators to predict crisis.  However, there are dozens of potential variables that could be used to explain the likelihood of a crisis.  For instance, Kaminsky et al. (1998) list 103 different indicators.  To solve this problem, the paper will utilize the IMF *World Economic Outlook* of May 1998 approach to trim down the indicators to three (3),  namely real exchange rate, credit growth, and M2/Reserves.  Following Abiad (1999), the variables were transformed to include the following:  deviation of real effective exchange rate from trend (representing the current account indicator), ratio of M2 to foreign exchange reserves (representing capital account indicator), and the ratio of domestic credit to GDP (representing the financial indicator).

Several studies explain that a deviation of the real effective exchange rate from trend may signal an overvalued exchange rate and thus, may lead to a financial crisis.  The specification was used since it is in line with the theoretical idea that deviations from an equilibrium real exchange rate translate to pressure for realignment.  On the other hand, the ratio of M2 to foreign exchange reserves captures the extent to which the liabilities of the banking system are backed by foreign reserves.  In the event of a currency crisis, individuals may rush to convert their domestic currency deposits into foreign currency, so that this ratio captures the ability of the central bank to meet their demands.  Lastly, the ratio of domestic credit to GDP indicates that a very high growth of domestic credit may serve as a crude indicator of the fragility of the banking system.  This ratio usually rises in the early phase of the banking crisis.  It may be that as the crisis unfolds, the central bank may be injecting money to the bank to improve their financial situation.

The deviation indicator determined earlier will also be applied to analyze whether it would be a useful mechanism as a crisis indicator, with the objective of promoting financial and economic stability in the region.  Analytically, the deviation indicator proxies currency misalignments but this time, relative to an average RMU value during the base year.  Periods during which deviations are sustained may contain information as to the likelihood of a crisis taking place.

### 3.2.1   Crisis Dating

To determine the existence of crisis in the sample period, we use the condition:

$$\begin{aligned} Crisis &= 1, if\ EMP > \mu_{EMP} + \sigma_{EMP}\bullet k \\ &= 0, otherwise. \end{aligned} \qquad\qquad (7)$$

where $\mu_{EMP} + \sigma_{EMP} \bullet k =$ threshold level; and $k = (1, 1.5, 1.75, 2)$.

The threshold accounts for the central tendency and the spread of the $EMP$ and $\sigma_{EMP} \bullet k$ represents the $k -$ deviation/s from the mean. The lower is the value of $k$, the lower will be the threshold, indicating that the number of crises may increase as we reduce $k$. Given consecutive crises periods associated with lower values of $k$, say $t_0 + h$ periods, a crisis period that is identified using a higher value of $k$ at $t_0 + h + 1$ may indicate that the crisis has deteriorated. However, based on statistical construction, the crisis identifier will not register a crisis even when $EMP$ is very close to the threshold. Thus, the crisis identifier will not capture crisis severity as well as duration.

For the first statistical description, changes in exchange rates (including lagged effects), changes in reserves (including lagged effects), and deviation indicators (including lagged effects were tested to determine crisis episodes. The discussion of the results focuses on threshold levels where $k = 1$ and $k = 2$, respectively. For the complete discussion of the results at different threshold levels (i.e., $k = 1.5$ and $k = 1.75$), please refer to Appendix Figures 41-80.

### 3.2.1.1 Cambodia

Table 19 summarizes the nine (9) recorded episodes for crisis months for $k = 1$ and three (3) episodes of crisis for $k = 2$ in Cambodia for the sample period:

**Table 19. Deviation Indicator Results: Crisis Episodes in Cambodia**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2000 M7 | 1 | 1 | 1.526 | 1.566 | 1.271 |
| 2002 M9 | 0 | 1 | 0.434 | -0.612 | 0.534 |
| 2003 M5 | 0 | 1 | 0.812 | 1.356 | 0.591 |
| 2004 M5 | 0 | 1 | 0.552 | -2.965 | 1.035 |
| 2004 M6 | 1 | 1 | 0.2 | -9.15 | 1.69 |
| 2005 M5 | 0 | 1 | 0.696 | 0.958 | 0.54 |
| 2005 M6 | 0 | 1 | 0.79 | -1.242 | 0.992 |
| 2005 M7 | 1 | 1 | 1.175 | 0.801 | 1.045 |
| 2005 M9 | 0 | 1 | 0.777 | -0.482 | 0.855 |
| Thresholds | 1.0385129 | 0.46773416 | | | |

For both threshold levels, most of the crisis months recorded occurred during the time when changes in reserves decreased significantly in the previous month. The lagged deviation indicator on the other hand was observed to be increasing during the crisis months while the highest $EMP$ during the crisis episode was only 1.690 (Appendix Figures 1-4). It may appear that the designation of July 2000 as a crisis episode is counterintuitive as the respective magnitudes of changes in $ER$ and reserves are almost the same. However, this can be resolved by examining the relative variation in $ER$ and reserves. The former registered only 0.41 while the latter tallied 2.53, indicating that Cambodia during the entire sample period may have extensively used foreign reserves instead of allowing its currency to depreciate. The threshold was recorded at k=2 are at 1.03.

### 3.2.1.2 China

As shown in the Table 20, China only experienced one (1) crisis episode in November 2004. China is one of the countries that implement a rigid exchange rate system, which implies that most of the variations in the exchange market pressure will be dictated by the movements in foreign reserves. During the said period, the country experienced a significant reduction in reserves while the deviation indicator showed an appreciation in its currency during the said crisis episode. This was also the only period where the $EMP$ was positive in the whole sample period (Appendix Figures 5-8). The threshold was one of the lowest in the sample countries with 0.33 at k=2.

**Table 20. Deviation Indicator Results: Crisis Episodes in China**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2004 M11 | 1 | 1 | 0 | -4.060861 | 0.453052 |
| Thresholds | 0.33541105 | 0.03786672 | | | |

### 3.2.1.3 Indonesia

Table 21 summarizes the ten (10) recorded episodes for crisis months for $k = 1$ and one (1) crisis episode for $k = 2$ in Indonesia for the sample period:

**Table 21. Deviation Indicator Results: Crisis Episodes in Indonesia**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2000 M7 | 0 | 1 | 6.285 | 0.545 | 5.428 |
| 2000 M10 | 0 | 1 | 4.845 | -0.04 | 4.907 |
| 2001 M3 | 0 | 1 | 5.226 | -1.332 | 7.305 |
| 2001 M4 | 1 | 1 | 9.856 | -1.125 | 11.625 |
| 2001 M9 | 0 | 1 | 5.411 | -2.569 | 9.452 |
| 2001 M10 | 0 | 1 | 8.693 | -0.399 | 9.321 |
| 2002 M7 | 0 | 1 | 2.677 | -1.805 | 5.515 |
| 2002 M10 | 0 | 1 | 2.557 | -2.012 | 5.722 |
| 2004 M6 | 0 | 1 | 4.73 | -1.248 | 6.692 |
| 2005 M5 | 0 | 1 | -0.694 | -4.605 | 6.548 |
| Thresholds | 9.8285552 | 4.7413697 | | | |

In terms of magnitudes, Indonesia has one of the highest thresholds. For both threshold levels, most of the crisis months recorded occurred during the months when the changes in reserves decreased during the crisis episode month. On the other hand, almost all crisis episodes occurred during the time when exchange rate increased. The lagged deviation indicator on the other hand was observed to be depreciating during the crisis months (Appendix Figures 9-12). Based on descriptive statistics across countries, Indonesia has the most variable exchange rate movements. It also registered the highest average depreciation during the sample period. Also, among the sample countries, the threshold level for Indonesia was highest at 9.82 for k=2.

### 3.2.1.4 Korea

In the case of Korea, 12 crisis episodes were recorded for $k = 1$ and none for $k = 2$ as shown in Table 22.

**Table 22. Deviation Indicator Results: Crisis Episodes in Korea**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2000 M12 | 0 | 1 | 5.22 | 3.695 | 1.335 |
| 2001 M1 | 0 | 1 | 4.58 | 3.83 | 0.553 |
| 2001 M3 | 0 | 1 | 3.148 | 1.154 | 1.935 |
| 2001 M9 | 0 | 1 | 0.809 | 0.174 | 0.626 |
| 2001 M12 | 0 | 1 | 0.752 | -0.81 | 1.604 |
| 2002 M1 | 0 | 1 | 1.945 | -0.086 | 2.035 |
| 2002 M2 | 0 | 1 | 0.216 | -0.934 | 1.198 |
| 2002 M3 | 0 | 1 | 0.217 | -1.028 | 1.297 |
| 2002 M9 | 0 | 1 | 1.046 | 0.39 | 0.636 |
| 2002M10 | 0 | 1 | 2.515 | 1.174 | 1.281 |
| 2003 M3 | 0 | 1 | 3.751 | 1.474 | 2.201 |
| 2005 M7 | 0 | 1 | 2.502 | 1.48 | 0.946 |
| Thresholds | 2.9635387 | 0.43880708 | | | |

It can be observed that most of the crisis episodes recorded was concentrated between 2001 and 2002. Results were found to be inconsistent as there were cases where the contemporaneous and lagged reserves decreased while in other crisis episodes, reserves actually increased (Appendix Figures 13-16). Threshold level was recorded at 2.96 at k=2.

### 3.2.1.5 Laos

Laos recorded two (2) crisis episodes for $k = 2$ and seven (7) crisis episodes for $k = 1$ (Table 23). Laos is second only to Vietnam in terms of variability in foreign reserve changes. Except for March 2001, reserves decreased during almost all the crisis episodes while the exchange rate depreciated during the said episodes (Appendix Figures 17-20). The threshold level of 7.79 at k=2 was one of the highest in the sample countries.

**Table 23. Deviation Indicator Results: Crisis Episodes in Laos**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2000M9 | 0 | 1 | 0.35 | -6.954 | 4.224 |
| 2000M11 | 1 | 1 | 7.574 | -2.185 | 8.797 |
| 2001M3 | 1 | 1 | 13.207 | 0.051 | 13.178 |
| 2001M10 | 0 | 1 | 1.803 | -4.478 | 4.311 |
| 2002M1 | 0 | 1 | 0.285 | -7.045 | 4.23 |
| 2002M7 | 0 | 1 | 2.824 | -8.595 | 7.637 |
| 2002M9 | 0 | 1 | 3.478 | -1.022 | 4.05 |
| Thresholds | 7.7926781 | 3.8532889 | | | |

### 3.2.1.6 Malaysia

In the case of Malaysia, the country experienced crisis episodes at $k=1$ in six months (Table 24). Since the exchange rate was relatively fixed, the reserves declined during the crisis episodes (Appendix Figures 21-24). This may simply indicate the active and consistent use of reserves in response in speculative pressures that target the currency's depreciation. Following theory, this may work but only at the expense of drawing down the country's reserves, which will eventually be exhausted. The threshold level on the other hand for Malaysia recorded the lowest among the sample countries at k=2 at 0.25.

**Table 24. Deviation Indicator Results: Crisis Episodes in Malaysia**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2000M8 | 0 | 1 | 0 | -4.289 | 0.166 |
| 2000M9 | 0 | 1 | 0 | -3.763 | 0.146 |
| 2001M6 | 0 | 1 | 0 | -3.494 | 0.136 |
| 2001M9 | 0 | 1 | 0 | -5.508 | 0.214 |
| 2002M2 | 0 | 1 | 0 | -5.757 | 0.223 |
| 2002M3 | 0 | 1 | 0 | -2.772 | 0.108 |
| Threshold | 0.2549326 | 0.09842785 | | | |

### 3.2.1.7 Philippines

The Philippines experienced eight (8) crisis episodes at $k=1$ and one (1) episode for $k=2$ (Table 25). Most of the said crisis episodes happened during the time when the reserves were declining while the currency was depreciating (Appendix Figures 25-28). This may imply the existence of a limited intervention in the exchange market, which point to the possibility that reserves will be reduced to combat speculative pressures only up to a certain extent and then allow the currency to seek its own value. In terms of average depreciation, the Philippines is second only to Indonesia. On a positive note, growth of exchange rate is not as variable as Indonesia's but displays greater variability in terms of its reserves. Threshold on the other hand was in between sample countries with 4.90 at k=2.

**Table 25. Deviation Indicator Results: Crisis Episodes in the Philippines**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2000M7 | 0 | 1 | 3.962 | 1.923 | 3.007 |
| 2000M10 | 0 | 1 | 5.181 | 1.018 | 4.676 |
| 2001M1 | 0 | 1 | 2.144 | -1.646 | 2.962 |
| 2001M4 | 1 | 1 | 3.549 | -2.889 | 4.984 |
| 2001M6 | 0 | 1 | 1.88 | -3.665 | 3.7 |
| 2003M6 | 0 | 1 | 1.699 | -4.845 | 4.105 |
| 2003M8 | 0 | 1 | 2.377 | -1.55 | 3.147 |
| 2005M6 | 0 | 1 | 1.542 | -2.054 | 2.562 |
| Threshold | 4.9015556 | 2.5619129 | | | |

### 3.2.1.8 Singapore

Singapore experienced ten (10) crisis episodes for $k = 1$ and one (1) for $k = 2$ (Table 26). Except for April and October 2001, reserves also declined during the crisis episodes while the currency depreciated (Appendix Figures 29-32). There are also months during which rare combinations of appreciations and reserve declines happened. Threshold level was recorded at a modest 2.73 at k=2.

**Table 26. Deviation Indicator Results: Crisis Episodes in Singapore**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2000M1 | 0 | 1 | 0 | -2.627 | 1.693 |
| 2000M2 | 0 | 1 | 1.796 | -0.796 | 2.309 |
| 2000M9 | 0 | 1 | 1.163 | -1.095 | 1.868 |
| 2000M10 | 0 | 1 | 0.575 | -1.082 | 1.272 |
| 2001M4 | 0 | 1 | 2.26 | 1.016 | 1.605 |
| 2001M6 | 0 | 1 | 0.552 | -1.573 | 1.566 |
| 2001M10 | 1 | 1 | 3.429 | 0.131 | 3.344 |
| 2002M2 | 0 | 1 | -0.543 | -3.194 | 1.515 |
| 2005M3 | 0 | 1 | -0.427 | -3.367 | 1.743 |
| 2005M6 | 0 | 1 | 1.235 | -1.848 | 2.426 |
| Threshold | 2.7390724 | 1.1903092 | | | |

### 3.2.1.9 Thailand

For Thailand, a total of 12 crisis episodes occurred with ten (10) at $k = 1$ and two (2) at $k = 2$ (Table 27). For most of the episodes, reserves were relatively increasing while exchange rate was depreciating. For both crisis episodes at $k = 2$, the reduction in reserves occurred and at the same time appreciation of the currency (Appendix Figures 33-36). The Thai case actually shares the characteristics of the Philippines and Singapore at least within the sample period. Threshold level was recorded at 3.63 at k=2.

**Table 27. Deviation Indicator Results: Crisis Episodes in Thailand**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2000M7 | 0 | 1 | 2.9191 | 0.92 | 2.264 |
| 2000M9 | 0 | 1 | 2.444 | 0.246 | 2.269 |
| 2000M10 | 0 | 1 | 3.182 | 1.273 | 2.275 |
| 2000M12 | 0 | 1 | -1.431 | -6.313 | 3.064 |
| 2001M3 | 0 | 1 | 2.947 | -0.282 | 3.147 |
| 2001M4 | 1 | 1 | 3.579 | -0.818 | 4.161 |
| 2002M8 | 0 | 1 | 2.322 | 0.042 | 2.292 |
| 2004M2 | 0 | 1 | 0.008 | -2.876 | 2.055 |
| 2004M5 | 0 | 1 | 2.866 | 1.315 | 1.929 |
| 2004M6 | 1 | 1 | 0.592 | -4.683 | 3.926 |
| 2005M4 | 0 | 1 | 2.405 | 0.331 | 2.169 |
| 2005m6 | 0 | 1 | 2.74 | 0.371 | 2.476 |
| Threshold | 3.6300801 | 1.5918798 | | | |

### 3.2.1.10  Vietnam

Vietnam experienced only four (4) crisis episodes at $k=1$ and one (1) at $k=2$ (Table 28). The crisis episode at $k=1$ in October 2001 transpired during the time when the currency during the previous month depreciated with no change in the level of reserves. This was a clear break from the subsequent crisis periods. The remaining crisis episodes were mostly due to the reduction in reserves and the depreciation of the currency (Appendix Figures 37-40). Therefore, what happened was a clear shift in policy intervention. As a matter of fact, the variability of reserve movements is highest for Vietnam relative to the other countries. The threshold level was recorded at 2.80 at k=2.

**Table 28. Deviation Indicator Results: Crisis Episodes in Vietnam**

| Month | k=2 | k=1 | % Δ ER | % Δ Reserves | EMP |
|---|---|---|---|---|---|
| 2001M10 | 1 | 1 | 6.547 | 0 | 6.547 |
| 2002M2 | 0 | 1 | 0.331 | -5.237 | 1.548 |
| 2002M5 | 0 | 1 | 0.191 | -5.48 | 1.464 |
| 2002M10 | 0 | 1 | 0.117 | -7.186 | 1.786 |
| Threshold | 2.8035582 | 1.28651 | | | |

### 3.2.2  Exchange Market Pressures and Deviation Indicators

The second statistical description includes the use exchange market pressure (including cumulative) and the deviation indicator (including changes and lagged effects) to determine crisis episodes. Though the informational content of $EMP$ and cumulative $EMP$ is the same, the latter provides an indicator for the severity of crisis in that it is concerned with the temporal buildup of $EMPs$. The discussion of the results focuses on cases involving $k=1$ and $k=2$, respectively, for all sample countries.

### 3.2.2.1  Cambodia

As expected, the crisis episodes were the same as the first model [i.e., nine (9) episodes for $k=1$ and three (3) for $k=2$] (Table 29). However, it became evident that although $EMP$ increased during the crisis episodes, the cumulative $EMP$ declined during the said periods. This is due to the fact that periods of tranquility outnumber crisis periods. On the other hand, the deviation indicator did not provide consistent result during the crisis episodes (Appendix Figures 81-84). Consider the three (3) crisis months from May to June 2005. $EMP$ has been increasing, indicating that the cumulative market pressure should likewise increase. Note that $EMP$ actually crossed the higher threshold after two months of registering positive for a crisis based on a lower threshold.

**Table 29. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in Cambodia**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2000M7 | 1 | 1 | 1.271205 | 1.163214 |
| 2002M9 | 0 | 1 | 0.5339612 | -4.039756 |
| 2003M5 | 0 | 1 | 0.5907333 | -7.298134 |
| 2004M5 | 0 | 1 | 1.03468 | -7.049075 |
| 2004M6 | 1 | 1 | 1.689996 | -5.359079 |

| | 0 | 1 | 0.5396185 | -8.937459 |
|---|---|---|---|---|
| 2005M5 | 0 | 1 | 0.5396185 | -8.937459 |
| 2005M6 | 0 | 1 | 0.9919 | -7.94556 |
| 2005M7 | 1 | 1 | 1.044591 | -6.900968 |
| 2005M9 | 0 | 1 | 0.855454 | -6.457684 |

### 3.3.2.2 China

The crisis episode was also the same as the first model in the case of China (Table 30). The cumulative $EMP$ also declined during the crisis episode while $EMP$ increased (Appendix Figures 85-88).

**Table 30. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in China**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2004M11 | 1 | 1 | 0.453052 | -11.43576 |

### 3.3.2.3 Indonesia

In the case of Indonesia, there is one different crisis episode that occurred in July 2005 as compared to the first model where the crisis episode occurred in May 2005 (Table 31). In most of the crisis episodes identified, the $EMP$ as well as the cumulative $EMP$ increased (Appendix Figures 89-92).

**Table 31. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in Indonesia**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2000M7 | 0 | 1 | 5.427956 | 10.05929 |
| 2000M10 | 0 | 1 | 4.907273 | 8.304996 |
| 2001M3 | 0 | 1 | 7.304821 | 9.77578 |
| 2001M4 | 1 | 1 | 11.625 | 21.40078 |
| 2001M9 | 0 | 1 | 9.451832 | 1.833387 |
| 2001M10 | 0 | 1 | 9.321121 | 11.15451 |
| 2002M7 | 0 | 1 | 5.515957 | 1.38654 |
| 2002M10 | 0 | 1 | 5.721833 | 6.194603 |
| 2004M6 | 0 | 1 | 6.692197 | -19.82164 |
| 2005M7 | 0 | 1 | 6.547807 | -24.2625 |

### 3.3.2.4 Korea

In the case of Korea, the crisis episodes were consistent with the first model (12 crisis episodes for $k=1$ and none for $k=2$) (Table 32). However, it can be noticed that the cumulative $EMP$ declined considerably while $EMP$ was increasing during the crisis episodes (Appendix Figures 93-96).

**Table 32. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in Korea**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2000M12 | 0 | 1 | 1.33543 | -31.72055 |
| 2001M1 | 0 | 1 | 0.5532091 | -31.16734 |
| 2001M3 | 0 | 1 | 1.935194 | -35.96571 |
| 2001M9 | 0 | 1 | 0.6262905 | -45.32888 |
| 2001M12 | 0 | 1 | 1.603941 | -48.67573 |
| 2002M1 | 0 | 1 | 2.03519 | -46.64054 |

| 2002M2 | 0 | 1 | 1.19835 | -45.44219 |
| 2002M3 | 0 | 1 | 1.297284 | -44.14491 |
| 2002M9 | 0 | 1 | 0.6360523 | -60.49945 |
| 2002M10 | 0 | 1 | 1.28051 | -59.21894 |
| 2003M3 | 0 | 1 | 2.20114 | -65.48168 |
| 2005M7 | 0 | 1 | 0.9459835 | -131.6997 |

### 3.3.2.5 Laos

The crisis episodes for Laos were the same as the first model (Table 33). However, during the crisis episodes, both $EMP$ and cumulative $EMP$ were increasing (Appendix Figures 97-100). Pressures were building-up between September 2000 and early months of 2003, which may indicate the failure of past interventions to address the cause of the said build-up.

**Table 33. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in Laos**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2000M9 | 0 | 1 | 4.243906 | 7.973393 |
| 2000M11 | 1 | 1 | 8.797337 | 18.31818 |
| 2001M3 | 1 | 1 | 13.17826 | 26.7819 |
| 2001M10 | 0 | 1 | 4.310678 | 12.69995 |
| 2002M1 | 0 | 1 | 4.229753 | 13.47791 |
| 2002M7 | 0 | 1 | 7.636611 | 21.47033 |
| 2002M9 | 0 | 1 | 4.050491 | 25.16164 |

### 3.3.2.6 Malaysia

Malaysia's crisis episodes were the same as the first model [six (6) crisis episodes at $k=1$ and none for $k=2$] (Table 34). The crisis episodes in 2000 and 2001 exhibited a reduction in the cumulative $EMP$ while $EMP$ was increasing. On the other hand, the crisis episodes in 2002 recorded increase in both $EMP$ and cumulative $EMP$ (Appendix Figures 101-104). Based on the data, no appreciable buildup in exchange market pressure can be observed.

**Table 34. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in Malaysia**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2000M8 | 0 | 1 | 0.1664931 | -0.5487964 |
| 2000M9 | 0 | 1 | 0.1460756 | -0.4027207 |
| 2001M6 | 0 | 1 | 0.1356197 | -0.7286654 |
| 2001M9 | 0 | 1 | 0.2137996 | -0.4434896 |
| 2002M2 | 0 | 1 | 0.2234908 | 0.0015104 |
| 2002M3 | 0 | 1 | 0.1076204 | 0.1091309 |

### 3.3.2.7 Philippines

In the case of the Philippines, the same crisis episodes in the first model occurred in all (except for July 2000) (Table 35). $EMP$ and cumulative $EMP$ increasing during the crisis episodes (Appendix Figures 105-108). Of all the countries contained in the sample, the Philippines' exchange market pressure was indeed very large.

**Table 35. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in the Philippines**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2000M7 | 0 | 1 | 3.006907 | -2.547459 |
| 2000M10 | 0 | 1 | 4.675668 | 4.588039 |
| 2001M1 | 0 | 1 | 2.961669 | 11.39192 |
| 2001M4 | 1 | 1 | 4.983599 | 6.301037 |
| 2001M6 | 0 | 1 | 3.700119 | 11.39371 |
| 2003M6 | 0 | 1 | 4.105025 | 11.87088 |
| 2003M8 | 0 | 1 | 3.146674 | 15.85308 |
| 2005M6 | 0 | 1 | 2.561919 | 17.57549 |

### 3.3.2.8 Singapore

Singapore also registered the same crisis episodes as the first model (Table 36). The crisis episodes the occurred from 2000 to 2002 showed an increasing $EMP$ and cumulative $EMP$ while the 2005 crisis episodes illustrate a reduction in the cumulative $EMP$ (Appendix Figures 109-112).

**Table 36. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in Singapore**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2000M1 | 0 | 1 | 1.692973 | 1.692973 |
| 2000M2 | 0 | 1 | 2.30892 | 4.001893 |
| 2000M9 | 0 | 1 | 1.868283 | 3.164008 |
| 2000M10 | 0 | 1 | 1.272182 | 4.436191 |
| 2001M4 | 0 | 1 | 1.60523 | 6.184936 |
| 2001M6 | 0 | 1 | 1.565614 | 6.547353 |
| 2001M10 | 1 | 1 | 3.344291 | 4.952451 |
| 2002M2 | 0 | 1 | 1.514828 | 5.939599 |
| 2005M3 | 0 | 1 | 1.742627 | -21.18414 |
| 2005M6 | 0 | 1 | 2.425556 | -19.46959 |

### 3.3.2.9 Thailand

For most part of the crisis episodes in 2000 to 2002, the $EMP$ and cumulative $EMP$ for Thailand were increasing (Table 37). However the crisis episodes in 2004 and 2005 recorded a decreasing cumulative $EMP$ (Appendix Figures 113-116).

**Table 37. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in Thailand**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2000M7 | 0 | 1 | 2.263797 | -2.508327 |
| 2000M9 | 0 | 1 | 2.268766 | 1.097808 |
| 2000M10 | 0 | 1 | 2.275446 | 3.373254 |
| 2000M12 | 0 | 1 | 3.063513 | 3.382861 |
| 2001M3 | 0 | 1 | 3.147472 | 6.09819 |
| 2001M4 | 1 | 1 | 4.161333 | 10.25952 |
| 2002M8 | 0 | 1 | 2.291882 | 1.285733 |
| 2004M2 | 0 | 1 | 2.055489 | -16.56849 |
| 2004M5 | 0 | 1 | 1.929469 | -16.01005 |
| 2004M6 | 1 | 1 | 3.926253 | -12.08379 |
| 2005M4 | 0 | 1 | 2.169415 | -24.68701 |
| 2005M6 | 0 | 1 | 2.475984 | -22.26706 |

### 3.3.2.10 Vietnam

Vietnam also registered the same crisis episodes as the first model (Table 38). However, during the said crisis episodes, $EMP$ was increasing while cumulative $EMP$ declined (Appendix Figures 117-120).

**Table 38. Exchange Market Pressure and Deviation Indicator Results: Crisis Episodes in Vietnam**

| Month | k=2 | k=1 | EMP | Cumulative EMP |
|---|---|---|---|---|
| 2001M10 | 1 | 1 | 6.547 | -5.046996 |
| 2002M2 | 0 | 1 | 1.547511 | -2.817917 |
| 2002M5 | 0 | 1 | 1.464164 | -3.019954 |
| 2002M10 | 0 | 1 | 1.786372 | -4.130408 |

**Summary of Results**

In general, the results of the EMP and deviation indicator showed mixed results in predicting crisis. Based on the results from the ten countries in the sample, it can be noted that the countries have different degrees of EMP and that the threshold spikes are also different for each country. In many cases, the adjustments were seen either in the exchange rate and/or combination with changes in the international reserves. On the other hand, EMP and thresholds differ for the sample countries with Indonesia having the highest EMP at 11.625 in April 2001 and threshold level of 9.82 at k=2. Meanwhile, Malaysia had the lowest EMP with no crisis episode recorded at k=2. Also, threshold for Malaysia was also lowest for k=2 at 0.25 among all the sample countries.

In a number of instances, it can be observed that the crisis periods were preceded by both rising EMP and cumulative EMP, which suggests that both EMP and cumulative EMP are good predictors of crisis. However, there were also instances when rising EMP and cumulative EMP did not lead to a crisis. In the case of the deviation indicator, there were also instances when the declining deviation indicator did not lead to a crisis.

## 3.3 Regression Analysis

The study uses two models. The first (Model 1) involves the use of three (3) indicators namely: deviation of real effective exchange rate from trend (representing the current account indicator), ratio of M2 to foreign exchange reserves (representing capital account indicator), and the ratio of domestic credit to GDP (representing the financial indicator). This represents the more traditional approach. The second (Model 2) includes the deviation indicator in the model and tries to determine if it can be used as an early warning indicator for surveillance (Table 39). One good criterion for assessing the empirical value of the deviation indicator as an early warning indicator is to be able to observe whether the resultant change in the goodness of fit is significant. It is also of econometric interest to ascertain the form of the deviation indicator that will support a very high explanatory power.

The results for the first model varied from country to country. In the case of Cambodia, the deviation of real effective exchange rate from the trend is the best crisis indicator while in the case of China and Malaysia, the ratio of M2 to foreign exchange reserves would be the better indicator. For Indonesia, all three indicators have significant explanatory powers to predict a crisis. On the other hand, Korea, Laos, Philippines, Singapore, Thailand and Vietnam yielded negative results.

In the second model, the deviation indicator was included to determine its effectiveness as an early warning tool. Results indicate that the deviation indicator is significant for four (4) out of the ten (10) sample countries (i.e., Korea, Philippines, Singapore, and Thailand). The results are consistent since the said countries use a floating exchange rate system. Thus, it can be said that the use of deviation indicator as surveillance tool can help countries determine if there are weaknesses in the system, particularly if they are currently adopting a flexible exchange rate system.

To check for the lagged effects, the moving average specification of the regressors was used to check the consistency of the results generated in the model. It was also used to economize on the degrees of freedom as noted in Eichengreen, Rose and Wyplosz (1996). The specifications were divided into four: the moving average of contemporaneous plus one (1) lag, the moving average of contemporaneous plus two (2) lags, the moving average of two (2) lags and four (4) lags. Table 40 shows the summary of the results generated.

In the models that utilized the moving average based regressors, the 12 month percentage change in M2/reserves were significant to both China and Malaysia since during most of the sample period, both countries were using a relatively fixed exchange rate. Understandably, monetary policy will be used to ensure stability. The real exchange rate deviation from the trend also yielded significant results only for China, indicating the significant role of trade. An overvalued currency as shown by an increasing deviation of $REER$ from its trend implies that for China, the exchange market pressure should decline. This is in contrast to the Cambodia, where an overvalued currency is associated with an increasing exchange market pressure. The 12-month percentage change in credit/GDP did not yield significant results except for Indonesia and Thailand.

For the deviation indicator, the initial regression results were consistent with the moving average as Korea, Philippines, Singapore, and Thailand yielded significant results. However, the results also support the fact that each of the said countries may require different information set that pertains to the deviation indicator. For instance, Philippines may scrutinize the first and second lags of the changes in the deviation indicator

but may also be interested in the contemporaneous specification. In Singapore's case, the relevant specification for the deviation indicator omits the contemporaneous component.

The econometric results present a case of sample separation with respect to the deviation indicator. On the one hand are countries, which may not need or require the use of the deviation indicator as an early warning indicator while on the other are countries where the deviation indicator has informational and inferential values, which may augment the set of early warning indicators that are currently in place. More importantly, the results confirm that countries which use floating exchange rate can benefit from the use of deviation indicator a surveillance tool and in the process achieve financial and economic stability in the region.

## 3.4    Some Remarks

Several weaknesses related to the use of the regression models may easily be pinpointed. First, the models presented did not compute for the probability of a crisis but instead focused only on the relationship between exchange market pressures and a set of crisis predictors. Second, sudden changes in the exchange market pressure were not captured by the regression models. These shifts are evident from the time series characterizations of the cumulative $EMP$. As Abiad (1999) pointed out, unless the model used is of the Markov switching model variety, the duration of the crisis will not be detected from the data. This may partly explain why in certain countries most models fitted were insignificant. Third, since the deviation indicator represents the deviation of the actual currency per RMU from the base year then it implies that replication studies that stretch the sample from the 1980s to the present will yield different predictions as the base year depends on the period under consideration. Fourth, important qualitative variables (e.g. contagion, political, and social crises) that are specific to a given country were not considered. Fifth, the interpretation of the regression equations was done within the context of early warning systems.

Nonetheless, regression analysis is useful in trying to determine the determinants of exchange market pressure. What is now needed is to explore $EMP$ thresholds and their relationship to crisis situations. This can be explored later in the future.

## 3.5    Summary

The risk of the occurrence of a crisis is always present, especially with the globalization of financial markets. A crisis arises even when countries at first have sound economic and financial fundamentals. There are cases when the risk of a crisis increases due to deterioration of market fundamentals. Therefore, governments must be able to identify weaknesses and imbalances before a crisis occurs.

The study showed that similar to other studies in the past, there is no one common model to detect crisis for all countries. In the study, the EMP and deviation indicators seem to have some promise as surveillance tools. For instance, most crisis periods identified in the study were preceded by both rising EMP and cumulative EMP. However, there were also instances when rising cumulative EMP did not lead to a crisis. On the other hand, the results for the deviation indicator suggest that it could be a useful tool for surveillance particularly for countries that use a floating exchange rate system. In the case of Korea, Singapore, Philippines, and Thailand, the deviation indicator can have informational value in assessing the occurrence of crisis. However, to fully appreciate the use of EMP and deviation indicators, it must be combined with other economic and financial indicators in detecting crisis.

The study can be further improved and expanded to include all ASEAN+3 economies. However, due to availability of data, not all countries were included in the sample. It was observed that the essential macroeconomic data, such as exchange rates, inflation rates, interest rates, trade data, GDP and balance of payment accounts among others, is not consistent across member ASEAN+3 countries. Moreover, several countries, such as Cambodia, Myanmar, Laos, and Vietnam lag behind its counterparts since they do not have the necessary database available online. Another problem encountered is the accessibility and availability of data in terms of language. Having accessible data at all times is very essential as it lowers the transactions cost of finding data online. The accuracy and timeliness of information is also very essential. This goes to say that information online needs to be maintained and updated frequently.

## Table 39. Summary of Regression Results

| Country | Model | Adj-R Squared | 12-Month % Change M2/reserves | | 12-Month % Change Credit/GDP | | Deviation from Trend (REER) | | Change in Deviation Indicator | | Constant | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic |
| Cambodia | 1 | 0.0668 | 0.01 | 1.12 | -0.002 | -0.42 | 1.137 | 2.36 | | | -0.146 | -1.92 |
| | 2 | 0.0821 | 0.01 | 1.17 | -0.001 | -0.16 | 1.137 | 2.38 | 0.1 | 1.45 | -0.165 | -2.15 |
| China | 1 | 0.3244 | 0.016 | 5.36 | 0.006 | 1.29 | -1.563 | -1.2 | | | -0.127 | -2.66 |
| | 2 | 0.3266 | 0.017 | 5.48 | 0.005 | 1.06 | -1.974 | -1.46 | 0.01 | 1.1 | -0.115 | -2.34 |
| Indonesia | 1 | 0.1018 | 0.131 | 2.44 | 0.151 | 2.49 | 20.481 | 1.95 | | | -0.841 | -1.32 |
| | 2 | 0.0965 | 0.141 | 2.54 | 0.149 | 2.45 | 19.362 | 1.83 | 0.369 | 0.78 | -0.866 | -1.36 |
| Korea | 1 | 0.0579 | 0.071 | 1.93 | 0.075 | 0.95 | 12.534 | 1.22 | | | -1.485 | -2.01 |
| | 2 | 0.331 | 0.074 | 2.38 | -0.006 | -0.09 | 6.673 | 0.76 | -1.022 | -5.29 | -0.904 | -1.43 |
| Laos | 1 | -0.0265 | 0.043 | 0.74 | 0.002 | 0.08 | 1.65 | 0.66 | | | -0.434 | -0.65 |
| | 2 | -0.0412 | 0.043 | 0.74 | 0.002 | 0.06 | 1.818 | 0.71 | 0.047 | 0.35 | -0.412 | -0.61 |
| Malaysia | 1 | 0.0969 | 0.004 | 2.6 | -0.005 | -1.11 | 1.311 | 1.29 | | | -0.039 | -2.06 |
| | 2 | 0.0831 | 0.004 | 2.55 | -0.005 | -1.09 | 1.303 | 1.27 | 0 | 0.09 | -0.039 | -1.99 |
| Philippines | 1 | -0.0124 | 0.016 | 0.55 | 0.057 | 0.69 | -1.851 | -0.25 | | | 0.404 | 0.8 |
| | 2 | 0.398 | 0.034 | 1.48 | -0.029 | -0.45 | -1.784 | -0.31 | -1.033 | -6.78 | -0.325 | -0.8 |
| Singapore | 1 | -0.0306 | 0.016 | 0.72 | 0 | 0.02 | 2.31 | 0.31 | | | -0.344 | -1.75 |
| | 2 | 0.0374 | 0.014 | 0.65 | -0.002 | -0.09 | 2.056 | 0.28 | -0.571 | -2.38 | -0.326 | -1.72 |
| Thailand | 1 | 0.0265 | 0.02 | 0.3 | -0.112 | -1.2 | 1.814 | 0.12 | | | -1.077 | -1.34 |
| | 2 | 0.2306 | 0.084 | 1.42 | -0.016 | -0.19 | 0.785 | 0.06 | -0.881 | -4.3 | -0.313 | -0.43 |
| Vietnam | 1 | 0.0102 | 0.012 | 1.16 | 0 | -0.2 | 5.843 | 1.47 | | | -0.403 | -1.81 |
| | 2 | -0.0039 | 0.012 | 1.12 | 0 | -0.23 | 5.681 | 1.4 | 0.054 | 0.27 | -0.391 | -1.72 |

**Table 40. Summary of Models with Moving Average Regressors**

| Country | Specification | Adj-R Squared | 12-Month % Change M2/reserves | | 12-Month % Change Credit/GDP | | Deviation from trend (REER) | | Deviation Indicator | | Constant | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic |
| Cambodia | MA of contemporaneous + 1 lag | 0.0877 | 0.011 | 1.24 | -0.001 | -0.26 | 1.042 | 2.2 | 0.126 | 1.37 | -0.163 | -2.03 |
| | MA of contemporaneous + 2 lags | 0.0372 | 0.014 | 1.35 | -0.001 | -0.2 | 0.619 | 1.61 | 0.154 | 1.33 | -0.167 | -1.99 |
| | MA of two lags | 0.0856 | 0 | 0.01 | -0.002 | -0.42 | 2.384 | 2.67 | 0.028 | 0.3 | -0.133 | -1.66 |
| | MA of 4 lags | 0.0737 | -0.01 | -0.8 | -0.001 | -0.12 | 3.541 | 2.71 | -0.018 | -0.14 | -0.12 | -1.41 |
| China | MA of contemporaneous + 1 lag | -0.007 | 0.017 | 5.71 | 0.004 | 0.99 | -2.298 | -1.71 | 0.009 | 0.82 | -0.112 | -2.28 |
| | MA of contemporaneous + 2 lags | 0.0851 | 0.018 | 5.89 | 0.003 | 0.62 | -2.618 | -2.04 | 0.015 | 1.07 | -0.093 | -1.78 |
| | MA of two lags | 0.0041 | 0.017 | 5.5 | 0.005 | 1.13 | -1.101 | -0.77 | 0.005 | 0.41 | -0.129 | -2.56 |
| | MA of 4 lags | 0.0194 | 0.019 | 5.3 | 0.004 | 0.8 | -1.977 | -1.14 | 0.017 | 0.85 | -0.112 | -1.9 |
| Indonesia | MA of contemporaneous + 1 lag | 0.0207 | 0.082 | 1.36 | 0.143 | 2.03 | 4.598 | 0.41 | 0.332 | 0.51 | -0.651 | -0.98 |
| | MA of contemporaneous + 2 lags | -0.0008 | 0.011 | 0.17 | 0.081 | 1.08 | -7.698 | -0.73 | -0.304 | -0.36 | -0.362 | -0.53 |
| | MA of two lags | 0.0174 | 0.061 | 0.9 | 0.124 | 1.78 | 27.997 | 2.21 | -1.05 | -1.64 | -0.277 | -0.43 |
| | MA of 4 lags | -0.0221 | 0.063 | 0.71 | 0.109 | 1.32 | 20.581 | 1.27 | -0.723 | -0.7 | -0.33 | -0.47 |

**Table 40. Summary of Models with Moving Average Regressors (cont.)**

| Country | Specification | Adj-R Squared | 12-Month % Change M2/reserves | | 12-Month % Change Credit/GDP | | Deviation from trend (REER) | | Deviation Indicator | | Constant | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic |
| Korea | MA of contemporaneous + 1 lag | 0.1025 | 0.07 | 1.95 | 0.012 | 0.15 | 10.293 | 0.99 | -0.937 | -3.32 | -1.042 | -1.37 |
| | MA of contemporaneous + 2 lags | 0.0382 | 0.031 | 0.76 | 0.076 | 0.81 | -3.928 | -0.32 | -0.524 | -1.17 | -1.866 | -2.05 |
| | MA of two lags | -0.0099 | 0.033 | 0.83 | 0.122 | 1.39 | 7.862 | 0.69 | 0.103 | 0.34 | -2.183 | -2.62 |
| | MA of 4 lags | -0.0416 | -0.005 | -0.12 | 0.236 | 2.42 | 1 | 0.08 | 0.881 | 1.97 | -3.225 | -3.43 |
| Laos | MA of contemporaneous + 1 lag | 0.0361 | 0.074 | 1.2 | -0.01 | -0.38 | -0.203 | -0.08 | -0.169 | -0.87 | -0.762 | -1.08 |
| | MA of contemporaneous + 2 lags | 0.0812 | 0.09 | 1.43 | -0.012 | -0.46 | -1.051 | -0.47 | -0.219 | -0.93 | -0.926 | -1.29 |
| | MA of two lags | 0.053 | 0.094 | 1.54 | -0.015 | -0.6 | -0.043 | -0.01 | -0.225 | -1.16 | -0.97 | -1.38 |
| | MA of 4 lags | 0.0096 | 0.125 | 1.83 | -0.019 | -0.72 | -2.137 | -0.32 | -0.261 | -0.8 | -1.16 | -1.58 |
| Malaysia | MA of contemporaneous + 1 lag | 0.0454 | 0.004 | 2.48 | -0.004 | -0.97 | 1.516 | 1.41 | -0.006 | -1.08 | -0.044 | -2.27 |
| | MA of contemporaneous + 2 lags | 0.1405 | 0.003 | 1.83 | -0.001 | -0.15 | 1.433 | 1.34 | -0.01 | -1.6 | -0.053 | -2.6 |
| | MA of two lags | 0.1897 | 0.003 | 1.94 | 0 | -0.04 | 1.767 | 1.64 | -0.011 | -2.2 | -0.052 | -2.75 |
| | MA of 4 lags | 0.1312 | 0.002 | 1.31 | 0.004 | 0.61 | 1.513 | 1.23 | -0.011 | -1.5 | -0.052 | -2.49 |

**Table 40. Summary of Models with Moving Average Regressors (cont.)**

| Country | Specification | Adj-R Squared | 12-Month % Change M2/reserves | | 12-Month % Change Credit/GDP | | Deviation from trend (REER) | | Deviation Indicator | | Constant | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic |
| Philippines | MA of contemporaneous + 1 lag | 0.2398 | 0.038 | 1.44 | -0.029 | -0.38 | 1.417 | 0.2 | -1.068 | -4.7 | -0.361 | -0.77 |
| | MA of contemporaneous + 2 lags | 0.1474 | 0.025 | 0.86 | 0.002 | 0.02 | -2.385 | -0.31 | -0.967 | -3.04 | -0.15 | -0.29 |
| | MA of two lags | 0.0422 | 0.005 | 0.16 | 0.08 | 0.9 | 9.076 | 1.1 | -0.406 | -1.52 | 0.476 | 0.89 |
| | MA of 4 lags | 0.0537 | -0.038 | -1.11 | 0.181 | 1.85 | 9.04 | 1 | 0.334 | 0.93 | 1.393 | 2.27 |
| Singapore | MA of contemporaneous + 1 lag | -0.0319 | 0.004 | 0.15 | 0.008 | 0.32 | 5.838 | 0.7 | -0.276 | -0.84 | -0.355 | -1.8 |
| | MA of contemporaneous + 2 lags | -0.0328 | -0.021 | -0.74 | 0.035 | 1.17 | 9.797 | 1.19 | 0.055 | 0.13 | -0.428 | -2.2 |
| | MA of two lags | 0.079 | -0.011 | -0.47 | 0.02 | 0.79 | 0.219 | 0.03 | 0.65 | 2.05 | -0.436 | -2.29 |
| | MA of 4 lags | 0.0596 | 0.016 | 0.52 | -0.003 | -0.09 | -3.906 | -0.42 | 1.344 | 2.49 | -0.448 | -2.31 |
| Thailand | MA of contemporaneous + 1 lag | 0.1701 | 0.06 | 0.9 | -0.06 | -0.63 | 3.502 | 0.23 | -0.813 | -3.09 | -0.665 | -0.81 |
| | MA of contemporaneous + 2 lags | 0.1073 | -0.022 | -0.28 | -0.167 | -1.53 | -9.213 | -0.53 | -0.503 | -1.36 | -1.598 | -1.7 |
| | MA of two lags | 0.0324 | -0.033 | -0.47 | -0.199 | -1.96 | 3.039 | 0.19 | -0.212 | -0.76 | -1.81 | -2.06 |
| | MA of 4 lags | 0.0809 | -0.113 | -1.25 | -0.331 | -2.62 | 1.533 | 0.08 | 0.336 | 0.9 | -2.857 | -2.61 |

**Table 40. Summary of Models with Moving Average Regressors (cont.)**

| Country | Specification | Adj-R Squared | 12-Month % Change M2/reserves | | 12-Month % Change Credit/GDP | | Deviation from trend (REER) | | Deviation Indicator | | Constant | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic |
| Vietnam | MA of contemporaneous + 1 lag | -0.0429 | 0.01 | 0.89 | 0 | -0.15 | 2.277 | 0.81 | 0.052 | 0.2 | -0.315 | -1.4 |
| | MA of contemporaneous + 2 lags | -0.0374 | 0.013 | 1.19 | 0 | 0 | 0.417 | 0.29 | -0.022 | -0.07 | -0.369 | -1.56 |
| | MA of two lags | 0.0028 | 0.014 | 1.26 | 0 | 0.53 | 5.504 | 1.22 | -0.179 | -0.66 | -0.487 | -2.04 |
| | MA of 4 lags | -0.0399 | 0.018 | 1.62 | -0.001 | -0.75 | 2.077 | 0.39 | -0.041 | -0.11 | -0.37 | -1.4 |

## CHAPTER 4
## RMU FOR TRANSACTION PURPOSES IN ASEAN+3 REGION

The use of a currency basket like an RMU on commercial and financial transactions can generate economic benefits for market players.  One potential advantage of utilizing RMUs as a medium of exchange, unit of account, and store of value, would be its ability to diversify and mitigate foreign exchange risk.  In fact, there is empirical evidence showing a lower foreign exchange risk embedded in currency basket Asian bonds and this is due to the RMU's "risk diversification effects" (Shimizu and Ogawa, 2004). An RMU-based financial instrument can also be an alternative investment vehicle that could offer acceptable returns.  Also, an RMU has potential use for hedging purposes and could thereby help in lowering transaction costs (Parrenas, 2006).  Furthermore, the appropriate use and facilitation of an RMU in market transactions could help promote capital market development, reduce and eliminate the saving-investment gap, and minimize foreign exchange mismatch in the region (IIMA, 2007).  Specifically, it has been argued that adopting a more stable exchange rate regime through a currency basket could serve as a precursor for strengthening local bond markets (Eichengreen, 2006).  Similarly, our interviewees who are private sector representatives and finance professionals based in the Philippines believe that an RMU can help improve intra-regional trade in goods and services within the ASEAN+3 region, can provide a more stable macroeconomic environment through appropriate fiscal and monetary policies and exchange rate stability, and can help deepen and broaden local financial markets in the region and thereby lead to market efficiency.

Against this backdrop, there are good arguments for an RMU to be used by the private sector for commercial and financial transaction purposes in the ASEAN+3 region.  It is indeed noted that financial markets in most ASEAN+3 countries are still segmented and are not yet deep and liquid compared to its counterparts in the United States (US) and European Union (EU) (Kawai, 2007a).  For instance, local currency bond markets in ASEAN+3 are still underdeveloped and have limited linkages with each other and with the rest of the world (McCauley, 2007).  In addition, ASEAN+3 countries still lack exchange rate policy coordination and the diverse nature of its exchange rate systems may be a problem in light of ensuring regional exchange rate stability (Kawai, 2007a).

  Given the unique characteristics of ASEAN+3 , the challenge now is how to entice the private sector who are based in the region to engage in the use of RMU-based financial instruments.

### 4.1     Survey of Financial Products that can Make Use of an RMU

Many financial products that exist in the ASEAN+3 region can make use of or can be denominated in an RMU.  From interviews made by the research group of finance professionals based in the Philippines, financial products that have potential in using an RMU include bonds (e.g., sovereign bonds and corporate bonds), commodities trading, deposits, equities, derivative instruments (e.g., structured notes and "plain vanilla" financial products), import-export instruments, loans, money market instruments, and mutual funds, among other types of financial products.  However, it may not be possible for all of the above-mentioned financial products to be denominated in an RMU.  For one, it may be difficult to use an RMU for denominating stocks since all stocks listed in the ASEAN+3 stock exchanges are denominated in the local currency while an RMU is considered to be a foreign currency (IIMA, 2007).  Also, using an RMU for short-term money market instruments may not be feasible at the moment due to the lack of a settlement system that deals with RMU-denominated money market transactions (Ibid.).  RMU-denominated deposits and loans may likewise be challenging to have as there still exists a number of capital controls (i.e., foreign

exchange restrictions) in most of the ASEAN+3 countries, making it impossible to have convertibility in all local currencies in the region, except for the Hong Kong dollar, Japanese yen, and Singapore dollar.

It has been proposed that an RMU can be used in bonds and loans (IIMA, 2007). Another type of financial product that shows promise is a synthetic version of an RMU-based financial instrument, specifically, a so-called RMU-linked structured note (see AKI, 2007). A structured note is a type of derivative instrument in which interest payments or returns are based on the performance of a benchmark, such as stock market, interest rates, commodities, or foreign exchange market for investment and hedging purposes. This product can be linked to an RMU by having it denominated in one ASEAN+3 currency but its return is linked to all ASEAN+3 currencies that comprise the RMU. An investor may be induced to buy this product if he/she expects the RMU to, say, appreciate and attain a positive return on his/her investment.

Certain variants of an RMU-linked structured note can be made. One is an RMU-linked structured note that contains an embedded option. This is important for risk-averse investors who want protection from potential losses since investment can be recovered with 100% redemption rate in case a depreciation of the RMU occurs upon maturity. However, such a scheme would tend to lower the return of investors in case of an RMU appreciation as this offers a lower participation rate. In cases where investors want to ensure a minimum return on their investment, this variant of having a minimum fixed rate from investing in the structured note can also be designed. The tradeoff of a minimum fixed rate may be in terms of a lower participation rate. An RMU-linked structured note will also be helpful to multinational corporations (MNCs) based outside ASEAN+3 that have exposures to different ASEAN+3 currencies. In this regard, investing in an RMU-linked structure note will allow these MNCs to offset the losses that may be incurred from currency appreciation. On the other hand, ASEAN+3-based MNCs that have loan exposures outside the region (e.g., in the US or Europe) and who may be hurt from the depreciation of ASEAN+3 currencies, will tend to offset its potential losses by engaging in an RMU-linked structure note designed to ensure positive returns whenever the RMU depreciates.

## 4.2    A Note on Currency Basket Bond Proposals in Asia

At present, there is a proposal to establish a currency basket bond in Asia. The European experience in using currency basket bonds, such as ECU-denominated bonds highlight the advantages of investing in these bonds. These include the lowering of foreign exchange risk due to the diversification effects brought about by having a set of component currencies, helping facilitate "regulatory arbitrage," and offering investors excess returns through high coupons because of foreign exchange stability (Dammers and McCauley, 2006).

In line with this, a working group under the Asian Bond Markets Initiative (ABMI) completed a study entitled "The ASEAN+3 Regional Multi Currency Bond" last September 2005. The study indicates that achieving an Asian currency basket bond requires time and a high degree of financial deregulation. It proposes that a regional multi-currency bond be first initiated prior to the currency basket bond and that designing a regional multi-currency bond be done in three (3) stages: the first is to design a reverse dual currency (RDC) bonds; second is to develop collateralized bond obligation (CBO)-type bonds; and last is to create synthetic bonds.

The study likewise noted three (3) kinds of regional multi-currency bonds: the dual currency (DC) bond, the RDC bond, and the powered RDC (PRDC) bond. The DC bond calls for the interest and principal investment to be in a currency with low interest rate and for redemption to be in another currency with high

interest rate.  The use of dual currencies exposes the investor to foreign exchange risk and therefore, the coupon in DC bond is higher than in conventional bonds.  The RDC bond calls for the initial investment and redemption to be in a low-interest rate currency while the interest is made in another currency with high interest rate.  The PRDC bond powered (Hyper) RDC bond uses the same currency for initial investment, interest, and redemption, but the coupon is based on a certain formula, which is based on the exchange rate of the currency used and another currency.  The last step is to create synthetic bonds, which require the use of dual or multiple currencies in the initial investment, interest, and redemption (ABMI WGI, 2005).

The second phase of this study called for the creation of RDC bonds, followed by the establishment of regional basket currency bonds (RBCBs) prior to the creation of synthetic bonds.  For this purpose, the ABMI WG1 has tapped the Asian Development Bank (ADB) to study the feasibility of establishing RBCBs in ASEAN+3 (Miyachi, 2007).  It is argued that RBCBs can serve as an alternative investment vehicle and a source of long-term funding; expand investor base because of its appeal to domestic and foreign investors; lower foreign exchange risk for both bond issuers and investors and make return more attractive; and provide better pricing for bonds and lowers the funding cost (ADB, 2006).

Similar to the RBCBs is the Asian basket currency (ABC) bond proposal.  It is argued that the ABC bond will help bridge the gap between issuers and investors; tends to have an acceptable risk-return profile; and its principals and coupons also have a basket value based on underlying bonds, among others (Ito, 2006).  A specific ABC bond proposal calls for Asian countries to issue local currency-denominated bonds to an ABC corporation.  This ABC corporation will then issue ABC bonds that are backed up by sovereign bonds and these ABC bonds will be traded in secondary markets, such as those in Tokyo, Japan, Hong Kong, China, and Singapore (Ito, 2007).

Amidst the popularity and the potential advantages of currency basket bonds, some have conjectured that a currency basket bond for Asia may not be that feasible especially for private use.  For one, Asian currencies are normally not convertible and this may pose a problem for issuers of locally-denominated bonds to make redemption using other Asian currencies in the basket (Shinohara, 2007).  Another is that the market can develop a currency bond market even without an RMU as an accounting unit but this has yet to be materialized due to certain market or regulatory problems that impede the development of this market (Park, 2007).

### 4.3    Review of Private Sector Experience in Using Currency Baskets in Europe[8]

In the second half of the twentieth century, four (4) currency baskets were used by the private sector in Europe.  The first was the European unit of account (EUA), which was introduced right after the Second World War with its value based on a basket of seventeen (17) currencies and the price of gold.  It has been argued that this type of currency basket was complex and that it never really took off among investors.  The second was the European composite unit (EURCO), where its value was based on a weighted average of nine (9) European Economic Community (EEC) member countries.  It was short-lived in the sense that there were very few EURCO-denominated bonds issued and that these issuances were made only in the early years of the 1970s.  In the mid-1970s, the EURCO was succeeded by the private version of the Special Drawing Rights (SDRs).  The original definition of the SDRs was a basket of sixteen (16) major currencies.  This was later changed in 1981 with the basket consisting only five (5) major currencies.  However, its lack of private sector supporters and political commitment from European governments led to

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[8] This draws heavily from Dammers and McCauley (2006).

only a few SDR-denominated bond issues (around thirteen (13) based on BIS data). The last currency basket in Europe that gained the most support from the private sector, relative to the previous currency baskets, was the European Currency Unit (ECU). It was introduced in 1979 and ten years later, its value was based on the weighted average of twelve (12) European currencies. The ECU was considered to be a success since based on BIS data, there were 1,218 bond issues from the inception of the ECU from 1981 to 1997 and that in many cases, ECUs were used in loans, including home mortgages and multi-currency loans.

However, some argue that the reason why ECU became a success in terms of private use was largely due to speculative investments and restrictions accorded to the internationalization of the Deutschemark (i.e., private sector demand for ECU-denominated bonds was partly based on investor speculations on currency stability with the view that ECU-denominated bonds tend to offer excess returns than those denominated in the Deutschemark). Also, the German government's restrictions on non-residents in using the Deutschemark in denominating bonds led to a search for a proxy for this local currency paving way for the ECU.

## 4.4    Some Constraints in the Private Use of RMUs in Financial Instruments

In Asia, the cost accompanying cross-border financial transactions continue to remain high (Barclays Capital, 2005). This could likely hinder the private use of RMU-based financial products in ASEAN+3. Interviews of private sector participants by the research team indicate certain obstacles in promoting the use of an RMU for commercial and financial transaction purposes in the Philippines and for the whole ASEAN+3 region. These potential constraints discussed below.

### 4.4.1    Capital Controls

Finance professionals from the private sector in the Philippines who were interviewed believe that capital controls such as foreign exchange restrictions is the biggest impediment in forming an RMU and in enticing the private sector to use an RMU for commercial and financial transactions. For example, capital controls may discourage private investors from buying RMU-denominated bonds. In fact, results of a region-wide survey jointly conducted by Bank of Japan and Bank Negara Malaysia for the Asian Bond Market Initiative (ABMI) working group on currency transactions and settlement issues presents show that foreign exchange controls is a significant barrier to cross-border bond flows in ASEAN+3 (Takeuchi, 2005). In addition, capital controls may explain why there is lack of available hedging instruments in certain ASEAN+3 countries and thereby lowering the appetite of investors for bonds. Furthermore, the existence of such controls in ASEAN+3 largely explain why most local currencies in the region are non-convertible (with the exception of the Hong Kong dollar, Japanese yen, and Singapore dollar) which make it impossible for an RMU to serve as a "settlement currency" (IIMA, 2007).

Table 41 provides a summary of existing capital controls in each of the ASEAN+3 countries. From among the countries in the region, only Brunei Darussalam and Hong Kong (China) have no foreign exchange restrictions while Japan and Singapore have minimal restrictions on their foreign exchange and capital account transactions. On the other hand, China still has a high level of foreign exchange controls. For example, it still imposes certain limits on foreign and local currencies for import and export purposes. In other ASEAN+3 countries, such as Malaysia and the Philippines, prior authorization from or declaration to their respective government is required in order to exchange currencies beyond a certain amount.

The main reasons for imposing controls on foreign exchange and capital account transactions were to curb speculative activities in the foreign exchange market, minimize foreign exchange volatility, and reduce the likelihood of an occurrence of a currency crisis.  Although recent years witnessed increasing financial integration in the ASEAN+3 region brought about by capital account liberalization and financial deregulation, there are still a number of capital controls that make financial markets in the region segmented from the rest of the world (Kawai, 2007a).

## Table 41. Capital Controls in the ASEAN+3

| Market | Import | | Export | | Borrowing/Lending | | Hold Accounts | |
|---|---|---|---|---|---|---|---|---|
| | Local Currency | Foreign Currency | Local Currency | Foreign Currency | Residents Borrowing Overseas | Nonresidents Borrowing Locally | Residents | Nonresidents |
| Brunei Darussalam | No restrictions. | No restrictions. | No restrictions | No restrictions. | No restrictions. | No restrictions. | No restrictions. | No restrictions. |
| Cambodia | Maximum USD10,000 or its equivalent. Must be declared upon arrival. | Maximum USD10,000 or its equivalent. Must be declared upon arrival. | Maximum USD10,000 or its equivalent. Must be declared upon arrival. | Maximum USD10,000 or its equivalent. Must be declared upon arrival. | Allowed through authorised intermediaries. | Allowed through authorised intermediaries. | No restrictions. | No restrictions. |
| China | Maximum CNY20,000 for both residents and nonresidents. | Amounts exceeding USD5,000 require filing customs report. | Maximum CNY20,000. | Maximum USD10,000 or its equivalent in cash; amounts in excessallowed as traveler's check or other payment certificate. Amounts above USD5,000 require License for Carrying Foreign Currencies Abroad. | All foreign borrowings must be registered with SAFE. | Only financial institutions authorized by the People's Bank of China. | Foreign currency accounts allowed for approved domestic or foreign-funded enterprises. | Nonresidents allowed to hold both CNY and foreign currency accounts.* |
| Hong Kong | No restrictions. | No restrictions. | No restrictions. | No restrictions. | No restrictions. | No restrictions. | No restrictions. | No restrictions. |
| Indonesia | BI approval and custom declaration required in excess of IDR100 million. | No restrictions. | BI approval and custom declaration required in excess of IDR100 million. | No restrictions. | Allowed subject to reporting requirement. | No restrictions. | No restrictions. | No restrictions. |
| Japan | Reporting required above JPY1 million or its equivalent. | Reporting required above JPY1 million or its equivalent. | Reporting required above JPY1 million or its equivalent. | Reporting required above JPY1 million or its equivalent. | No restrictions. | No restrictions. | No restriction. | No restrictions. |

**Table 41. Capital Controls in the ASEAN+3 (cont.)**

| Market | Import | | Export | | Borrowing/Lending | | Hold Accounts | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Local Currency | Foreign Currency | Local Currency | Foreign Currency | Residents Borrowing Overseas | Nonresidents Borrowing Locally | Residents | Nonresidents |
| South Korea | Customs declaration required for KRW above USD10,000 or its equivalent. | BOK permission required for amounts above USD10,000. | Customs declaration required for KRW above USD10,000 or its equivalent. | Bank of Korea permission required for amounts above USD10,000. | MOFE notification required for amounts above USD50 million. | Foreign exchange banks lending KRW to nonresidents above KRW1 billion require BOK approval. | No restrictions. | Allowed subject to certain restrictions. |
| Lao PDR | BOL authorization required for amounts above LAK5 million. | Customs declaration and BOL approval are required for amounts above USD2,000 or its equivalent. | BOL authorization required for amounts above LAK5 million. | Customs declaration and BOL approval are required for amounts above USD2,000 or its equivalent. | Requires BOL approval. | Not permitted. | Foreign currency accounts held abroad require BOL approval. | No restrictions. |
| Malaysia | COFE authorization required for amounts above MYR1,000. | No restrictions. | COFE authorization required for amounts above MYR1,000. | COFE authorization required for amounts above MYR10,000. | Amounts exceeding certain limits require COFE approval. | No restrictions. | No restrictions. | Allowed through licensed banks. |
| Myanmar | Not permitted. | Nonresidents are allowed to bring up to USD2,000 or its equivalent without declaration. | Not permitted. | Allowed with specific restrictions. | Requires CBM approval. | Not permitted. | Requires CBM approval. | Requires CBM approval. |

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**Table 41. Capital Controls in the ASEAN+3 (cont.)**

| Market | Import | | Export | | Borrowing/Lending | | Hold Accounts | |
|---|---|---|---|---|---|---|---|---|
| | Local Currency | Foreign Currency | Local Currency | Foreign Currency | Residents Borrowing Overseas | Nonresidents Borrowing Locally | Residents | Nonresidents |
| Philippines | Prior authorization from BSP required for amounts above PHP10,000. | Amounts exceeding USD10,000 or its equivalent must be declared. | Prior authorization from the BSP required for amounts above PHP10,000. | Amounts exceeding USD10,000 or its equivalent must be declared. | BSP registration and/or approval required. | No restrictions. | Residents are allowed to hold foreign currency accounts locally and abroad. | Nonresidents are permitted to hold PHP and foreign currency accounts. |
| Singapore | No restrictions. | No restrictions. | No restrictions. | No restrictions. | Only allowed to maintain foreign currency account with an Asian Currency Unit (ACU)-licensed bank in Singapore. | No restrictions. | No restrictions. | Approval required for amounts above SGD5 million. |
| Thailand | No restrictions. | Conversion into THB required. | A maximum of THB500,000 is allowed when travelling to neighboring countries. | Conversion into THB required. | No restrictions. | THB borrowings limited to THB50 million.* | Allowed subject to minor conditions. | Allowed provided that funds originate abroad. |
| Vietnam | Customs declaration and SBV approval are required for amounts above VND5 million. | Customs declaration and SBV approval are required for amounts above USD3,000. | Customs declaration and SBV approval are required for amounts above VND5 million. | Customs declaration and SBV approval required for amounts above USD3,000. | Subject to SBV registration and approval. | Subject to SBV registration and approval. | SBV approval is required. | SBV approval is required. |

Source: IMF Annual Report on Exchange Arrangements and Exchange Restrictions 2004; Economist Intelligence Unit Country Reports; and information as compiled by AsianBondsOnline.

### 4.4.2 Taxation

Another potential barrier to the use of RMU-like or RMU-denominated financial products, such as RMU-denominated bonds is the different tax policies governing certain financial instruments across ASEAN+3 countries.  One of interviewees was of the opinion that the tax treatment on bonds may be stringent and that the tax treatment on bond transactions across ASEAN+3 countries differ largely.  This may be the reason why domestic and foreign investors are not that keen in investing in local bond markets.  In principle, imposing capital gains tax on bonds may limit cross-border bond transactions and at the same time may reduce arbitrage opportunities while a withholding tax on interest income tends to lower the return on the bond being held by investors (Takeuchi, 2005).  Similarly, the ABMI survey also showed taxation on bond transactions in the ASEAN+3 region as a barrier to cross-border bond investments and that investors found the different tax policies implemented by ASEAN+3 countries to be complex.

Table 42 shows the tax policies on cross-border bond transactions that are applicable in each of the ASEAN+3 countries.  Evidently, most ASEAN+3 countries still charge taxes, such as withholding tax on interest income and capital gains tax on bond transactions (e.g.,, Brunei Darussalam, Cambodia, China, Indonesia, Myanmar, Philippines, and South Korea impose withholding taxes on all types of bonds to non-residents).  In the Philippines for example, a 20% withholding tax on interest income is charged to non-residents who purchase government and corporate bonds (including commercial papers).  In South Korea, non-residents are required to pay both withholding and capital gains taxes on all types of bonds.  On the other hand, Hong Kong, Japan, Malaysia, Singapore, and Thailand charge withholding tax to non-residents who invest in certain types of bonds.  Laos is the only ASEAN+3 region that do not have withholding tax imposed upon foreign bond investors.

Majority of ASEAN+3 countries (i.e., Cambodia, China, Japan, Indonesia, Myanmar, Philippines, Singapore, South Korea, Thailand, and Vietnam) also require their residents who invest in bonds to pay withholding tax on interest income.  On the other hand, capital gains taxes imposed on residents who invest in bonds are evident in China, Indonesia, South Korea, Philippines, and Thailand.  In China, for instance, capital gains tax on all types of bonds is 20% for individual residents and 33% for corporate residents.

**Table 42. Tax Policies on Cross-Border Bond Transactions in the ASEAN+3**

| Market | Bond Type | Withholding Tax | | | Capital Gains | | Fee Income | Stamp Duty |
|---|---|---|---|---|---|---|---|---|
| | | Interest Income | | Non-interest Income | | | | |
| | | Resident | Nonresident | | Resident | Nonresident | | |
| Brunei Darussalam | All bond types | Exempt | 20% | N/A | Exempt (unless gains form part of normal trading activities) | | N/A | N/A |
| Cambodia | All bond types | Corporate: 20% Individual: 15% | Corporate: 20% Individual: 15% | N/A | N/A | | N/A | N/A |
| China, People's Rep. of | Government | Exempt from tax | N/A | N/A | Individual: 20% Corporate: 33% | Exempt from tax | N/A | None |
| | Financial Bond | Individual: 20% Corporate: 33% | Taxed at 33% subject to a 10% witholding tax | N/A | Individual: 20% Corporate: 33% | Exempt from tax | N/A | |
| | Corporate Bonds and Commercial Paper | Individual: 20% , coupon payment of corporate bonds for individual investor is subject to 20% witholding tax Corporate: 33% | Taxed at 33% subject to a 10% witholding tax | N/A | Individual: 20% Corporate: 33% | Exempt from tax | N/A | |

**Table 42. Tax Policies on Bond Transactions in the ASEAN+3 (cont.)**

| Market | Bond Type | Withholding Tax | | | Capital Gains | | Fee Income | Stamp Duty |
|---|---|---|---|---|---|---|---|---|
| | | Interest Income | | Non-interest Income | | | | |
| | | Resident | Nonresident | | Resident | Nonresident | | |
| Hong Kong, China | Exchange Fund Bills and Notes and HKD-denominated Supranational Bonds | Exempt | Exempt | N/A | No capital gains tax | Exempt from tax | N/A | 0.1% of the face value |
| | Corporate and Quasi Government Bonds | Individual and Corporation: Not taxed | Individual and Corporation: Not taxed | N/A | Individual: exempt from tax. Corporation: No Capital Gains Tax apply. Corporated business are taxed 17.5%. Unincorporated business are taxed 16% (bonds with maturities of more than 7 years, for 3 to seven years tax is reduced to 50%.) | Individual: Exempt from tax. Corporation: No Capital Gains Tax apply. Corporated business are taxed 17.5%. Unincorporated business are taxed 16% (bonds with maturities of more than 7 years, for 3 to seven years tax is reduced to 50%.) | N/A | N/A |

**Table 42. Tax Policies on Cross-Border Bond Transactions in the ASEAN+3 (cont.)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Japan | Government Bonds | Individual: Separate WHT (15% income tax + 5% local tax) Corporate: WHT (15$ income tax+ local tax); in addition, corporate tax is levied (on profits included in revenue); witholding tax can be deducted from corporate tax accdg. to the holding period. | Individual: Tax exempt (provided that non-resident tax-exempt system for JGBs interest, etc. shall be applied ). Corporate: Tax exempt (provided that non-resident tax-exempt system for JGBs interest shall be applied. | N/A | Individual: Tax-exempt (for low coupon bonds, aggregate income tax is levied on its capital gain) Corporate: Corporate tax (inclusion in revenue) | Individual: No tax Corporate: No tax | N/A | None |
| | Quasi Government Bonds, Municipal Bonds and Corporate Bonds | Individual: Separate WHT (15% income tax + 5% local tax) Corporate: WHT (15$ income tax+ local tax); in addition, corporate tax is levied (on profits included in revenue); witholding tax can be deducted from corporate tax accdg. to the holding period. | Individual: separate WHT (15% income tax) Corporate: Tax (inclusion in revenue) | N/A | Individual: Tax-exempt (for low coupon bonds, aggregate income tax is levied on its capital gain) Corporate: Corporate tax (inclusion in revenue) | Individual: No tax Corporate: No tax | | |

**Table 42. Tax Policies on Cross-Border Bond Transactions in the ASEAN+3 (cont.)**

| Market | Bond Type | Withholding Tax | | Non-interest Income | Capital Gains | | Fee Income | Stamp Duty |
|---|---|---|---|---|---|---|---|---|
| | | Interest Income | | | | | | |
| | | Resident | Nonresident | | Resident | Nonresident | | |
| Indonesia | Government Bonds | Interest on bonds coursed through SSX are subject to a final WHT of 20%. Interest from OTC are subject to a general income of 30% maximum, after a preliminary tax of 15% is deducted | 20% reducible by treaty | N/A | For interest-bearing bonds, 5-35 % depending on institution and income level | No capital gains tax. | N/A | N/A |
| | State-Owned Companies and Private Corporate Bonds | Domestic investors pay 20% witholding tax on interest income. Onshore licensed domestic banks, pension funds, charity foundations are not subject to WHT. | 20% WHT is levied on all interest income earned by foreign investors. Singapore taxpayers are not subject to withholding tax | N/A | Interest on bonds coursed through SSX is subject to a final WHT of 20%. Interest from OTC are subject to a general income of 30% maximum, after a preliminary tax of 15% is deducted | 20% tax, may vary depending on existing tax treaties between Indonesia and the investor's country of origin. | N/A | N/A |

**Table 42. Tax Policies on Cross-Border Bond Transactions in the ASEAN+3 (cont.)**

| Market | Bond Type | Withholding Tax | | Non-interest Income | Capital Gains | | Fee Income | Stamp Duty |
|---|---|---|---|---|---|---|---|---|
| | | Interest Income | | | | | | |
| | | Resident | Nonresident | | Resident | Nonresident | | |
| South Korea | All bond types | 14% withholding tax. (Combined taxes result in an effective rate of 15.4%.) | 14% withholding tax. (Combined taxes result in an effective rate of 15.4%.) | N/A | 15% withholding tax. (Combined taxes result in a 16.5% effective rate.) | 10% of gross proceeds or 25% of capital gains, whichever is lower. (Combined taxes result in an effective rate of 11% and 27.5%, respectively.) | N/A | N/A |
| Lao PDR | All bond types | Exempt | Exempt | N/A | N/A | | N/A | N/A |
| Malaysia* | Government Bonds | Exempt for some issuers | Exempt for some issuers | 15% | Exempt from tax | Exempt from tax | N/A | Exempt |
| | Corporate Bonds | | | | | | | |
| Myanmar | All bond types | Resident foreigner:15% | 20% | N/A | N/A | | N/A | N/A |
| Philippines | Government Bonds and Quasi Government Bonds | Subject to 20% final WHT. | Subject to 20% final WHT. | N/A | No Capital Gains Tax Applies | No Capital Gains Tax Applies | N/A | N/A |
| | Corporate Bonds and Commercial Papers | Subject to 20% final WHT if bonds have maturities of less than 5 years. | Subject to 20% final WHT if bonds have maturities of less than 5 years. | N/A | Subject to 20% final witholding tax if bonds have maturities of less than 5 years | Subject to 20% final witholding tax if bonds have maturities of less than 5 years | N/A | N/A |

**Table 42. Tax Policies on Cross-Border Bond Transactions in the ASEAN+3 (cont.)**

| Market | Bond Type | Withholding Tax | | Non-interest Income | Capital Gains | | Fee Income | Stamp Duty |
| | | Interest Income | | | | | | |
| | | Resident | Nonresident | | Resident | Nonresident | | |
|---|---|---|---|---|---|---|---|---|
| Singapore* | Government Securities: Bonds and Bills | Individuals are exempted from interest inomce tax. Institutions and corporations earning interest are taxed at a concessionary rate of 10%. | Nonresident investors are exempted from paying taxes on interest income. Institutions and corporations earning interest are taxed at a concessionary rate of 10%. | 15% | No capital gains tax. | No capital gains tax. | Exempt | N/A |
| | Statutory Board, Domestic Corporate Bonds, Foreign Financial Institutions and Supranational bond issues | Institutional investors are taxed at a concessionary rate of 10% | Nonresidents are exempted. | | No capital gains tax. | No capital gains tax. | | |

**Table 42. Tax Policies on Cross-Border Bond Transactions in the ASEAN+3 (cont.)**

| Market | Bond Type | Withholding Tax | | Non-interest Income | Capital Gains | | Fee Income | Stamp Duty |
| | | Interest Income | | | | | | |
| | | Resident | Nonresident | | Resident | Nonresident | | |
|---|---|---|---|---|---|---|---|---|
| Thailand | Government Bonds & Quasi Government Bonds | Individual: 15% WHT (recipients can choose to include in calculation for the purpose of personal income tax) Corporate: 1% WHT | Individual: WHT exempted Corporate: WHT exempted | N/A | Individual: 15% WHT (for zero coupon instruments, if 15% is prepaid, capital gains is tax exempt) Corporate: Liable for corporate income tax | Individual: WHT exempt Corporate: WHT exempt | N/A | N/A |
| | Corporate Bonds | Individual: 15% WHT (recipients can choose to include in calculation for the purpose of personal income tax) Corporate: Liable for corporate income tax | Individual: 15% WHT Corporate: 15% WHT | N/A | Individual: 15% WHT (for zero coupon instruments, if 15% is prepaid, capital gains is tax exempt) Corporate: 15% WHT | Individual: 15% WHT (for zero coupon instruments, if 15% is prepaid, capital gains is tax exempt) Corporate: 15% WHT | N/A | N/A |
| | Supranational Bonds | Waived | Waived | N/A | Waived | Waived | N/A | N/A |

**Table 42. Tax Policies on Cross-Border Bond Transactions in the ASEAN+3 (cont.)**

| Market | Bond Type | Withholding Tax | | Non-interest Income | Capital Gains | | Fee Income | Stamp Duty |
| | | Interest Income | | | | | | |
| | | Resident | Nonresident | | Resident | Nonresident | | |
|---|---|---|---|---|---|---|---|---|
| Thailand (cont.) | Securitized Bonds | Individual & Corporate: 15% WHT upon debenture interest payment | N/A | N/A | Waived | Waived | N/A | N/A |
| | Asian Bond Fund | N/A | Exempt | Exempt | N/A | | N/A | N/A |
| Vietnam | Government and State Owned Enterprises | Individual: Exempt; Institutions at 28% | Withholding tax of 0.1% on coupon + 0.1% of bond notional on every coupon payment date + tax of 0.1% of sale proceeds on sale of the bond/redemption proceeds at maturity | N/A | N/A | N/A | N/A | N/A |

Legend:

    N/A:    Not available or not applicable

    *   :    Market with offshore financial center or offshore currency unit.

Source:   AsianBondsonline (www.asianbondsonline.adb.org)

### 4.4.3   Market Infrastructure

Some of interviewees felt that the current market infrastructure on cross-border currency and securities transactions may be another impediment to the private use of RMU-based financial products.  One private sector representative argued that the use of an RMU will lead to "cash payment difficulties" for the ASEAN+3 countries while another laments the lack of transparency in the payment systems.  In addition, investors are highly concerned about the foreign exchange settlement risk embedded in cross-border bond trading in ASEAN+3 (Rhee and Taylor, 2007).  Such sentiment may be viewed as a sign that the market infrastructure on the settlement of payments and securities does not yet fully address such risk.

In a 2005 study conducted by the Asian Development Bank (ADB), it was found that the domestic clearing and settlement systems in the ASEAN+3 are unique to its respective host country and that these are largely made up of local participants.  Government and quasi-government bonds as well as bills and notes are traded over the counter and go through settlement systems operated by the central bank while corporate bonds are traded in local stock exchanges and settled in a central clearing and depository system operated by the exchanges.  Four (4) settlement mechanisms that are available to market participants.  These include:  local agent (investor taps a local custodian), global custodian (GC), central securities depositories (CSDs) and international CSDs (ICSDs).  Many CSDs in the region are linked with the ICSDs, such as Clearstream and Euroclear and this allowed foreign investor participation in cross-border bond transactions within the region (ADB, 2005).

At present, there is a debate on whether the existing clearing and settlement system in the ASEAN+3 should be retained or whether it is now time to establish a regional clearing and settlement system for region.  The arguments in support of the status quo is that it is a "market-based solution" and that the current local custodians (i.e., GCs, CSDs, and ICSDs) are very much capable of providing clearing and settlement services given that they are well-capitalized and regulated (Rhee and Taylor, 2007).  Also, private sector participants see no need to establish a regional clearing and settlement intermediary at this time (ADB, 2005).  On the other hand, the disadvantages of the current arrangement are that there are only a few providers of clearing and settlement services and that the ICSDs are very much focused on Europe and the US (Rhee and Taylor, 2007).  In addition, it is found that there are weak linkages among CSDs within the ASEAN+3 region and that investors who are based in the region may have concerns with the use of ICSDs for securities settlement because of the huge time zone differential between ASEAN+3 and Europe (ADB, 2005).

Various arguments have been made to push for the creation of a clearing and settlement system for the ASEAN+3.  Among these are that it will help promote capital market development in the region through lower cross-border currency and securities trading costs and encourage the use of better technology among ASEAN+3 CSDs (Chung, 2007).  Also, a regional system can help serve as an alternative channel for settlement of securities; act as a "one-stop shop" of custody services to GCs; develop the region's derivatives market; establish a more efficient infrastructure for market participants; and enhance the accessibility of local financial products to international investors (ABMI Working Group 3, 2006).  Most market participants believe that a regional clearing and settlement system will also help lower settlement risks on bond transactions and foreign exchange transactions (Rhee and Taylor, 2007).

Table 43 illustrates the existing clearing and settlement systems for bond transactions in ASEAN+3.

**Table 43. Bond Settlement Systems in ASEAN+3**

| Market | Settlement Organization for Government Bonds | Settlement Organization for Unlisted Corporate Bonds | Settlement Organization for Bonds Traded on a Stock Exchange (Government and Corporate) | Link Between Organizations | International Links Used for Settlement |
|---|---|---|---|---|---|
| China, People's Rep. of | China Government Securities Trust and Clearing Company (CDC) | CDC | China Securities Depository and Clearing Corporation (SD&C) | SD&C performs settlement of stock exchange transactions. However CDC maintains the master record for government and corporate debt (other than convertible bonds listed on an exchange) and therefore SD&C records are sub-accounts of CDC records. | CDC has one way links with HK CMU. CDC participants can settle CMU eligible securities and use the CMU links with other international organizations. |
| Hong Kong, China | Central Moneymarket Unit (CMU) of Hong Kong Monetary Authority (HKMA) | CMU (although direct counterparty settlement is also possible.) | Central Clearing and Settlement System (CCASS) which is wholly owned by Hong Kong Exchanges (HKEx). | CCASS is responsible for settlement of stock exchange transactions. However CMU maintains the master record for government bonds and therefore CCASS records are sub-accounts of CDC records for these securities. | CMU has two-way links with Euroclear, Clearstream, Austraclear (New Zealand), KSD; one-way, outward links with Austraclear (Australia); and one-way, inward links with CDC. |

**Table 43. Bond Settlement Systems in ASEAN+3 (cont.)**

| Market | Settlement Organization for Government Bonds | Settlement Organization for Unlisted Corporate Bonds | Settlement Organization for Bonds Traded on a Stock Exchange (Government and Corporate) | Link Between Organizations | International Links Used for Settlement |
|---|---|---|---|---|---|
| Indonesia | Scripless Settlement System (SSS) owned and operated by Bank Indonesia | Directly between the counterparties by re-registration at the nominated transfer agent. | Indonesia Central Securities Depository (KSEI). | KSEI is one of 10 sub-registries in the scripless securities settlement system. The other sub-registries are private sector banks. | |
| Japan | Bank of Japan-NET JGB Services owned by the Bank of Japan | Counterparties settle transactions at registrar banks using Japan Bond Settlement Network (JB Net). A book entry system will be set up in January 2006. | Bank of Japan-NET JGB Services for listed JGBs; Delivery of physical certificates for listed corporate bonds. | | |
| South Korea | Korea Securities Depository (KSD) operated by the Korea Stock Exchange (KRX). | KSD operated by KRX. | KSD operated by KRX | The same organization (KSD) is used for both types of bonds. | |
| Malaysia | Scripless Securities Trading System (SSTS). This is part of the RENTAS system owned and operated by Bank Negara Malaysia | | Malaysian Central Depository (MCD), which is owned and operated by Bursa Malaysia. | | |

**Table 43. Bond Settlement Systems in ASEAN+3 (cont.)**

| Market | Settlement Organization for Government Bonds | Settlement Organization for Unlisted Corporate Bonds | Settlement Organization for Bonds Traded on a Stock Exchange (Government and Corporate) | Link Between Organizations | International Links Used for Settlement |
|---|---|---|---|---|---|
| Philippines | Registry of Scriptless Securities (ROSS) operated by the Bureau of the Treasury, which is part of the Department of Finance. | | The Philippine Securities Settlement Corp. (PSSC) is responsible for matching, clearing and settlement, with Philippine Depository & Trust Corporation (PDTC) handling depository and custodianship of fixed-income securities and derivatives. | PDTC holds an account in ROSS for government securities being held by PDTC as a custodian or trust entity. | |
| Singapore | MAS Electronic Payment System - delivery versus payment (MEPS-SGS) operated by the Monetary Authority of Singapore (MAS). | Debt Securities Clearing and Settlement System (DCSS) operated by Stock Exchange of Singapore (SGX). | Debt Securities Clearing and Settlement System (DCSS) operated by Stock Exchange of Singapore (SGX). | | Central Depository (Pte) Ltd. has bilateral links with Japan Securities Settlement and Custody (JSCC) and unilateral links with Clearstream, DTCC (US) and Shenzhen Securities Registrar Ltd. |

**Table 43. Bond Settlement Systems in ASEAN+3 (cont.)**

| Market | Settlement Organization for Government Bonds | Settlement Organization for Unlisted Corporate Bonds | Settlement Organization for Bonds Traded on a Stock Exchange (Government and Corporate) | Link Between Organizations | International Links Used for Settlement |
|---|---|---|---|---|---|
| Thailand | The Bond Registry System and the book entry system at the Bank of Thailand (BOT), government bonds in the book entry system are settled through BAHTNET, which is operate by the BOT. | Counterparties make their own direct settlement arrangements. | The Thailand Securities Depository Co., Ltd. (TSD), a subsidiary of the Stock Exchange of Thailand (SET), facilitates the book entry system for the dealers to settle listed corporate bond. | | |

Source:   Asian Development Bank (ADB). Bond Market Settlement and Emerging Linkages in Selected ASEAN+3 Countries (June 2005) as reported in AsianBondsOnline (www.asianbondsonline.adb.org).

### 4.4.4  Limited Availability of Hedging Instruments

Another potential drawback to the private use of RMU-based financial instruments is the limited availability or limited use of hedging instruments in many ASEAN+3 countries.  As shown in Table 44, Hong Kong (China), Japan, Malaysia, Singapore, South Korea, and Thailand, are the only countries in the region that use conventional hedging tools (e.g., credit default swaps, cross currency swaps, futures, forwards, and options, interest rate swaps, and repurchase agreements).  On the other hand, only some of these hedging tools are used in China, Indonesia, Philippines, and Vietnam, while none of these are available in Brunei Darussalam, Cambodia, Lao PDR, and Myanmar.

**Table 44. Hedging Instruments in the ASEAN+3**

| Country | Hedging Instruments | | | | |
| --- | --- | --- | --- | --- | --- |
| | Futures, Forwards, and Options | Interest Rate Swaps | Repurchase Agreements | Credit Default Swaps | Cross Currency Swaps |
| Brunei | N/A | N/A | N/A | N/A | N/A |
| Cambodia | N/A | N/A | N/A | N/A | N/A |
| China | N/A | N/A | Available | N/A | Available |
| Hong Kong (China) | Available | Available | Available | Available | Available |
| Japan | Available | Available | Available | Available | Available |
| Indonesia | N/A | Available | N/A | N/A | N/A |
| Lao PDR | N/A | N/A | N/A | N/A | N/A |
| Malaysia | Available | Available | Available | Available | Available |
| Myanmar | N/A | N/A | N/A | N/A | N/A |
| Philippines | Available | Available | Available | N/A | Available |
| Singapore | Available | Available | Available | Available | Available |
| South Korea | Available | Available | Available | Available | Available |
| Thailand | Available | Available | Available | Available | Available |
| Vietnam | N/A | Available | Available | N/A | N/A |

Legend:   N/A:  Not available or not applicable.
Source:   AsianBondsOnline

It has been conjectured that ASEAN+3 countries that have the most sophisticated derivatives market tend to have the least regulatory restrictions while those with the least developed derivatives market are highly regulated (Hohensee and Lee, 2006).  Furthermore, the development of both the bond market and derivatives market is mutually reinforcing.  This implies that increasing the number of hedging instruments in the region is necessary to encourage private investors to invest in the local bond market.  This is in order to insulate investors from various risks (e.g., credit, interest rate, and foreign exchange risks) that are prevalent in bond investments.

### 4.4.5  Varied Economic and Political Structures

Many of our respondents in the private sector perceive the ASEAN+3 countries to have huge divergences in terms of economic size, trade, and macroeconomic policies, and also in their political structures and ideologies.  They assert that such disparities may make it difficult to establish an RMU for the region and

hence will not entice private sector participation. This may suggest that the perception of market participants is that the ASEAN+3 has not yet fulfill the preconditions of an "optimum currency area."

### 4.4.6    Lack of Familiarity About RMU

A private sector interviewee revealed that one possible reason why the private sector has not yet shown its full support in having a currency basket like an RMU for the ASEAN+3 region is that they may fully aware of its concept in general. Specific information, such as the formula, weights, and local component currencies of the RMU are not yet available or known to many private investors. Also, others admit that they do not yet fully understand how an RMU will help improve on their business operations.

### 4.5    Learning from the Non-Deliverable Forward (NDF) Market in ASEAN+3

The use of non-deliverable forwards (NDFs), a derivative product that is traded over the counter, in Asia can be a guide in the development of bond markets in the region (Ma et al., 2004). This can also serve as a stimulus for the private sector to use financial products such as bonds that can make use of an RMU.

The recent expansion of NDF markets in the region is largely brought about by the existence of capital controls in domestic markets. Specifically, the various restrictions on onshore foreign exchange transactions as well as the absence of local forwards markets in the region, allowed for the advent of these NDF markets. Countries in the ASEAN+3 that have an active NDF market are China, Indonesia, and South Korea, with the latter being the deepest and most liquid not just in the region but also in the world. In South Korea, onshore banks are allowed to engage in NDF transactions with other banks and other corporations without prior approval while onshore corporations in China are not allowed to participate in the country's NDF market (Hohensee and Lee, 2006).

The non-convertibility of most ASEAN+3 currencies is one of the reasons why market players participate in offshore NDF markets. It serves both as a hedging instrument against foreign exchange risk and investment tool for foreign investors to set offshore positions using local currency. The NDF market helps maintain equilibrium amidst capital controls. It has been argued that the advent of NDF markets in Asia in the last ten years or so was partly triggered by the introduction of capital controls in response to the Asian financial crisis during the late 1990s. In recent years, the Asian NDF market has been growing relatively fast and has occupied the largest chunk in the global NDF market. In particular, the NDF market in South Korea is so far the biggest in the world in terms of volume and that NDF markets in other ASEAN+3 countries such as in China have significantly expanded as well. It is noted that the major trading hubs of NDFs in ASEAN+3 are China, Japan, Singapore, and South Korea. (Ma et al., 2004) The existence of active and liquid NDF markets in ASEAN+3 is important for the development of domestic bond markets. This is because the use of NDF as a hedge for currency risk is vital for offshore bond investors.

### 4.6    Some Prerequisites and Measures to Facilitate the Private Use of RMUs

There must be government support in facilitating the private use of RMU for transaction purposes in the ASEAN+3. One way is to create an official RMU that will first be used by ASEAN+3 central banks or by regional agencies (Eichengreen, 2007). Such official action may serve as a signal to, and eventually convince, the private sector as regards the RMU's importance in market transactions. Another is to let the

ASEAN+3 governments address the impediments in cross-border financial transactions within the region; to build better business environment that is conducive for the use of RMU-based financial products; and to help market participants be more aware of the potential benefits in using RMU-based financial instruments. In line with this, the following are proposed:

## 4.6.1    Relaxation of Capital Controls

It is imperative for ASEAN+3 governments to continue efforts in liberalizing capital account and foreign exchange transactions by gradually reducing or eliminating capital controls.  This would help in making ASEAN+3 currencies convertible, which is a prerequisite for facilitating the private sector use of an RMU. Currency convertibility will help promote the importance of using an RMU and will make the creation of RMU-denominated financial products, such as bonds, deposits, and loans more likely.  The dismantling of capital controls will also fast track the development of the region's bond and derivatives markets.  It may also be worthwhile to provide an incentive of exempting RMU financial products from capital controls as this may stimulate private sector interest (Chow et al., 2007).

However, it is important not to disregard the risks associated with capital account and financial liberalization.  For example, an excessive pace of capital account liberalization tends to precipitate currency and financial crises (Eichengreen and Mussa, 1998).  In this connection, there must be proper sequencing of liberalization and that this must be complemented by developing further local financial markets and fostering financial integration in the region.  Among the reforms that must be continued to further promote financial integration are: improve corporate governance and transparency, expand investor base, establish necessary market infrastructures, apply internationally-accepted standards and practices in governing financial markets, and adopt risk-based supervision, among others (see Cowen, et al., 2006).  Overall, dismantling the impediments of cross-border capital flows must be coupled with reforms to further foster financial integration in order to help promote the use of RMUs for transaction purposes.

However, fully eliminating capital account restrictions and attaining an acceptable level of financial market development in ASEAN+3 may not be immediate and may take a long time.  In this regard, an alternative scenario is that ASEAN+3 currencies that are already convertible—Hong Kong dollar, Japanese yen, Singapore dollar—may be used as initial set of RMU composite currencies.[9]  Later, once an acceptable level of financial integration has been achieved and that currency convertibility has been fully attained, the other ASEAN+3 currencies can be included as composite currencies of the RMU.

## 4.6.2    Harmonization of Tax Policy

The tax treatment on financial products (e.g., bonds) that have potential in using an RMU must be made less complicated and conducive to the appetite of market players.  The private sector perception that such tax policy is complex due to the different tax treatments across ASEAN+3 countries must be addressed. Given this, there is a need to harmonize tax policies encompassing certain financial transactions, such as cross-border bond investments in the ASEAN+3.  Also, there may also be a case in supporting the provision of tax incentives on financial instruments that could make use of an RMU.  It is noted that in recent years, Thailand announced a withholding tax exemption on nonresidents who purchase its government bonds (ABMI WG1, 2006).  Similarly, Indonesia introduced a new set of tax incentives for local

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[9] This is also known as a "core-RMU" (IIMA, 2007).

corporate bond issuers while South Korea provided tax incentives to high-yield notes investors with one (1) to three (3) year maturities (ADB 2007). Such official action may signal to the private sector the seriousness of committing to the creation of an RMU in ASEAN+3.

### 4.6.3 Improvement of Market Infrastructure

The improvement of market infrastructure that govern cross-border financial transactions in ASEAN+3 is crucial for instilling investor confidence in the region's capital markets and also for the promotion of the private use of RMU-based financial products. In this regard, there is a need to further develop existing clearing and settlement systems in order to better facilitate cross-border payment and securities transactions. Various options of which type of system should be adopted by the region have already been proposed (e.g., establish a regional clearing and settlement system or maintain the present system). To encourage the use of RMU-based financial instruments, however, the call for establishing a regional clearing and settlement system for RMU-related transactions may be warranted. But it is equally important to note that the development of this system must take into account private sector concerns (e.g., ensuring reliable and transparent information, conforming with international standards, and reducing settlement and other related risks).

### 4.6.4 Strengthening of Regional Financial Cooperation

Establishing an RMU requires high degree of regional cooperation especially on monetary and exchange rate policies. By showing that ASEAN+3 governments are indeed serious in establishing an RMU for transaction purposes through enhancing its financial cooperation efforts, this could serve as a signal for the private sector to start considering and building a market for RMU-denominated financial instruments. For instance, it has been argued that stronger cooperation in the areas of money and finance in ASEAN+3 is a requirement for infusing more liquidity in the region's bond markets (Kanamura, 2007). Also, it is essential to enhance regional exchange rate and monetary cooperation that will ensure regional exchange rate stability (Eichengreen, 2007).

Since the Asian financial crisis in the late 1990s, various regional initiatives and cooperation efforts in the field of money and finance have been made. Among these are the Chiang Mai Initiative (CMI), the Asian Bond Market Initiative (ABMI), and the two Asian Bond Funds (ABFs). The CMI, a reserve pooling facility, was introduced in 2000 with the aim of mitigating the risks related to currency and financial crises. It covers bilateral swap arrangements amongst China, Japan, and South Korea, and between each of these 3 countries and certain ASEAN member countries (Kawai, 2007a). The ABMI was launched in December 2002 with the aim of developing the regional bond market via facilitating market access and improving market infrastructure. It now comprises of four (4) working groups: the first working group is tasked to increase the supply of local-denominated bonds and create new securitized debt instruments; the second working group is exploring options for the credit guarantee and investment mechanism; the third working group is studying ways to establish regional settlement linkage and barriers to cross-border transactions in the region; and the fourth working group is focusing on credit ratings in the region.

The first ABF (ABF 1) was launched in mid-2003 with the issuance of US dollar-denominated sovereign and quasi-sovereign bonds by eight (8) economies [i.e., China, Hong Kong (China), Indonesia, Malaysia, Philippines, Singapore, South Korea, and Thailand] of which their respective central banks are members of the Executive's Meeting of East Asia-Pacific Central Banks (EMEAP). (The other 3 member economies of EMEAP are Australia, Japan, and New Zealand.) Investors of the ABF 1 are all EMEAP central banks.

The second ABF (ABF 2) was introduced in March 2005 with local currency-denominated bonds issued by sovereign and quasi-sovereign issuers based in the eight (8) EMEAP economies. The first phase of ABF 2 required all bond investors to come from the eight (8) EMEAP central banks but its second phase opened the ABF 2 to the public through the creation of the Pan-Asian Index Bond Fund (PAIF), which is an exchange-traded fund that is listed in the Hong Kong Stock Exchange. The PAIF invests in sovereign and quasi-sovereign bonds issued by the eight (8) EMEAP member economies.

Such initiatives were deemed to be very helpful in promoting local bond markets in ASEAN+3. For example, the ABF 2 serves as an investment product that is perceived to be passively managed, efficient, and of low costs and therefore helped in widening the investor base in bonds. In addition, it has also assisted in identifying barriers to the bond market development in the region through the removal of regulatory restrictions in China, Malaysia, and Thailand, as well as the elimination of tax barriers in Malaysia and Thailand, among others (Nagai, 2007). Also, there are indications that the ABF 1 and 2, including the PAIF, have led market microstructures in the region to reach a certain degree of convergence (ADB, 2007). Hence, such regional financial cooperation efforts should be continued and enhanced in order to achieve the development of capital markets in the ASEAN+3.

Hence, regional financial cooperation must be continued and further enhanced so that financial markets in the region will deepen and broaden and will be able to meet the requirements of an RMU market.

### 4.6.5    Market Promotion

Based on our survey of finance professionals, it can be inferred that the private sector is not yet clear on the general concept and details of the RMU. There is curiosity with respect to the formula of the RMU, its weights, its component currencies, and how these elements are going to be derived. It has been highlighted by one respondent that there is a need to conduct road shows that will present the nuances of the RMU, its advantages and disadvantages, and how it will help its potential stakeholders, especially the private sector, in their operations. In this regard, more market consultations should be made in each of the ASEAN+3 countries on RMUs to familiarize the private sector with its concept and to convince them about its potential advantages. These activities must highlight the value of RMUs as an investment tool and as a hedging instrument. Also, these market consultations will help encourage active private sector partnership in the process of creating an RMU.

### 4.6.6    Macroeconomic Stability

Since there are certain doubts among market participants regarding the feasibility of establishing an RMU due to diversities in the economic and political structures of ASEAN+3 countries, it is recommended that ASEAN+3 governments must exert efforts to put in place a stable macroeconomic and political environment in the region. That is, government policies must be geared towards a common goal of attaining robust economic growth, price stability, openness in trade and investment, and more appropriate fiscal and monetary policies. In addition, labor and capital movements across borders must be more flexible. Equally important is that macroeconomic policies including exchange rate policy must be harmonized as well. There is evidence showing that macroeconomic stability helps promote the development of local debt markets in Asia (Ruivivar, 2007). Such macroeconomic environment may serve as a catalyst for the private sector to build an RMU market in the ASEAN+3 region.

## 4.7    Summary

This section discusses the potential use of an RMU for market transactions in the ASEAN+3 region. It enumerates certain financial products that exist in most ASEAN+3 countries that could possibly be denominated or linked with an RMU. It highlighted the synthetic form of selected financial products such as a structured note or a currency basket bond as the most feasible type of financial instrument that can make use of an RMU. RMU-linked structured notes may be traded in an NDF market based in certain ASEAN+3 countries. In introducing an RMU bond to the private sector in the region, it may be worthwhile to learn from the lessons of Europe in its use of currency basket bonds (e.g., ECU bonds).

During interviews of private sector participants and finance professionals based in the Philippines, the perception towards an RMU is generally positive. They believe that an RMU will be helpful in boosting inter and intra-regional trade via lowering of transaction costs; mitigate foreign exchange risk in cross-border financial transactions; and deepen and broaden financial markets in the region, among others. However, they likewise caution about certain issues that could hamper private sector involvement in using RMU-based financial instruments. These include: capital controls; tax treatment; weak market infrastructure; limited hedging instruments; diverse economic and political structures; and lack of information about RMU.

In this regard, for ASEAN+3 to stimulate private sector interest in using RMU-based financial instruments for transaction purposes, the following are recommended: reduce or eliminate capital controls; harmonize tax policy and other related rules and regulations accorded to cross-border securities transactions; further develop market infrastructure, such as clearing and bond settlements; continue and enhance regional financial cooperation; pursue macroeconomic stability; and render more market promotions and consultations with private sector participants about the characteristics of an RMU.

# CHAPTER 5
## Conclusion and Recommendations

Two factors stand out as key drivers of Asian policymakers' preoccupation for stable exchange rates: export-led growth and the Asian currency crisis of 1997-1998. In the case of the former, an outward-oriented strategy has been the main tactic for development in the region during the past two decades with the US as the dominant destination for exports. The recent years however have been characterized by a noticeable shift from less reliance on the US export market to increased intra-regional trade (especially with Japan and China), which now comprise more than half of total regional exports. Since competitiveness of export products lies to a large extent on price and the strengthening of regional production networks, stable and appropriately valued currencies play a pivotal role in the success of this strategy, as shown for example by the Japan's manufactured exports (Chung and Eichengreen, 2007).

On the other hand, the Asian financial crisis highlighted the contagion effect of interdependent economies. Although intraregional trade shares between the affected economies at that time were relatively small, the crisis spread quickly from Thailand to Malaysia, Indonesia, the Philippines, and finally to Korea and Hong Kong, which destabilized currencies and interrupted growth in the region (Plummer and Wignaraja, 2007; Chung and Eichengreen, 2007). The combined impact of these two factors underscored the need for macroeconomic stability in the face of an increasingly integrated regional and global economy, internationalization of financial services, and the diverse liberalization of economic and financial markets in the region.

In response to this, a regional monetary unit (RMU) has been proposed as a strategy to stabilize the regional macroeconomy by stabilizing the exchange rate of Asian currencies and to encourage macroeconomic policy coordination in the region (Kawai and Takagi, n.d., as cited in Williamson, 2005) This in turn is expected to encourage trade and investment within the region, as well as reduce the vulnerability of member economies to external shocks (Venner, 2002; Boschma, n.d.; Eichengreen, 2006). Of particular interest to this research paper is the role of an RMU as a macroeconomic surveillance tool for monitoring currency movements and detecting signs of growing vulnerability to possible currency crises early on. The RMU is also meant to be denomination of financial transactions, and thereby encourage greater intra-regional financial development.

## 5.1    Summary and Conclusion

Against this background, the paper first addressed the mechanics involved in the computation of an RMU. Taking into account the diverse economic and political conditions of member countries in the ASEAN+3 region and the various permutations in the selection of component currencies in the RMU basket, for practical reasons, all 13 currencies in the ASEAN+3 were included in the currency basket for surveillance purposes based on natural selection. The inclusion of all the members of the ASEAN+3 in the RMU basket is especially important for the use of the RMU as a surveillance tool.

Base year selection was then made on the basis of yearly volatilities of the effective exchange rates using actual and average trade volume during the sample period covering 2000-2006. In both cases, 2004 emerged as the appropriate base year due to the discernible stability of most currencies during the sample period (2000-2006) [i.e., of a total of 13 currencies in the RMU basket, eight (8) currencies (e.g., Brunei

dollar, Chinese yuan, Japanese yen, Laotin kip, Myanmar kyat, Philippine peso, Singapore dollar, and Vietnamese dong] exhibited the most stable (equilibrium) conditions using average trade volume weights and seven (7) currencies using actual trade volume (e.g., Brunei dollar, Chinese yuan, Japanese yen, Myanmar kyat, Philippine peso, Singapore dollar, and Vietnamese dong).

Weights of the numeraire currency against the US dollar and the euro were then determined as a proportion of the average trade volume allocation of the ASEAN+3 countries to the US and Europe for 2004-2006, where bilateral transactions were dominated by the G3 countries (i.e., Europe, Japan, and the US). The proportional trade weight in favor of the US ($w_1$=66.11 vs. $w_2$=33.89 for Europe) reflects the traditional role of the US as the major market destination of Asian exports, as mentioned earlier, and therefore, the high degree of interdependence of ASEAN+3 economies to the US compared to Europe. Since an RMU as a surveillance indicator is designed to keep track of the movement of the ASEAN+3 currencies against an outside currency or external set of currencies, component currencies in the basket, such as the Japanese yen, were excluded in the composition of the numeraire currency, even if Japan was a major trading partner of the economies within the region during the sample period.

The next issue that was considered was the weight of each of the currencies in the RMU based on RMU the economic significance of a particular country and its contribution to regional economic activity relative to the rest of the member countries in the ASEAN+3. Some of the established economic size indicators, such as trade volume, nominal GDP, GDP measured at purchasing power parity (PPP), and international reserves less gold were utilized. Composite weights (average of the four economic size indicators) was also added to the list of economic size indicators used in the model to address the asymmetry problem in terms of particular supply side variables or the sheer dominance of China and Japan, which accounted for 53.5% and 53.1% share of GDP based on PPP and nominal GDP, respectively. This implies that the proportional weight of China or Japan exceeds the joint shares of the rest of the ASEAN+3 in any of these two economic size indicators. In fact, the combined shares of China and Japan in either GDP based on PPP or nominal GDP account for more than three-fourths of the total for the region. These exceptionally large shares of China and Japan were somewhat dampened when using the composite average of the four (4) economic size indicators, with an RMU allocation proportion of 37.8% and 35.2% for the yuan and yen, respectively. Improved symmetry on the basket weights enhances the usefulness of the RMU and its divergence indicators as an unbiased surveillance instrument and evens out the adjustment burden among currencies (Chow, et al., 2008).

From among the five (5) economic size variables used for computing the RMU, the composite allocation was found to be the best currency basket based on volatility measures (standard deviation=0.03, coefficient of variation=3.20%, average deviation=0.025) while the RMU with nominal GDP proved to be the most unstable with the highest volatility measures based on standard deviation (0.04) and coefficient of variation (3.97%) compared to the rest of the economic size variables. The resulting basket weights or the currency value per RMU ranged from 0.0016 for the Brunei dollar to 336.6036 for the Indonesian rupiah.

The next part of the paper demonstrated the use of the RMU as a divergence indicator or as a measure of fluctuations from the benchmark value in 2004. Mixed results were evident among economies in the Asean+3 region with some currencies exhibiting large deviation from the benchmark rate over the sample period, especially for the Laotian kip. Korean won, and Myanmar kyat. The Philippine peso and Indonesian rupiah likewise recorded large volatilities in the exchange rates but not in the same magnitude as the above mentioned three (3) currencies.

It is useful to note that in the case of the EU, the European Currency Unit (ECU) was suppose to function as supplemental early warning system (EWS) in the European Monetary System (EMS) to detect divergence from the average of other currencies in the basket.  A threshold of divergence was set at 75% of the maximum spread of divergence for each currency with the understanding that corrective action will be undertaken by monetary authorities once a currency goes beyond the limit.  However, the ECU-based divergence indicator was later abandoned due to technical flaws in its design and the lack of legal enforcement power, which reduced its importance as an early warning device (Institute for International Monetary Affairs, 2008).

The study also modeled the "snake" system as an indicator of currency misalignment.  The European snake was an earlier mechanism established in the 1970s to stabilize exchange rates among participating countries in Europe, prior to the introduction of the divergence indicator during the 1980s.  Under the snake system, all participating currencies in the European Economic Community (EEC) were allowed to move within a divergence band of 2.25% against its target rate with another currency, with the exception of the Italian lira, which had a wider divergence spread of 6%.

Parallel to this, exchange rate movement for each of the ASEAN+3 currencies against the US dollar was traced vis-à-vis their corresponding snake (or movement along an arbitrary 6% band).  Results of the simulation exercise showed that with the exception of the Brunei dollar, Chinese yuan, Malaysian ringgit, and Singapore dollar, which were generally within the snake, representing exchange rate stability, all other currencies in the RMU experienced periods of sustained and significant deviations from their respective snake during the sample period from 2000-2007, signaling possible currency misalignment.  Currencies with episodes above the snake, signifying pressure for depreciation, include the Indonesian rupiah (second quarter 2001, second quarter to fourth quarter 2005, and second quarter to fourth quarter 2007), Japanese yen (first quarter to second quarter 2002 and first quarter 2006 to fourth quarter 2007), Laotian kip (second quarter 2005 to fourth quarter 2007), and Myanmar kyat (fourth quarter 2005 to fourth quarter 2007).  On the other hand, currencies with appreciation pressure, as shown by certain time periods below the snake include the following:  Cambodian riel (fourth quarter 2001 to second quarter 2002), Indonesian rupiah (first to second quarter 2000), Korean won (first quarter 2004 to fourth quarter 2007), Philippine peso (first quarter 2000 to third quarter 2003 and second quarter 2006 to fourth quarter 2007), Thai baht (fourth quarter 2006 to fourth quarter 20070, and Vietnamese dong (first quarter 2000 to second quarter 2002).  When interpreted in terms of competitiveness, currencies below the snake were losing competitiveness due to currency appreciation while currencies above the snake were gaining competitiveness due to currency depreciation.

In general, countries with fixed rate regimes were within the snake, as expected, while those with significant deviations from the snake were economies with more flexible exchange rate regime or fixed exchange rate countries that have undertaken significant exchange rate adjustments, such as Laos.  This implies that overall, there may be merit in using the snake system and how each currency deviates from the snake as a tool for monitoring exchange rate alignments in the region.  Whether or not episodes outside of the band, particularly those above the snake, should give cause for alarm (i.e., actually coincide with a pre-crisis situation) will have to be tested further using other early warning mechanisms as was done in the study.

To test the deviation variable of the real exchange rate as an indicator of an impending financial crisis in the region, a quantitative model of exchange market pressure $(EMP)$ and cumulative market pressure

($cumulative\ EMP$) was developed as a proxy for currency misalignments relative to an average value during the base year utilizing three (3) crisis indicators: deviation from real effective exchange rate from trend (current account indicator); ratio of M2 to foreign reserves (capital account indicator); and ratio of domestic credit to GDP (financial indicator). Results of the analysis covering ten (10) countries (i.e., Cambodia, China, Indonesia, Korea, Laos, Malaysia, Philippines, Singapore, Thailand, and Vietnam) from January 2000 to November 2005 showed that countries in the region have different degrees of exchange market pressures.

Using the first statistical description to test for a crisis [i.e., changes in exchange rates (including lagged effects), changes in reserves (including lagged effects), and deviation indicators (including lagged effects), thresholds for spikes were different per country and ranged from a low of 0.25 for Malaysia to a high of 9.83 for Indonesia. In many cases, the adjustments were both in the exchange rate and in international reserves. Using Korea, Malaysia, the Philippines and Indonesia as illustrations, Indonesia had the highest $EMP$ values ranging from 4.9 in October 2000 to 11.6 in April 2001 during its ten (10) recorded crisis episodes; Malaysia had the lowest $EMP$ values from 0.1 in March 2002 to 0.2 in February 2002 during its six (6) crisis episodes; and the Philippines (2.5 in June 2005 to 5.0 in April 2001 with eight "crisis" episodes) and Korea (0.6 in January 2001 to 2.2 in March 2003 with 12 "crisis" episodes) were in between. In the study, a crisis is defined as an attack on a currency that leads to sharp depreciation or a large decline in reserves or a combination of both.

On the other hand, results of the second statistical description, which includes the use of $EMP$, $cumulative\ EMP$, and the deviation indicator (including changes and lagged effects) to determine crisis episodes showed that in a number of instances, the crisis periods were preceded by both rising $EMP$ and $cumulative\ EMP$ (e.g., Indonesia prior to a crisis episode during the second quarter of 2001, Laos prior to a crisis episode in the first quarter of 2001, Philippines prior to the crisis in the second quarter of 2001, and Thailand prior to a crisis episode in the second quarter of 2001), which suggests that both $EMP$ and $cumulative\ EMP$ are relatively good predictors of a crisis and using more than one $EMP$ index is likely to improve the credibility and conclusiveness of results.

However, there were also instances when rising $cumulative\ EMP$ did not lead to a crisis, as in the case of Indonesia during the second half of 2001, Laos during the second quarter to the end of 2002, and the Philippines from the first quarter to the third quarter of 2003. The observed changes in foreign exchange between crisis and non-crisis periods, particularly prior to the observed crisis months suggests that countries which reflected crisis episodes during a particular period as indicated by the model did not really experience a crisis but undertook significant changes in their foreign exchange policies or underwent sizeable changes in their international reserves.

In addition, of the four (4) thresholds used in the study (1, 1. 1.5, 1.75 and 2 standard deviations), runs using the standard deviation equal to 1 identified the most number of crisis incidence compared to the results obtained from higher thresholds. Countries with stable economic and monetary policies, such as Singapore and Korea for example recorded 10 and 11 crisis episodes, respectively. However, these crises were not actually real but represent the appreciation of the currency values vis-à-vis the US dollar. Further analysis revealed that a threshold of 2 as the standard deviation above the mean for the sample period 2000-2006, dramatically reduced the number of crisis episodes compared to a threshold of 1 and was more accurate in defining the occurrence of a crisis. In the case of Singapore, the occurrence of a crisis was reduced to only one (1) in October 2001 while none was identified for Korea. This implies that careful

scrutiny of national issues through the use of other economic or financial indicators needs to be undertaken to correct or spot any possible misalignments in currencies and to more accurately pinpoint the sources of market pressure.

Similar to the results obtained above, the results for the deviation indicators were likewise mixed. While there were instances where a crisis was preceded by declining deviation indicator, there were also instances when the declining deviation indicator did not lead to a crisis. Empirical analysis for the $EMP$ vis-à-vis the deviation indicator showed that in general, for countries with relatively flexible exchange rate, the change in deviation indicator explains part of the $EMP$. This is consistent with the general consensus in the literature, which have observed that there is no good parsimonious EWS model to rely on due primarily to lack of data for crisis probability tests for what the analytical literature highlights (e.g., indicator of financial fragility should be a significant increase in domestic credit in tandem with rising non-performing loans). This suggests that although $EMP$ and deviation indicators seem to have some promise as surveillance tools, more analysis and tests are needed. In particular, what is called for is in-depth country specific full analysis to include the likelihood of the occurrence of crisis, which was the focus of the study, as well as the extent of a crisis in terms of severity and duration.

In summary, although macroeconomic and financial surveillance mechanisms have been in place both at the global level (i.e., International Monetary Fund, Organization for Economic Cooperation and Development (OECD), G7, and G10) and at the Asia regional level[10] [Asian Development Bank (ADB), Asia-Pacific Economic Cooperation (APEC), Association of Southeast Asian Nations (ASEAN), ASEAN+3, and central bank networks [e.g., Executives' Meeting of East Asia and Pacific Central Banks (EMEAP) South East Asia, New Zealand, Australia (SEANZA)], results of the empirical analysis provide some evidence of an RMU as a helpful supplement to existing surveillance tools for improved crisis detection and prevention. In particular, the study showed that the RMU and the snake system may be useful as a tool for macro-economic consultation. With this, one can show that some countries are way far from the snake, which may merit explanation and further discussion. Nonetheless, the RMU and deviation indicator are not sufficient tools for surveillance by themselves. There were many instances of false starts for a crisis occurrence and cases where it does not provide accurate information on a crisis. It appears that $EMP$ and $cumulative\ EMP$ may be a better alternative surveillance tools, but the problem lies on the setting of an arbitrary threshold, which warrants further analysis. Although the two have some explanatory power, overall, the degree of explanatory power is small for most countries.

The paper also chose three (3) representative deviation indicators (e.g., real effective exchange rate, ratio of M2 to foreign reserves and ratio of domestic credit to GDP) in developing a parsimonious model. With and without changes in the deviation indicator, more things must be done in explaining which variables could be good indicators of a crisis. Results indicate that deviation indicators cannot be relied heavily as an effective surveillance mechanism. Similarly, parsimonious models are not effective predictors of crises. Therefore, the deviation indicator needs to be used in tandem with other economic and financial indicators in an in depth country analysis. Moreover, further studies need to be done on the dynamics of an economy and the analysis of various country specific indicators that can provide signal for early warning signals and an effective surveillance mechanism.

In terms of the use of the RMU for transactions, a major component of financial stability is the resilience of the financial system, that is to say, the ability of the financial markets and financial institutions to continue

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[10] The Manila Framework Group ceased activity in 2005.

functioning effectively in the wake of threats to and shocks in the environment in which it operates. Compared to countries in Latin America and other economies that experienced crisis episodes in the past, the general response of most East Asian economies to the currency crisis in 1997, especially among the developing countries in the region (e.g., Korea, China, and Malaysia), was the instantaneous reform of their respective financial systems. Liquidity support provided by multilateral agencies, such as the IMF and ADB, facilitated quick recovery of their financial markets. Thus, among the economies hit by the crisis, varying degrees of economic and financial reforms were undertaken, ranging from a gradual shift to more straightforward and stringent policy reform as a way to recover. In fact, the experience of Korea and China in reversing the adverse impacts of a crisis can be utilized as a model for crisis response.

One of the crucial factors affecting the resilience of the financial system is the quality of the institutional and market infrastructure. To date, this had been inadequate and is still in its infancy stage in the ASEAN+3 region. For example, while the region can be regarded as bank-based, the private sector, especially corporations, relies heavily on bank credit for their operations and long-term growth, thereby leaving capital markets underdeveloped. Turnover in the capital market is relatively low and despite its existence, most of the trading activities are heavy on bonds, most of which are government-issued. Most debt issues are likewise government bonds in both the national and international markets. The general condition in the ASEAN+3 region is in stark contrast with market and trading activities in the US and Europe, which are private-sector driven, with most issues originating from corporate and institutional investors, such as pension and mutual funds and insurance companies, among others. Given this, development of the financial infrastructure in the region will depend on the strengthening of the market infrastructure that would foster the development bond, equities and derivatives markets.

In addition, capital controls have limited the market for financial instruments and investments in the region, particularly in the money market, derivatives, and even credit-related transactions. However, even in economies in the region which have lifted restrictions on investments by residents and non-residents, as well as foreign and local investors, government and corporate issues remain small compared to other economies in the international market.

The Asian financial crisis provided valuable policy lessons for regional cooperation, particularly in relation to maintaining financial stability throughout the region. It is believed that a well-established medium-term framework for monetary and financial policy supported by a well-anchored and stable exchange rate regime is a key ingredient in facilitating economic and financial stability. One of the proposed tools for maintaining and promoting the health of the regional macroeconomy is the creation of a RMU for transactions.

Given that bonds comprise the bulk of financial market transactions in the region, it can serve as a precursor for an RMU in the future. In Europe, currency basket bonds were used as a means to reduce foreign exchange risk arising from the diversification effects provided by the component currencies in the basket, which eventually reduce the transaction costs of trading. A proposal by the Asia Bond Market Initiative (ABMI) to create a currency basket bond in Asia provides welcome news towards developing a synthetic bond market. Despite its prospects, non-convertibility of most currencies in the region and the wide differences in the market structure and regulatory underpinnings of the financial market among member countries will make it difficult to implement (Park, 2007; Shinohara, 2007).

Interviews were conducted among selected private sector representatives in the Philippines to assess acceptance and use of RMU for transaction purposes. Positive feedback was generated for its utilization, given that most financial products can be linked with the RMU. Foremost among these products are

structured notes and bonds, which are continuously growing and gaining acceptance in the market. However, respondents sounded off that difficulties may be encountered with regard to issues relating to cross-border restrictions, which are common in many countries in the region. Among those that relate to the use of RMU are capital controls and tax policies on cross-border securities transactions (e.g., withholding and capital gains tax) for both residents and non-residents. Likewise the striking differences among countries with regard to their economic, legal, and political structures, may also pose problems, as well as the lack of familiarity on the RMU.

## 5.2    Recommendations

The introduction of an RMU to stabilize the exchange rates within the ASEAN+3 region has long been discussed by officials but to this day remains in its conceptual stage. At the official level, a monetary unit at the regional level can act as a supplemental early warning device to signal an impending currency misalignment or a financial crisis by monitoring the movement of Asian currencies as a group in relation to other currencies, such as the US dollar and euro. Learning from the experience of the Asian financial crisis of the past decade, early detection of possible trouble spots is key in mitigating a crisis and controlling any tendencies towards a contagion effect. Thus, research studies, such as this provides an important venue for exploring the various issues related to the establishment of an RMU.

Any meaningful effort towards this end will have to start with addressing some technical issues related to the computation of a common currency basket as a benchmark exchange rate for the region. Some of these issues are the following:  the component currencies to include in the Asian basket, the choice of base year from which currency movements will pegged, the indicators from which weights of component currencies will be assigned, the band where currencies will be allowed to move, the threshold level from which deviations will be based, crisis dating or the minimum time period that crisis indicator levels will have to maintain before an event is considered a crisis, etc. For example, although the study utilized 2004 as the base year for analysis, member countries must come to a mutually agreeable understanding on the choice of the base year and the timing when changes in the base year will have to be undertaken since a change in the base year is likely to affect RMU trends and values. On the other hand, in terms of the divergence indicator, the simulation exercises presented above showed the wide range of deviations among the Asian currencies from their respective benchmark value in 2004 and the RMU. This implies that careful selection must be made in choosing the number with which currencies within the basket are allowed to move. A wide band has been proposed for the region by Moon et al. (2001) in the range of +/-15% around the target rate. Another option would be a tiered approach where currencies whose countries more stable can be restricted to a narrower band while currencies whose countries are volatile will be allowed to move within a wider band. Another possibility is to have a wider band in the meantime and then aim for a narrower band in the future.

In addition, although the indicators used in the model to calculate for the RMU composite is consistent with other similar models established in the literature, other variables which were not in the study, such as current account, capital account, and financial indicators (e.g., inflation rate, credit, short-term-foreign debt and total foreign debt, import-export ratios, short-term debt /reserve ratio, among others), should also be explored. Aside from the economic indicators that can be found in the balance of payment account, it is crucial for the region or the participating countries to consider the activities undertaken by financial institutions and the corporate sector, which can also provide a good indication of performance, especially in terms of financial market development, as is done by the IMF.

To do this, a combination of EWS models must be adopted for short- and long-term surveillance process, along with the choice of the inputs that can be utilized as predictors of vulnerabilities to exogenous shocks that may undermine each country's economic performance in the region. One of the constraints identified in the use of deviation indicator as crisis indicator in the current model is the short time horizon employed in the study (2000-2005) due to data constraints. Thus, it would be best if the data set will allow for longer exchange rate lags to determine inconsistencies in the model and for better assessment of observations.

In addition, Japan was among the countries excluded in the current assessment in the study due to data constraints. It is worth noting that Japan posted double-digit divergence of its exchange rate from its benchmark value. Hence, its inclusion as well as the addition of Brunei and Myanmar merits further scrutiny, if only to provide a holistic view of surveillance of the ASEAN+3 countries. This once again puts in the forefront the need for the surveillance system to take into account the disparity in the database across countries in the region and much needed commitment from each member country in generating and providing accurate, regular, and timely data as input to exchange rate surveillance. In the end, although a common basket peg will allow for the stability of the currencies among the ASEAN+3 countries compared to a stand-alone currency peg, measurement hurdles and some technicalities will have to be overcome first by consensus.

This exercise also displayed the usefulness of the RMU as a deviation indicator in identifying potentially obvious misalignments of currencies that may undermine the value of component currencies and regional currency basket. Regular monetary programming that includes a review and realignment of existing monetary and fiscal policies in countries, especially in countries with weak currencies, must be undertaken to ensure the stability of the currency basket. In fact, it renders due diligence on the part of the national leaders to respond immediately to particularly trouble spots as manifested by significant and sustained currency misalignments, by pinpointing relevant issues that cause wide divergence of their currency from their respective benchmark value.

Institutional arrangements for the RMU computation and other related issues will also have to be addressed. For example, since the Asian Development Bank (ADB) has an in-house EWS for its member countries, the issue of whether or not it should take overall responsibility over surveillance of ASEAN+3 currencies is an important point for discussion. On the one hand, ADB has a natural advantage having the needed information and infrastructure for exchange rate surveillance. However, ADB serves the interest of its member countries that comprise the larger Asian region. Thus, its surveillance function is intended to monitor the movement of Asian currencies as a whole relative to external currencies. As such, a separate institution may likewise prove useful this purpose unless some sort of mutually agreeable arrangement can be made with the Bank.

In order to put teeth to the surveillance and exchange rate stability functions of an RMU, a fund earmarked to provide substantial emergency funding assistance to crisis hit countries is encouraged (or larger amounts of currency swap agreements following the Chiang Mai Initiative. This is a revival of a similar proposal by Japan called the Asian Monetary Fund (AMF), which was intended to provide emergency funding relief to countries affected by the Asian financial crisis. Unfortunately, the proposal was not approved due to strong resistance posed by the United States (Woosik, et al., n.d.).

Finally, the political will or the readiness of financial leaders to take the necessary steps to implement the RMU is important even if it will involve the loss of some degree of political independence and monetary autonomy since adjustments may be needed to align economic, monetary, and fiscal policies towards

currency stability in the region.  After all, the success of the RMU as a surveillance instruments relies on a decentralized strategy or a bottom-up approach where countries assume the more important role of monitoring one's own backyard with the region having oversight functions.

Once all these issues have been addressed, a target date for the trial run of the RMU for surveillance can be finally set and a step closer can be made towards the realization of monetary cooperation and integration in the ASEAN+3 region through a common currency.

Although utilization of the RMU for transactions is primarily a private sector decision, the use of the RMU at the official level as a surveillance instrument can promote its acceptance as a unit of account for exchange by encouraging the establishment of an RMU-based bond market in the region (Woosik, et al., n.d.).  Unlike the RMU for regional surveillance where all member economies' currencies will be immediately included in the currency basket, given the wide disparity in the level of financial and economic development of the various member counties in the ASEAN+3 region, an RMU for financial products, such as the proposed Asian currency basket bond, comprising the 13 member countries will be virtually impossible to undertake at this point.  This implies that RMU for transactions will have to proceed in phases starting off with currencies whose respective home countries have well-developed capital markets that are virtually free from controls or restrictions in both the current and capital accounts (otherwise called "hard-core" currencies).  Among the countries that have fully liberalized or have removed capital restrictions include Korea, Japan, and Singapore.  Hence, their respective currencies can be utilized for the initial creation of the RMU.  This will ensure the smooth flow of transactions from one country to another.  Expansion of the currency basket to include other currencies in the region or admittance of other countries in the RMU arrangement will require preconditions set by national leaders, such as macroeconomic performance but will depend primarily on the country's ability to address the issue of eliminating exchange controls.

The next batch of currencies (otherwise known as "soft-core" currencies) that are likely to join the RMU fold would comprise the Malaysian ringgit, Thailand baht, China yuan, and Brunei dollar.  To date, Malaysia and Thailand have virtually liberalized their foreign exchange restrictions while China is aggressively opening up its market in the international arena.  Next in the pipeline would likely comprise currencies from the Philippines, Indonesia, and Vietnam, followed by the rest of the member counties in the region.  Once a desirable level of convergence and harmonization is reached, the creation of an RMU comprising all currencies in the basket can be achieved.

It should be noted that while the RMU is used for transactions among the initial batch of countries, economies comprising the RMU soft currencies can start discussions on how to develop and harmonize financial markets in the region, particularly the bond market.  This will require a conducive environment for issuers and investors to actively participate in financial market transactions at the national and regional levels that can be achieved through the gradual removal of regulatory and legal impediments and the development of existing market and financial infrastructure.  On a national level, officials should reassess laws relating to movement of capital across the region and address issues related to ratings agencies, accounting, auditing standards, trading, clearance, settlement of securities transactions, judicial and legal framework to allow for the harmonious development of financial markets, reduce transaction costs, and enhance the processing of trade in the region.  Countries with developed financial markets can help by extending their resources and providing other forms of assistance, possibly in the form of training and other support mechanisms, that are needed in preparing other economies with underdeveloped financial systems and financial markets in moving forward.  Sincere commitment among national leaders or government officials is critical in the successful implementation of such an arrangement.

Also, since the use of the RMU as a currency on selected transactions in the region, at least initially, is expected to reduce foreign exchange risks and lead to more stable exchange rates, each country must provide substantial liquidity to defend the regional currency from shocks through the use of international reserves, which shall serve as buffer for any crisis that may arise. Thus, as suggested earlier, countries whose currencies are included in the basket can help one another by providing liquidity support or by extending credit in times of currency misalignment or speculative attack.

On the technical side, arrangements among countries on the proposed weight or the type of common currency peg become a crucial issue. As the number of participating members increase over time, the choice of the best RMU arrangement must be refined to adapt to the uniqueness of the financial markets, especially in terms of its regulatory framework, and market infrastructure. Successful implementation of the RMU will depend on the credibility of a mutually agreed upon currency arrangement and the institutional support provided. As suggested for the use of the RMU for surveillance, it would be best if a secretariat or a currency board is tasked to monitor exchange rate movements in the region.

If successfully implemented, RMU in transactions could lead to smooth capital flow within the region, which will in turn facilitate better matching of investments and savings among market participants within member economies and likewise attract portfolio investments from outside the region. As integration intensifies as a result of the increasing number of participants in the RMU, intra-regional trade will heighten from the free movement of capital and long-term bonds, and the equity market and other derivative products will be developed as a result of lower foreign exchange risk. Likewise, the introduction of the RMU in bond transactions could facilitate the introduction and development of other RMU-denominated financial products. This will encourage the formation of larger and diverse markets, which will increase liquidity in the system and attract foreign investors than it would have been when undertaken on a solo basis by the country. More opportunities await banks and other financial institutions in exploiting economies of scale brought by this integration and will result to less vulnerability to crisis episodes. Thus, acceptance of RMU denominated private claims by market participants is quite important.

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# APPENDIX

**Figure 1: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Cambodia**
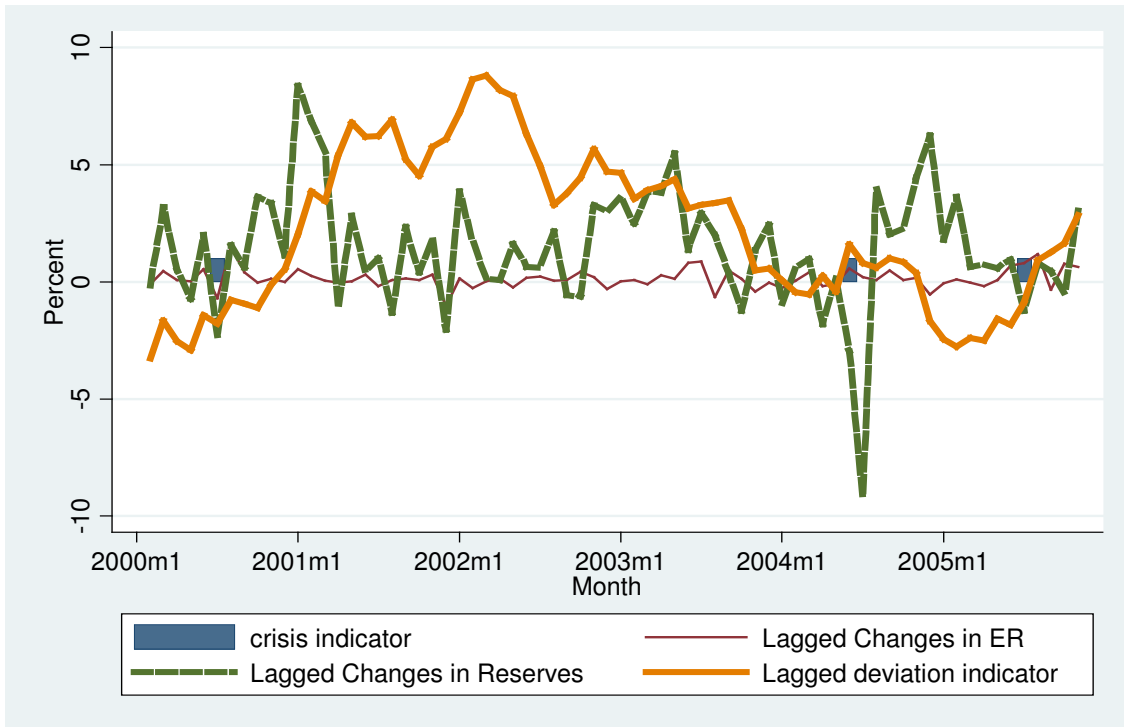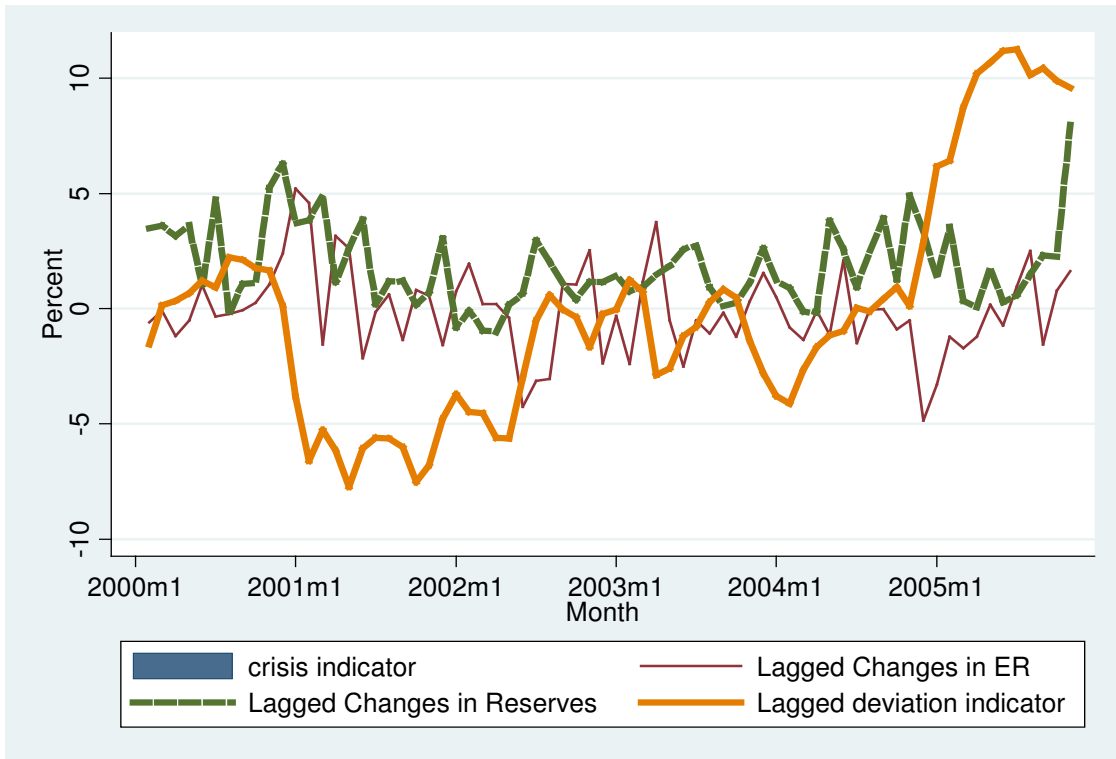


**Figure 2: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Cambodia**
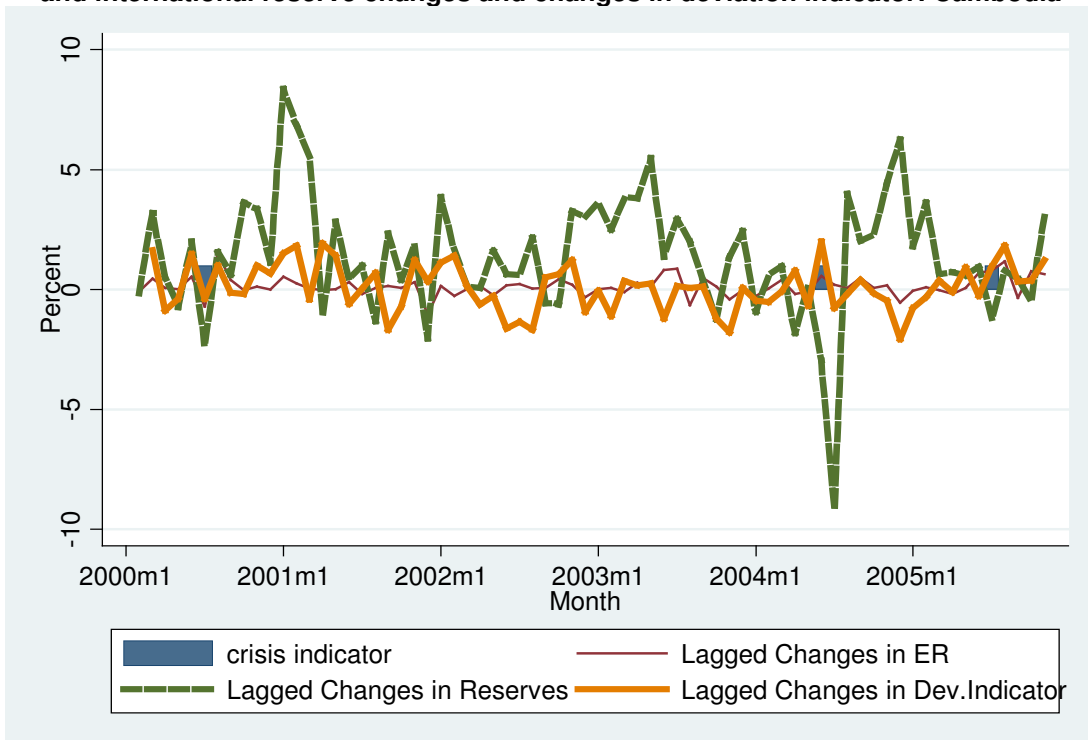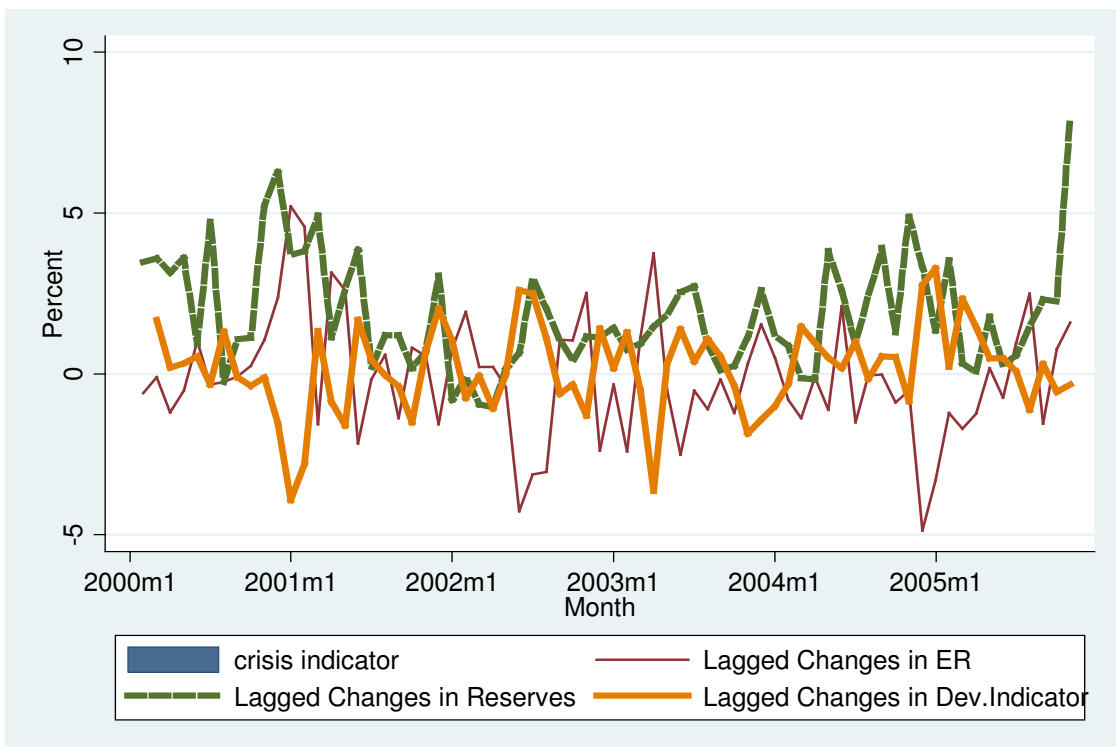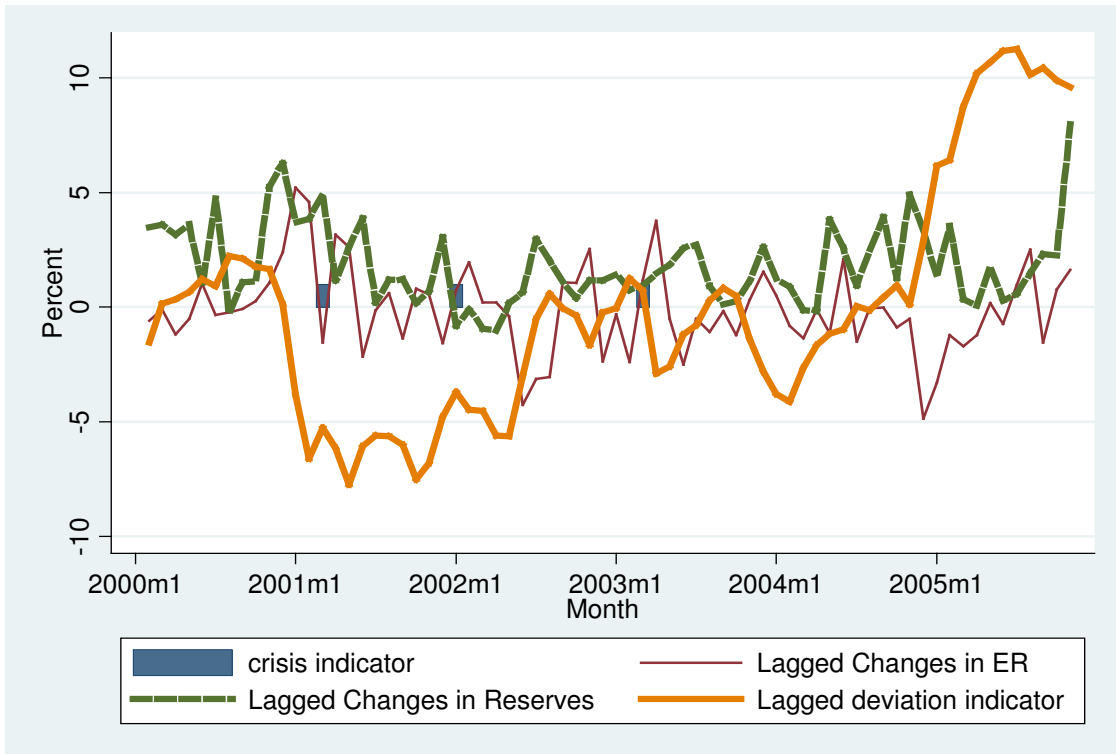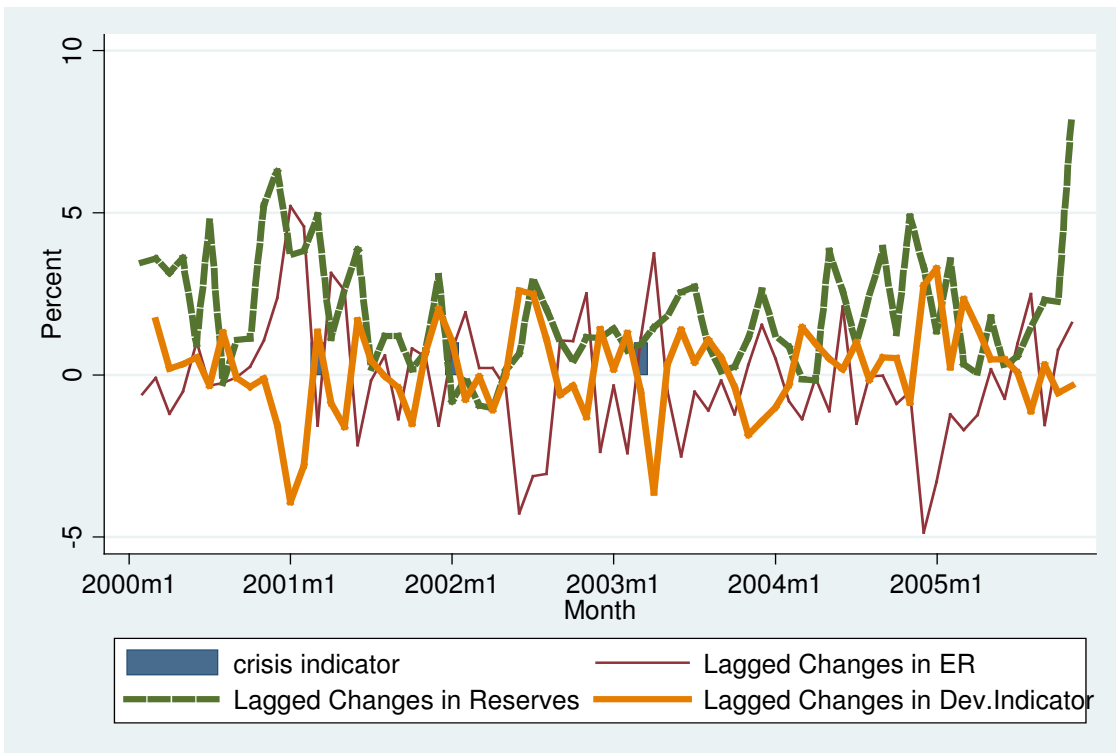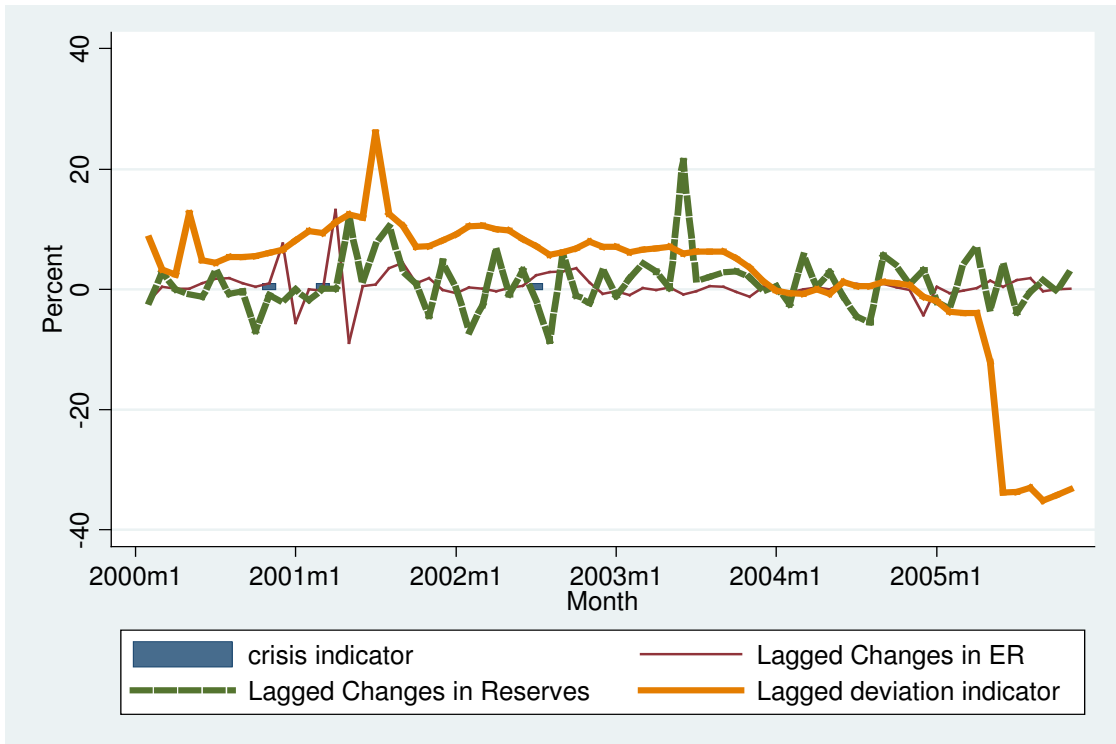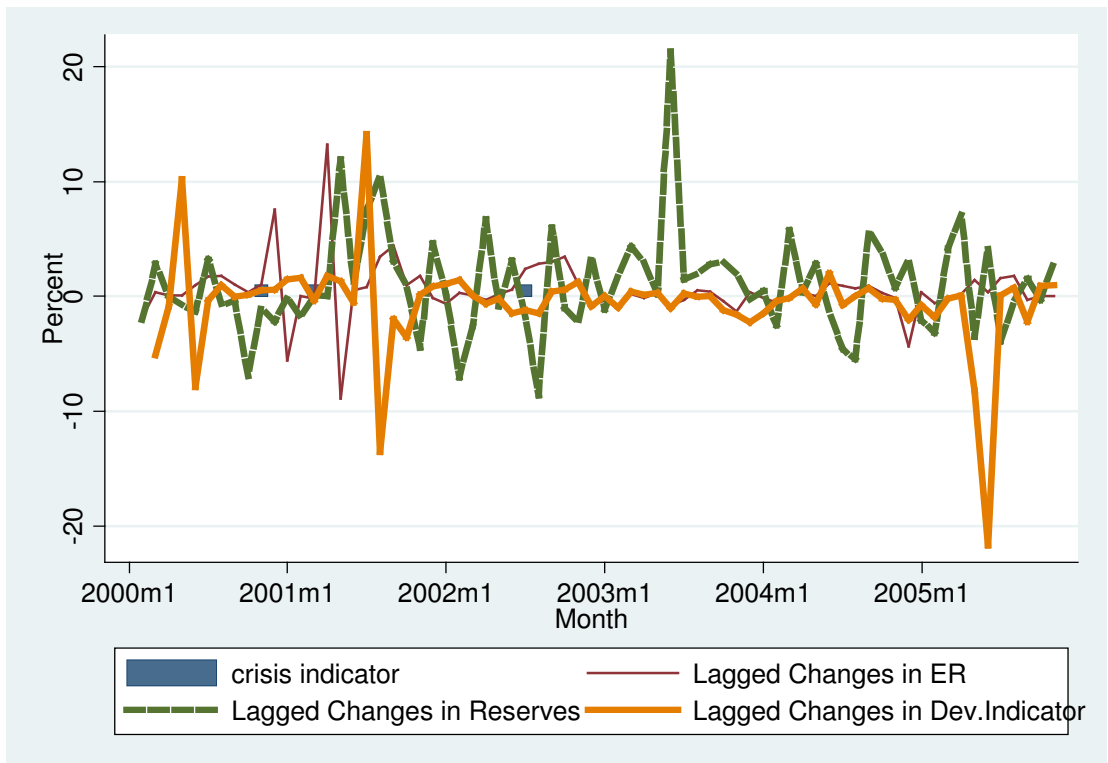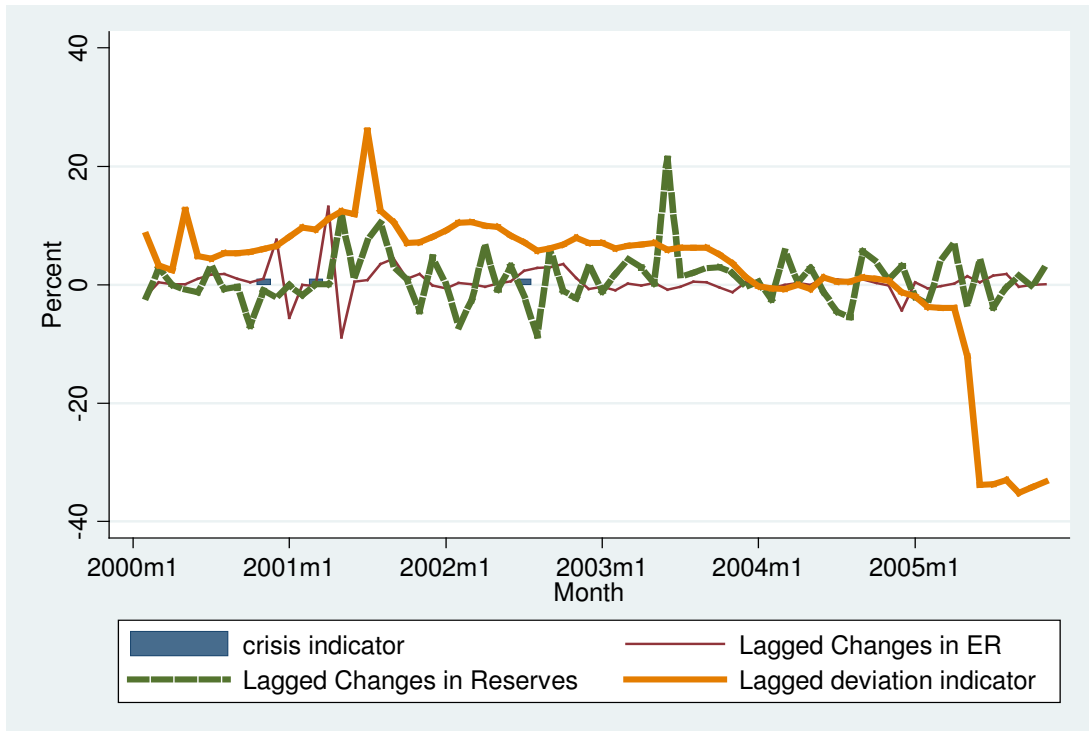
**Figure 3: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Cambodia**
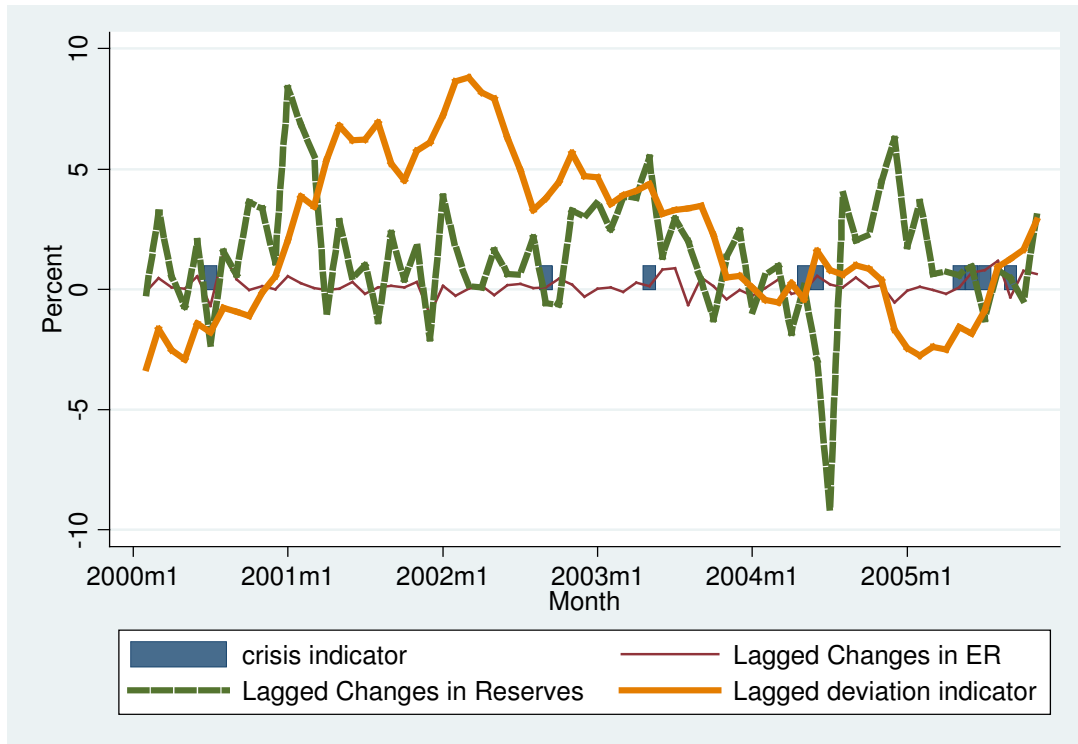


**Figure 4: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Cambodia**
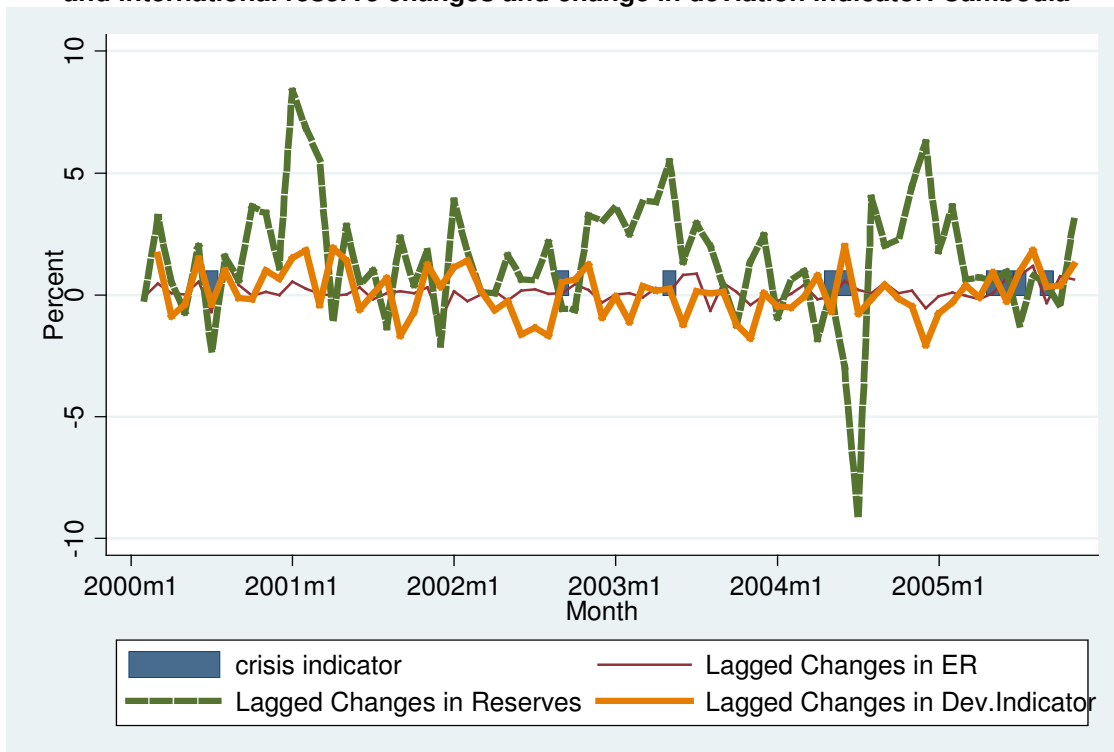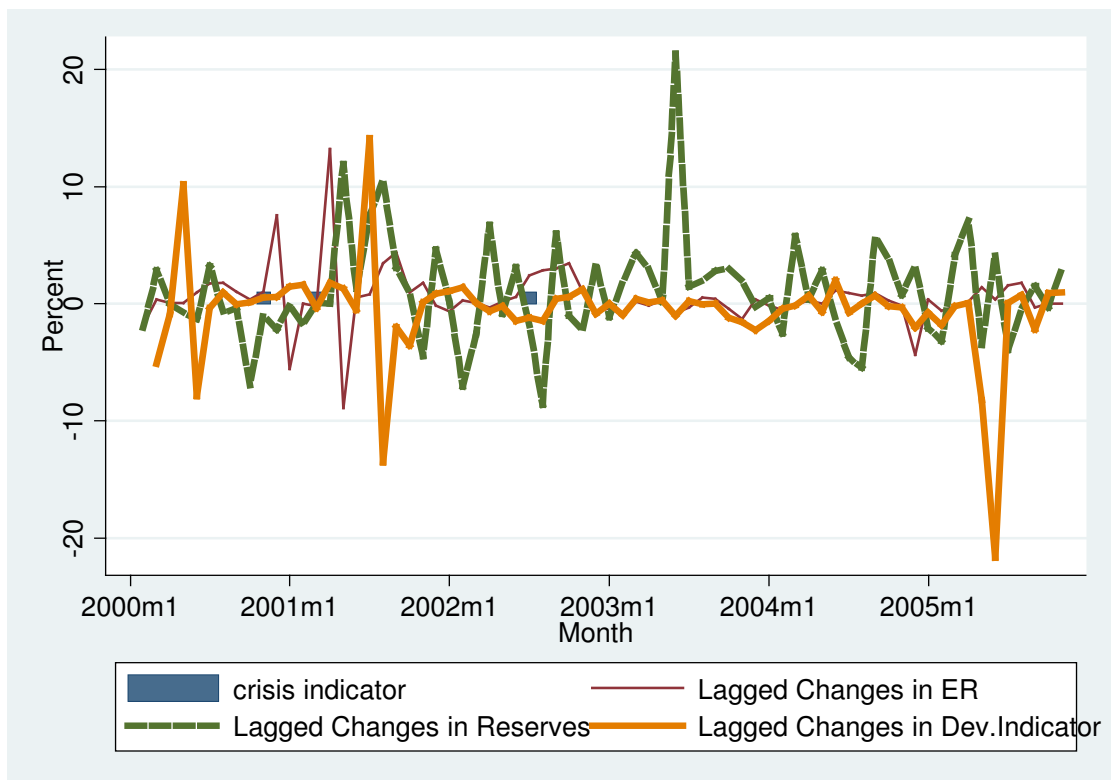
**Figure 5: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: China**
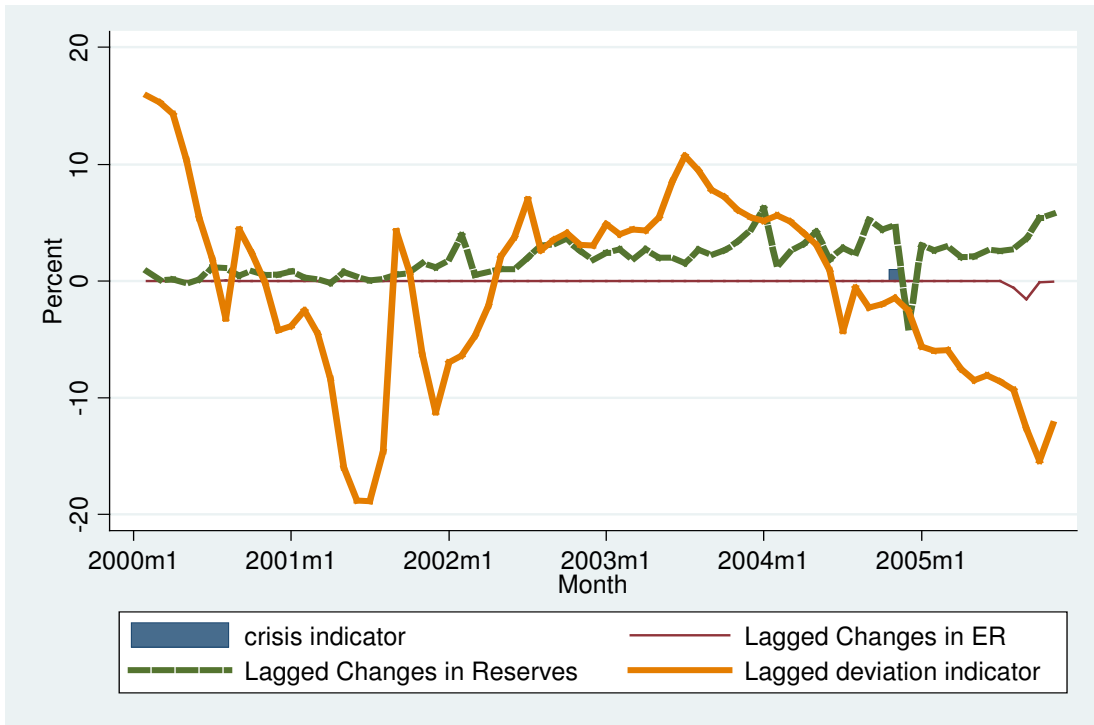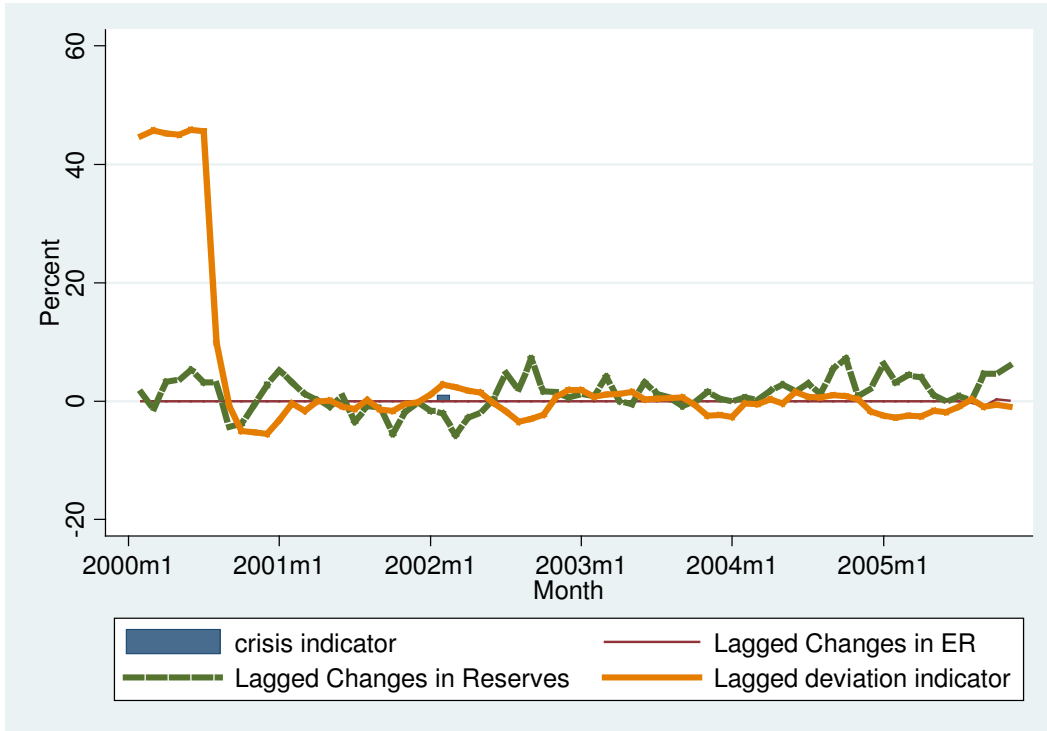


**Figure 6: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: China**
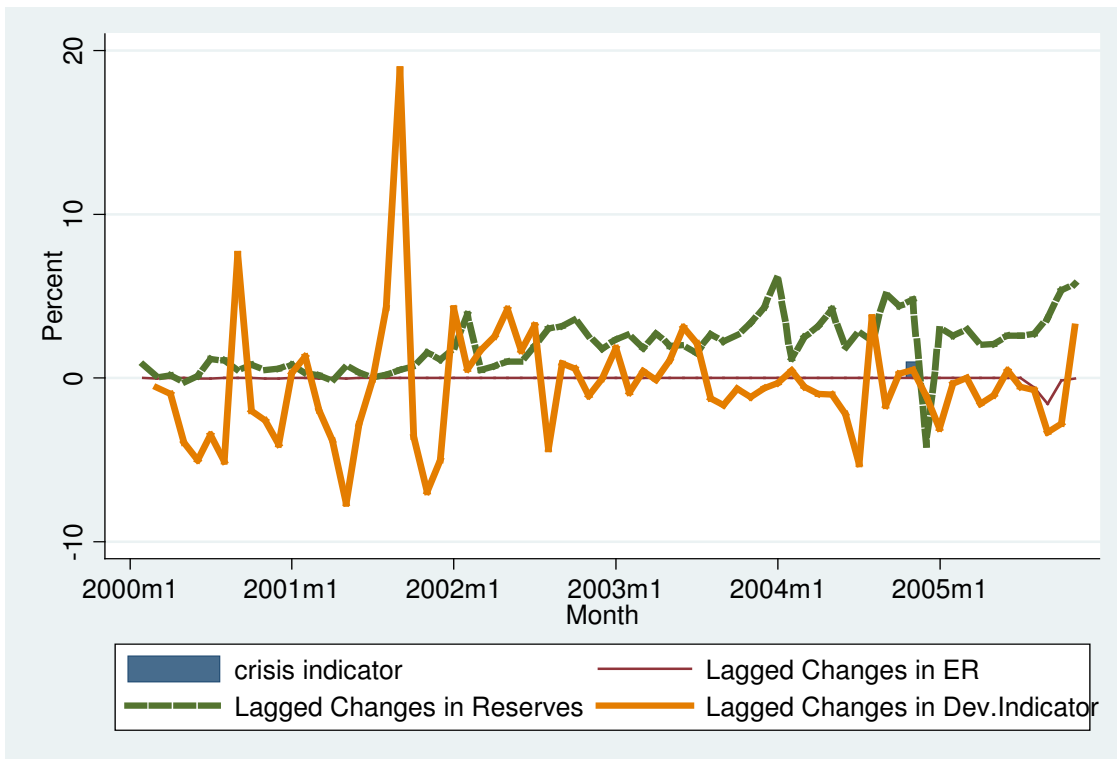
**Figure 7: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: China**
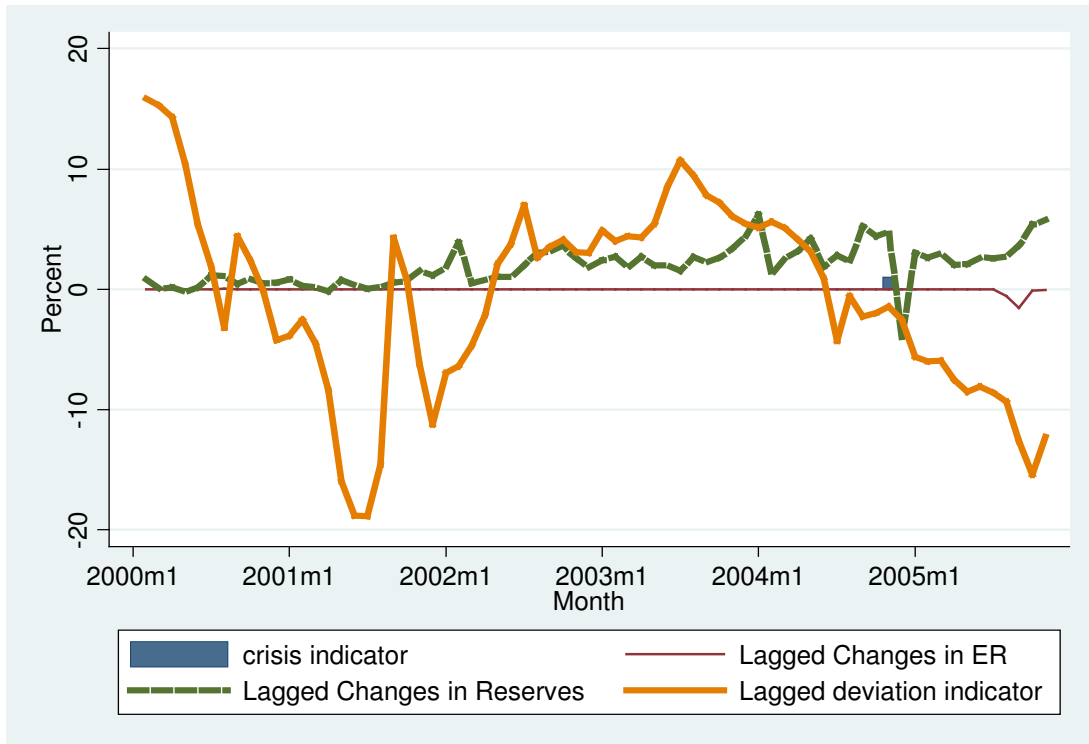


**Figure 8: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: China**
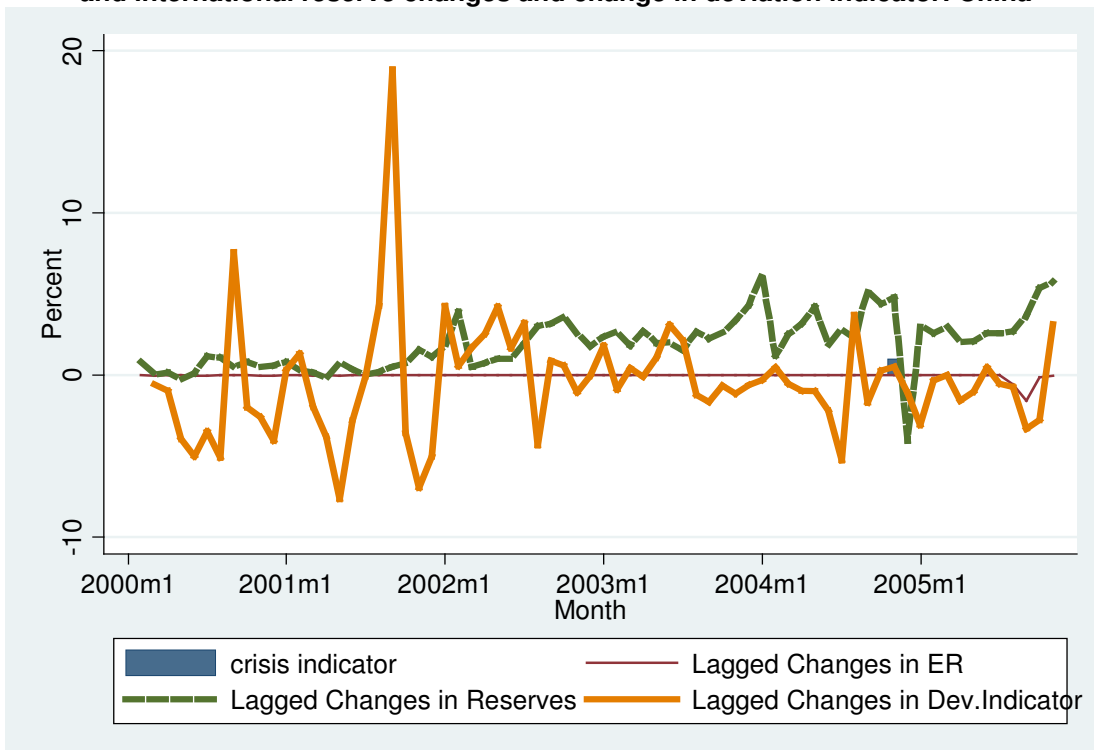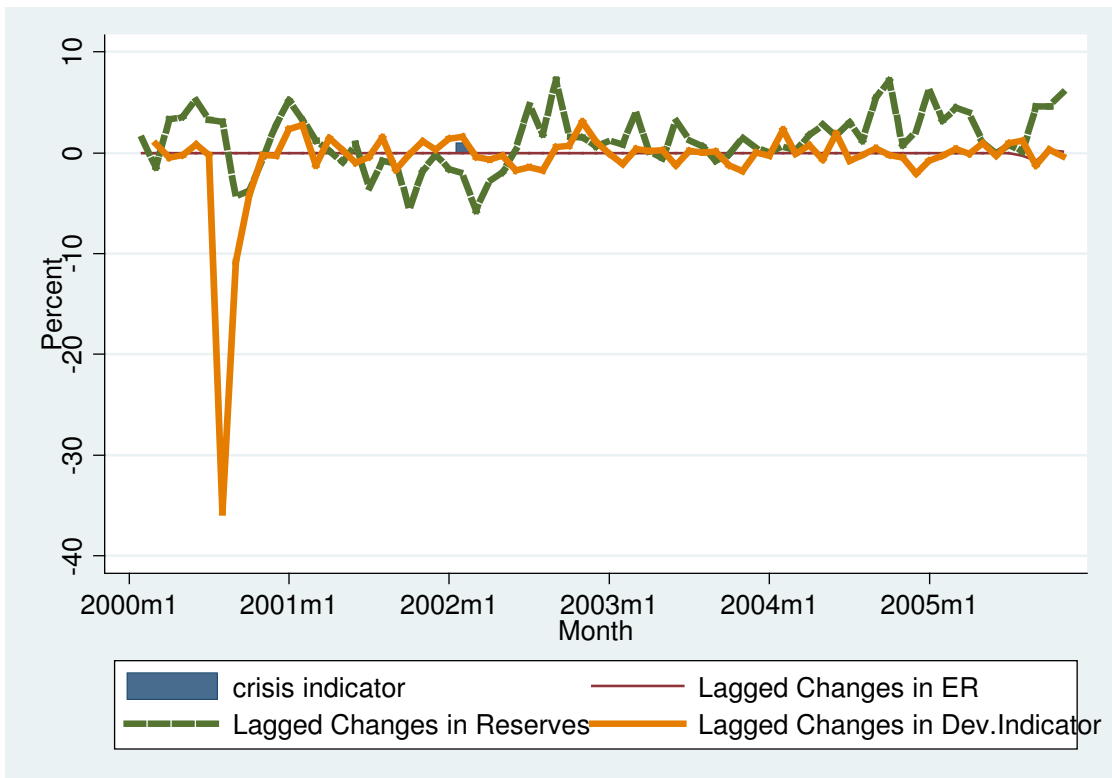
**Figure 9: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Indonesia**
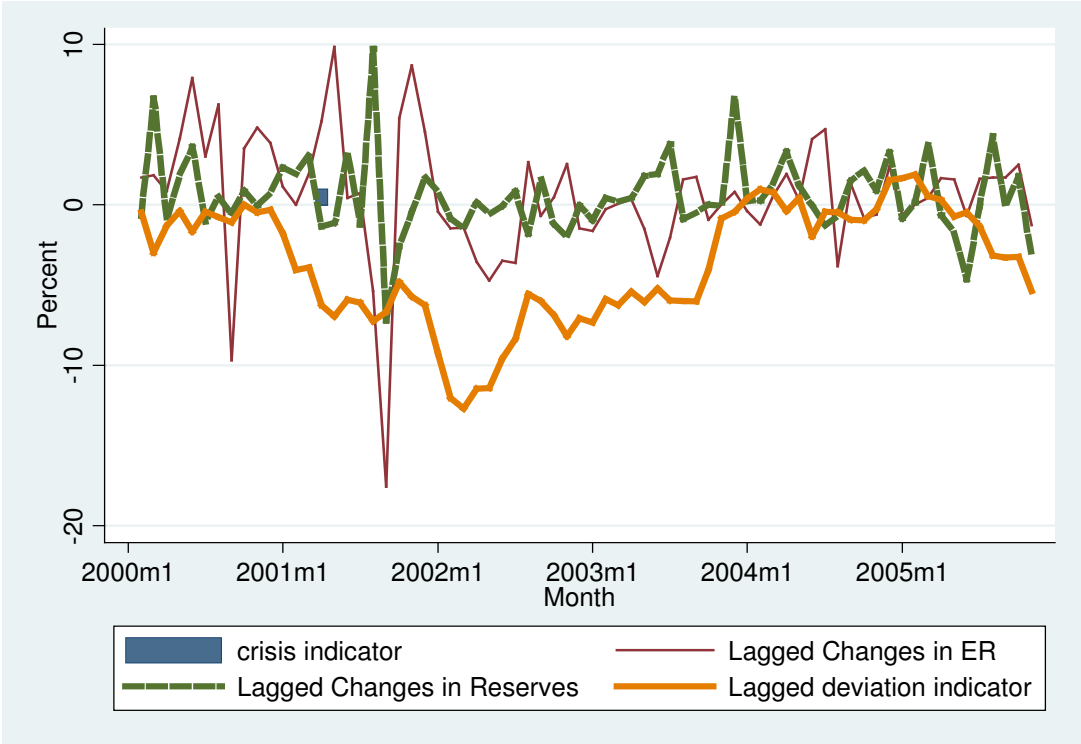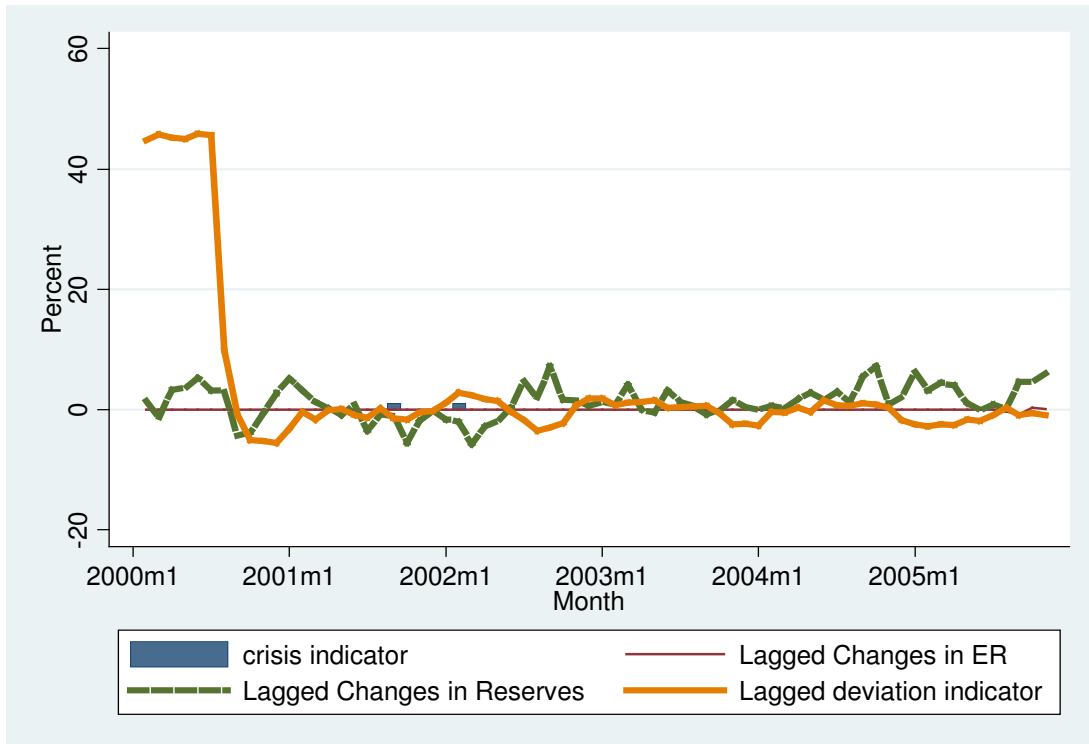


**Figure 10: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Indonesia**
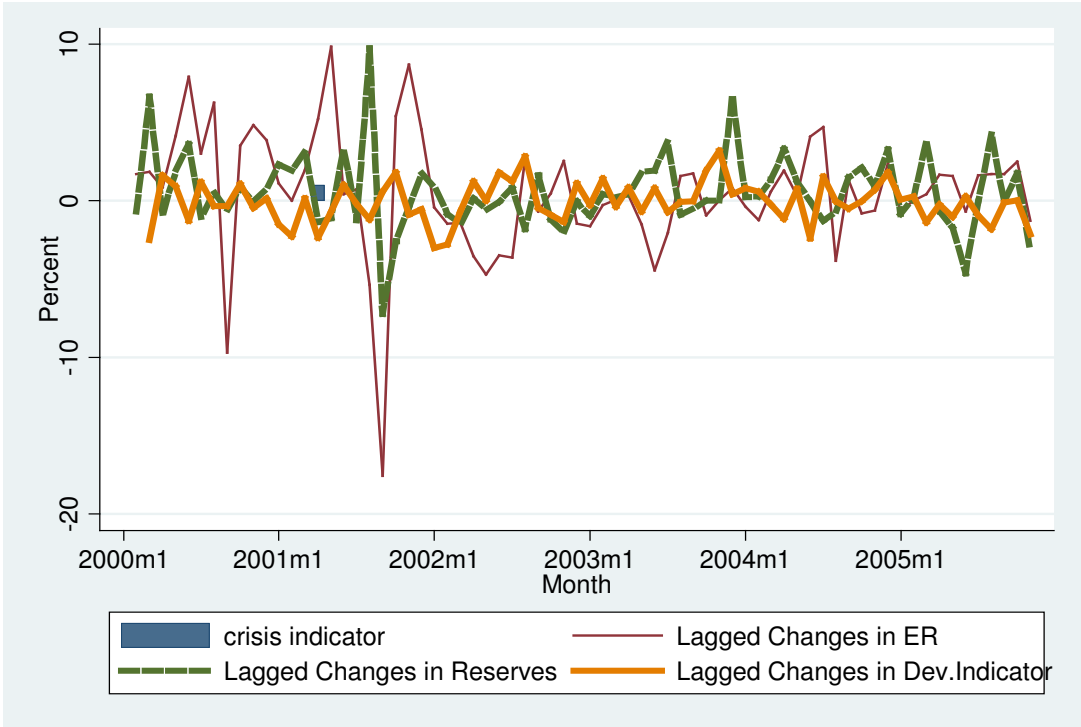
**Figure 11: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Indonesia**
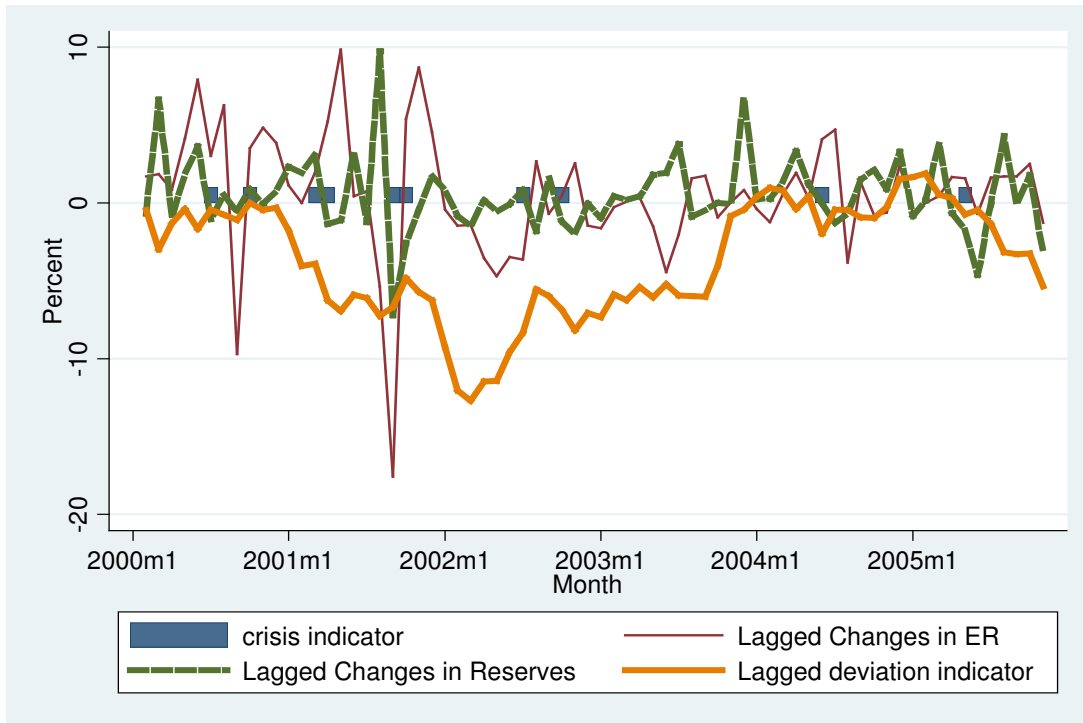


**Figure 12: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Indonesia**
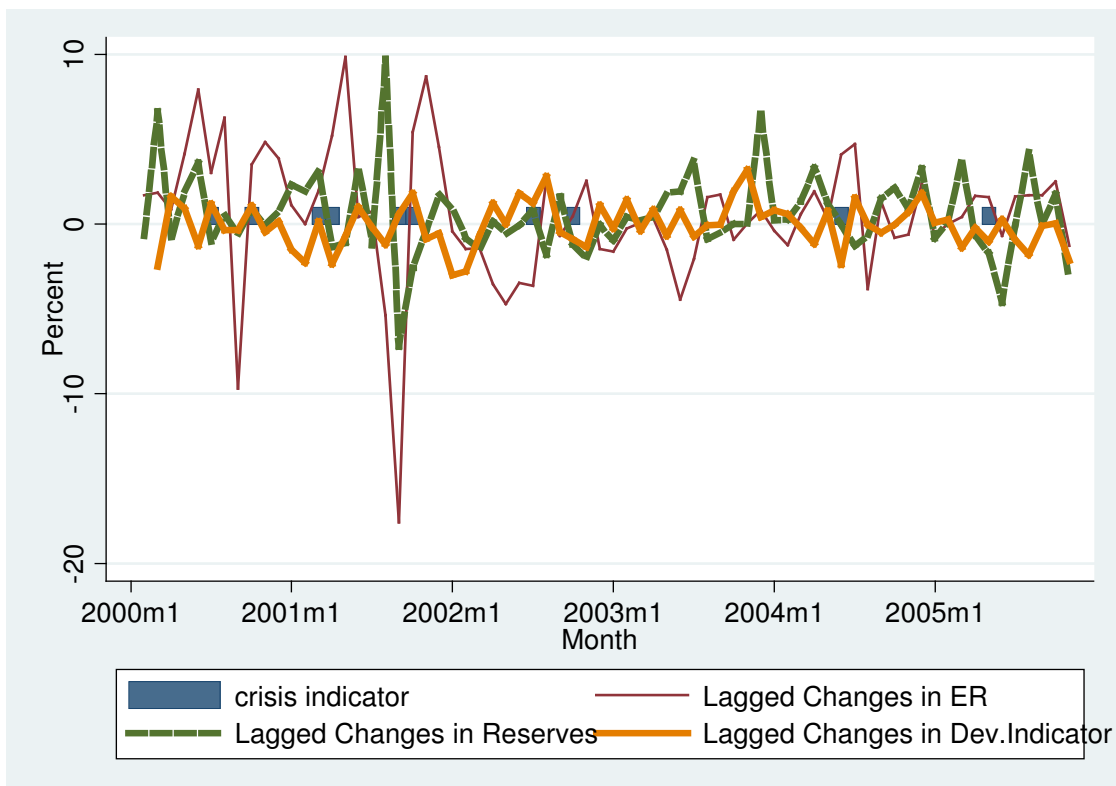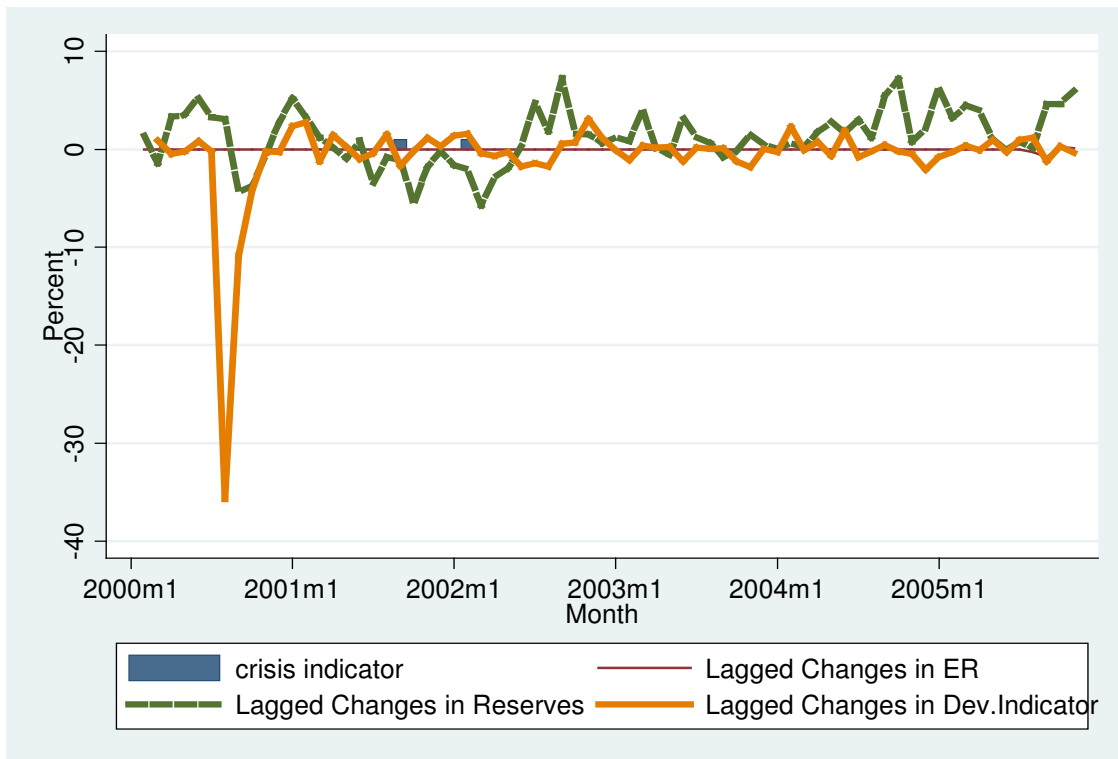
**Figure 13: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Korea**
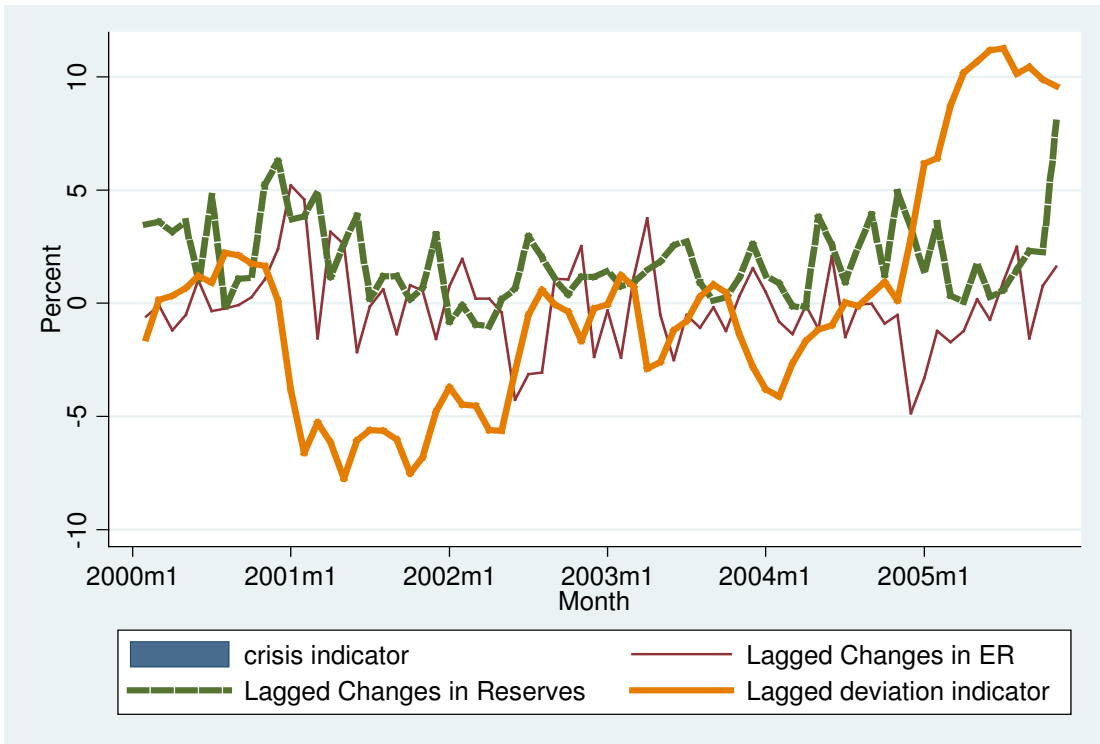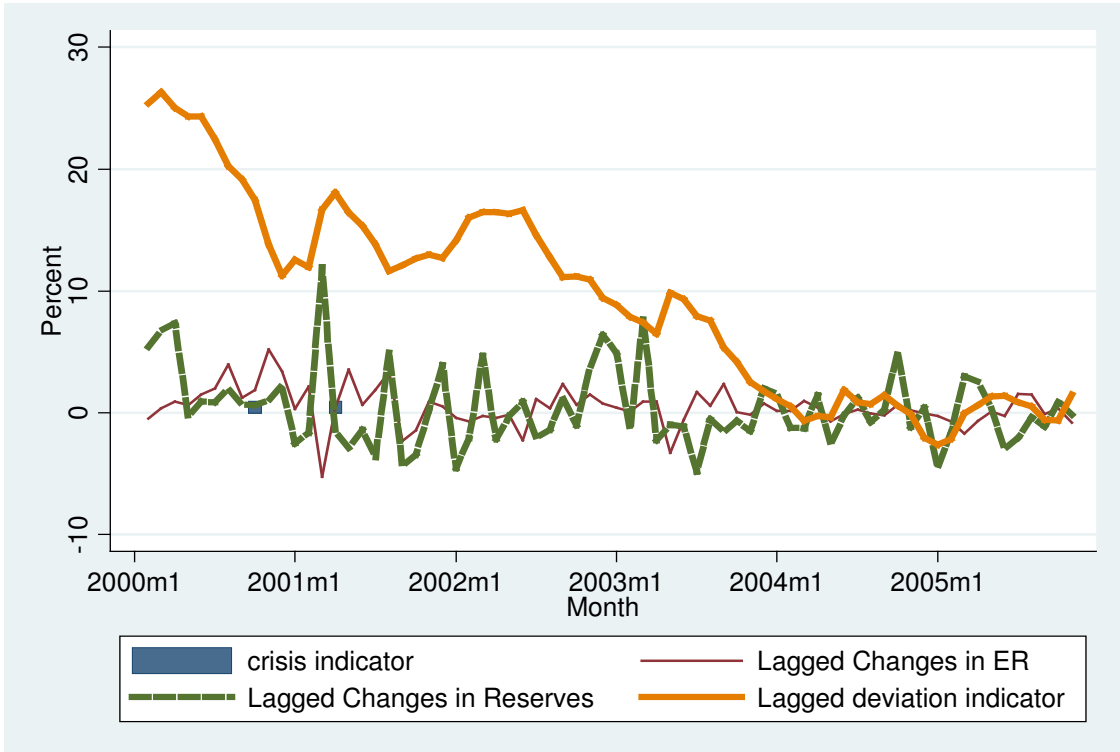


**Figure 14: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Korea**
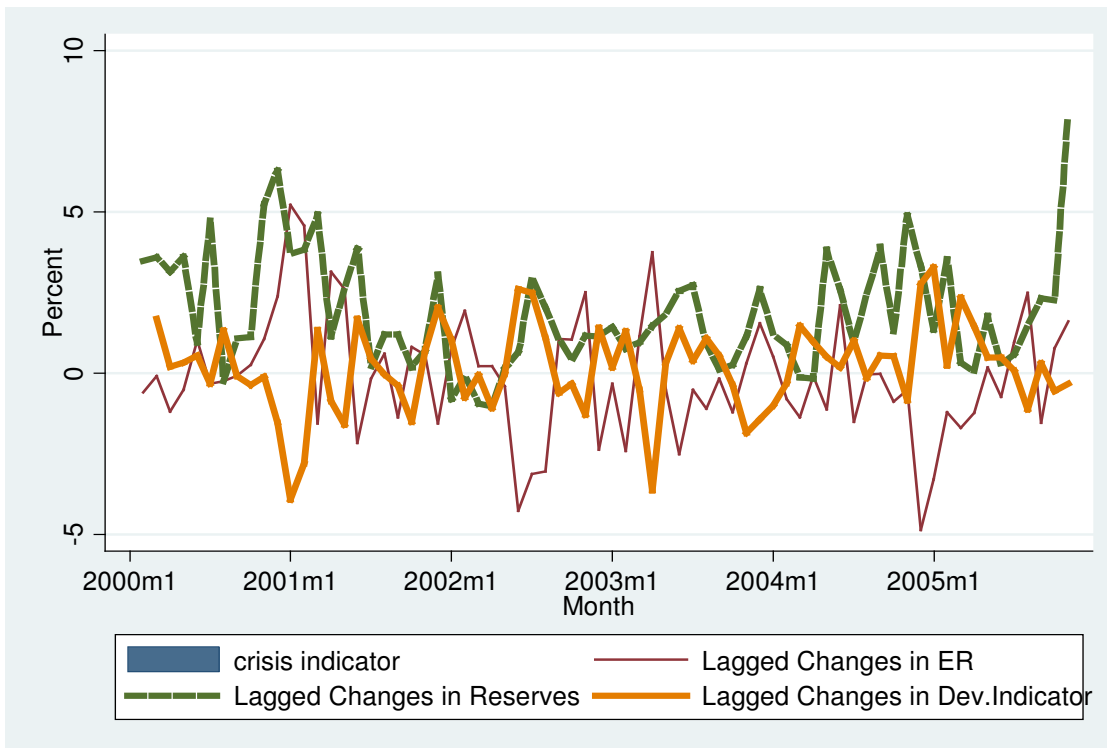
**Figure 15: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Korea**
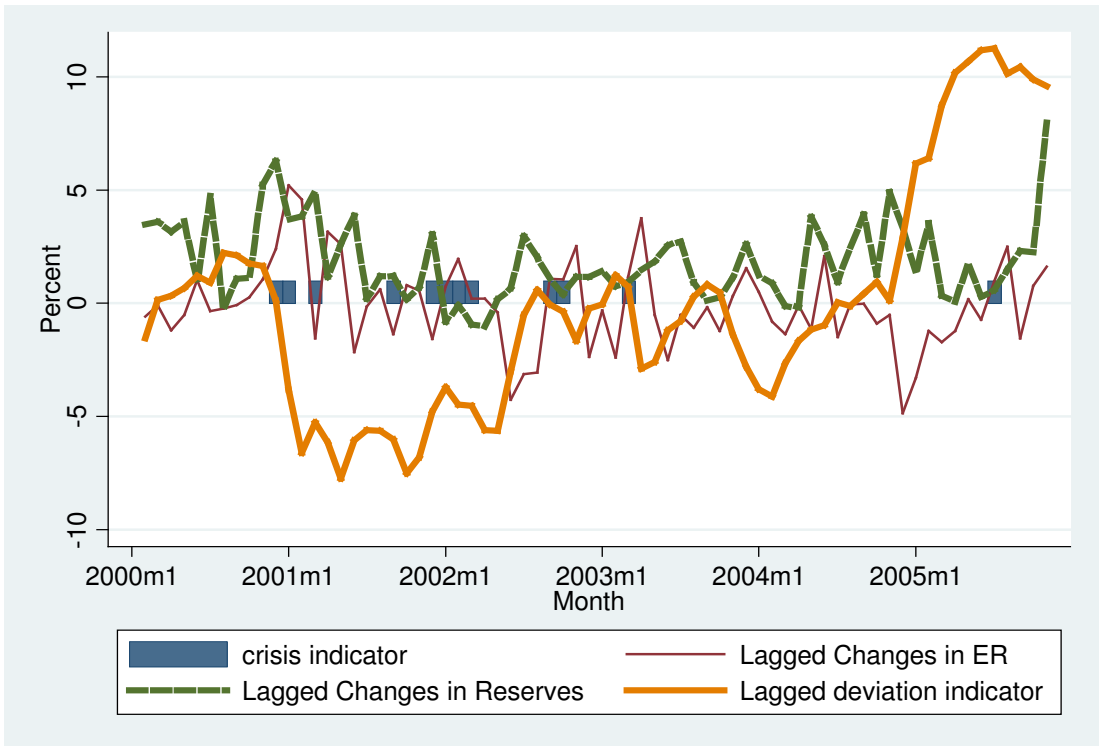


**Figure 16: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Korea**
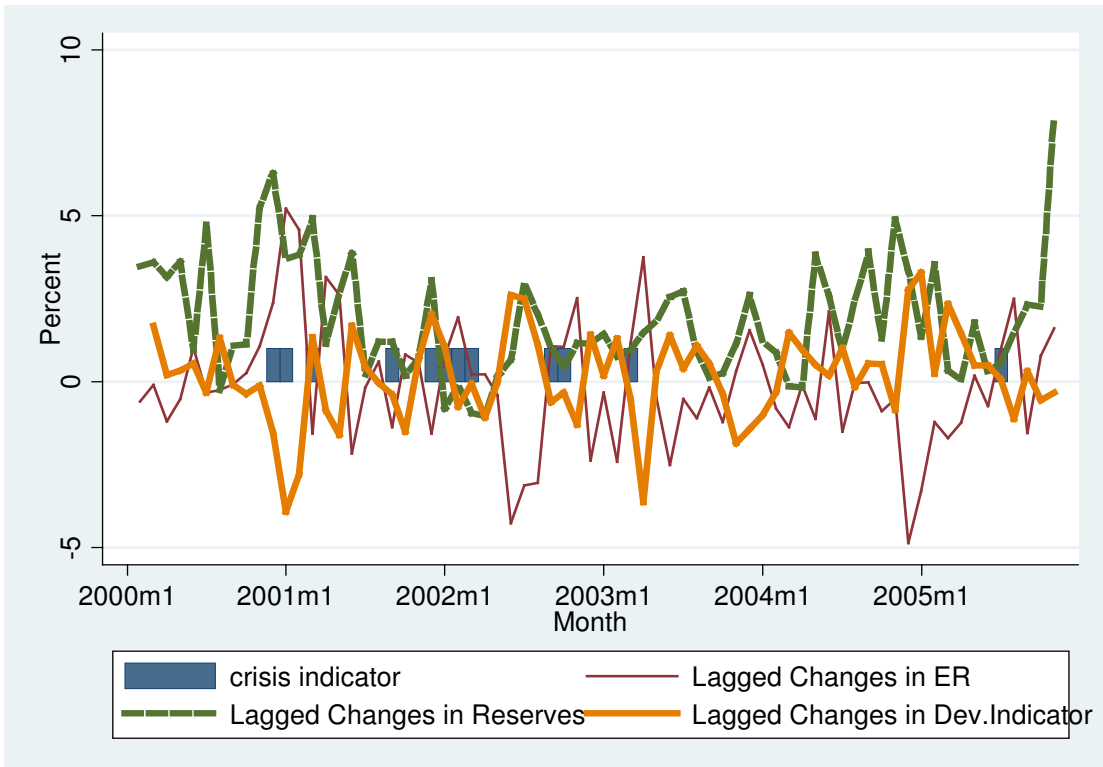
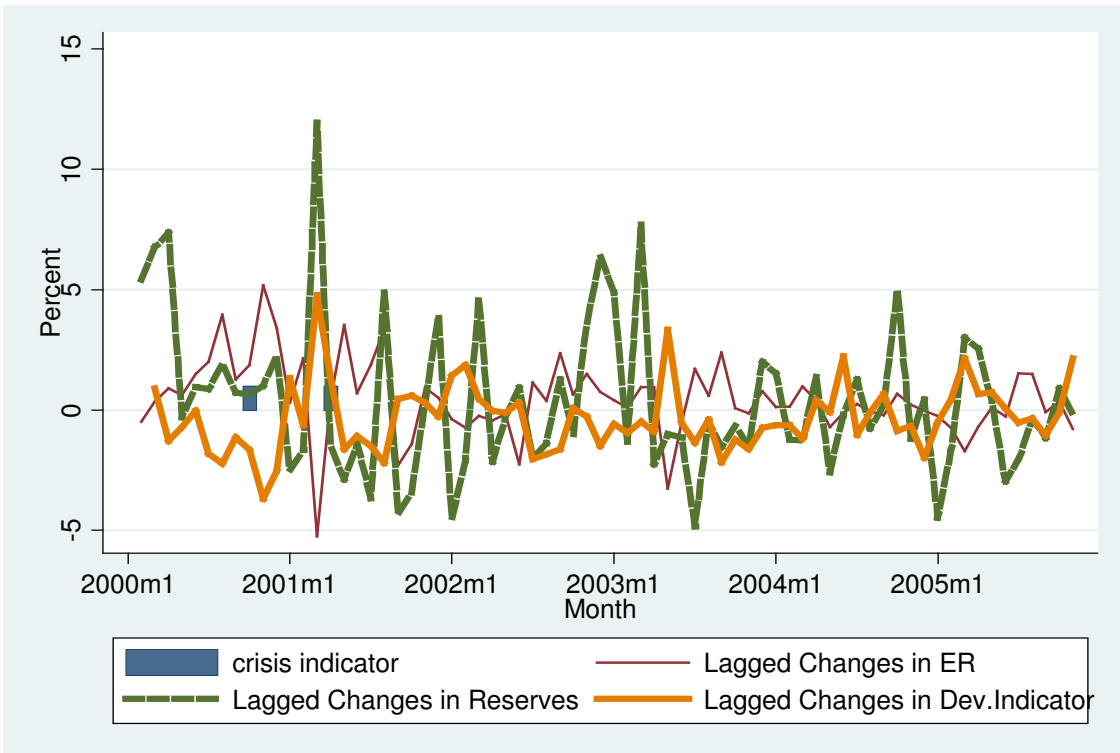**Figure 17: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Laos**
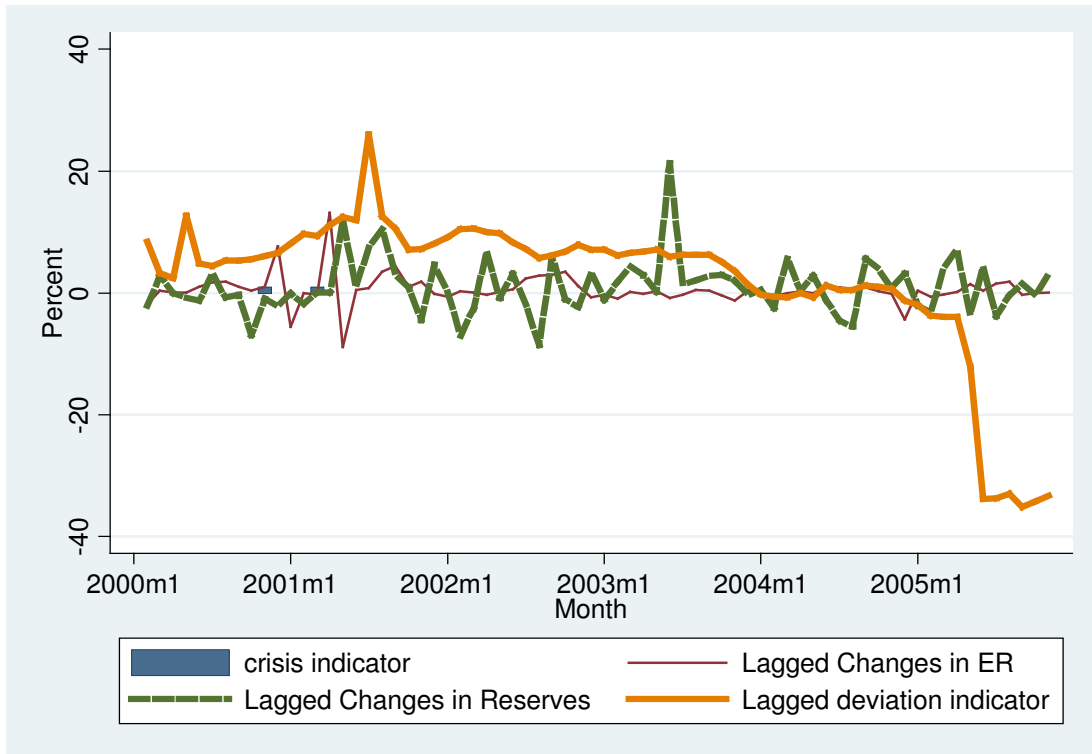


**Figure 18 Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Laos**
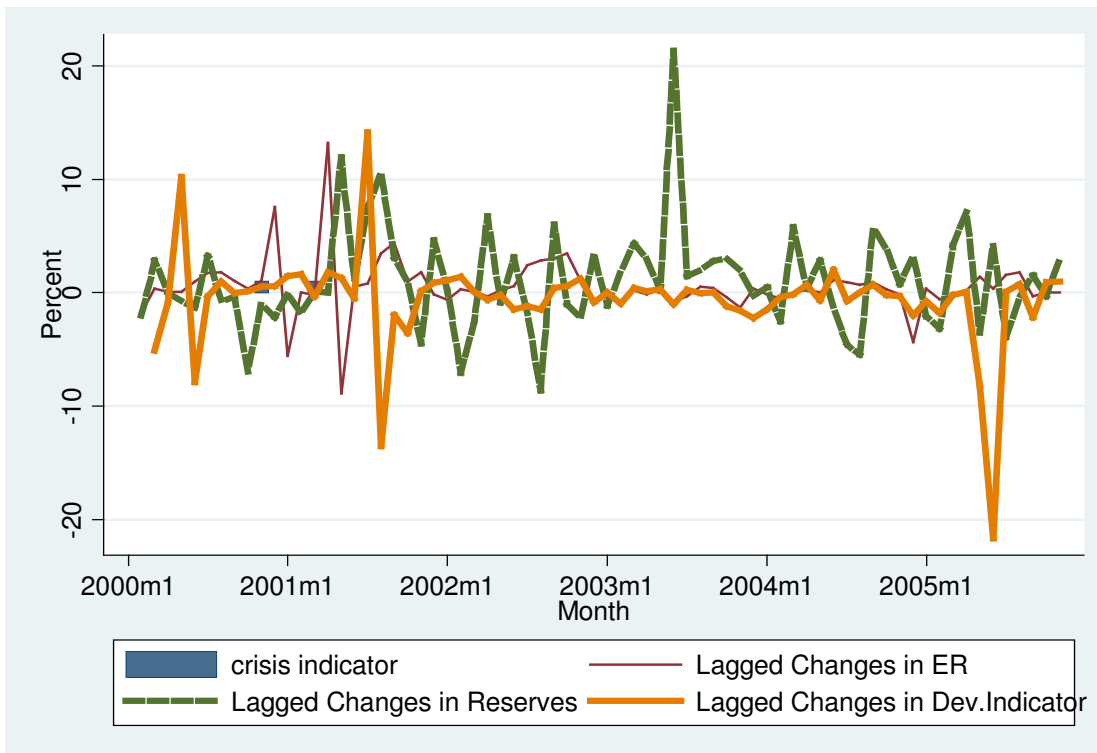
**Figure 19: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Laos**
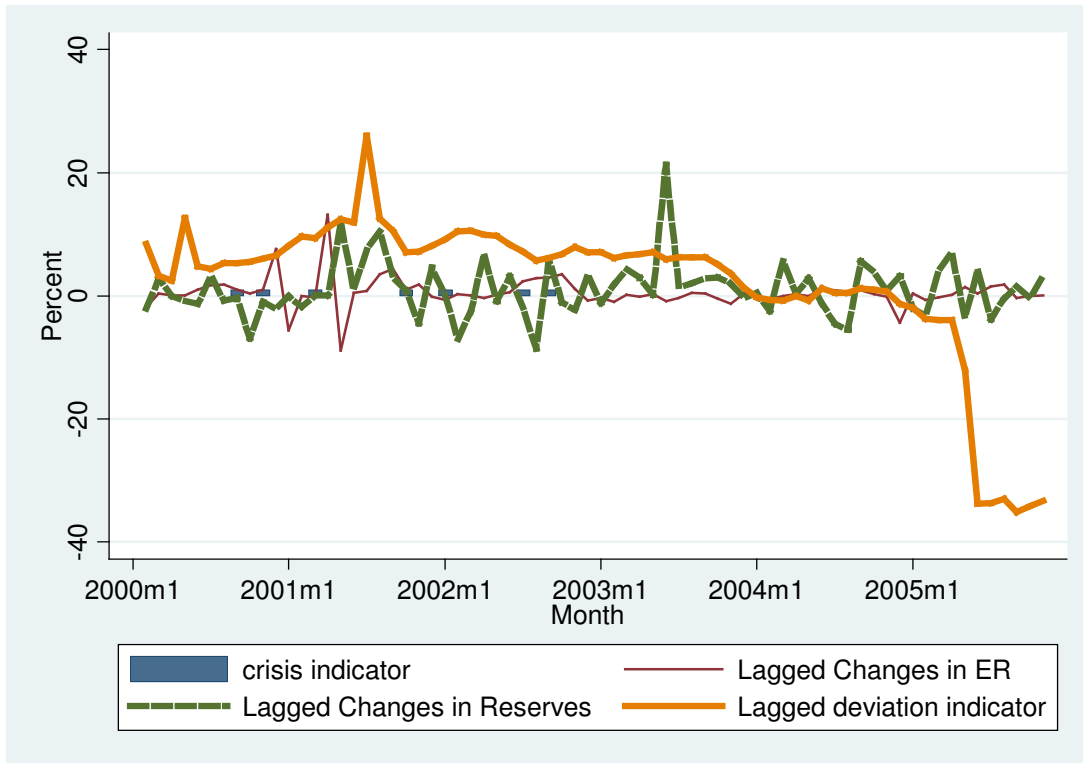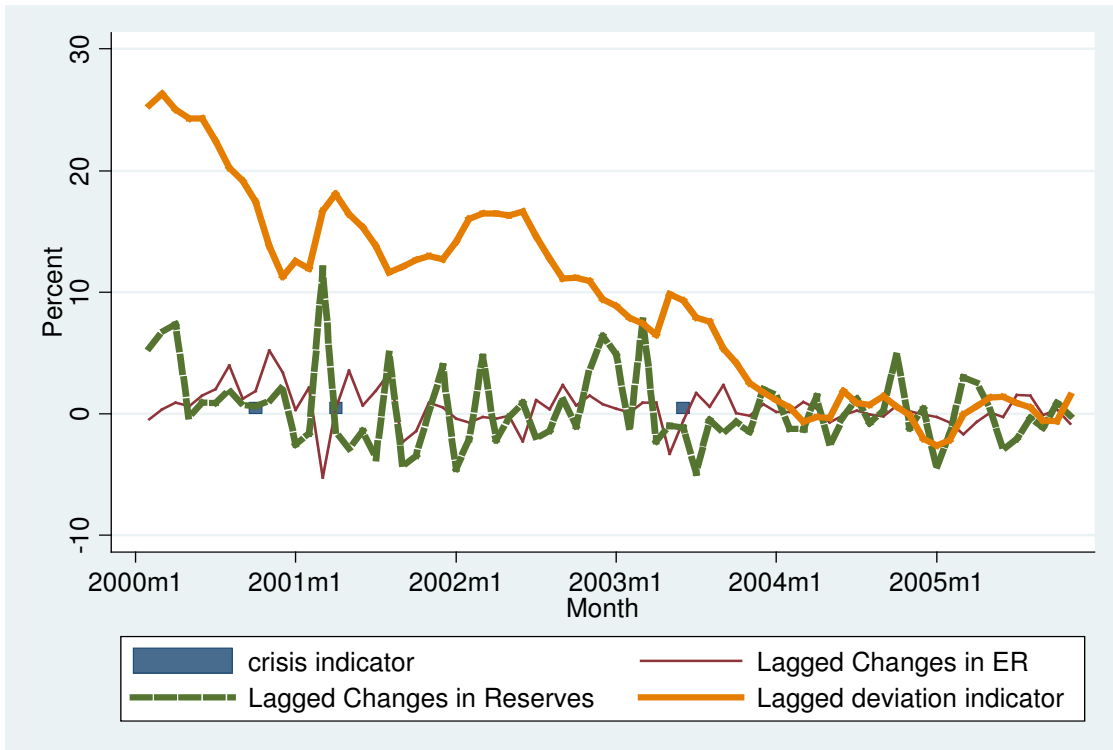


**Figure 20: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Laos**
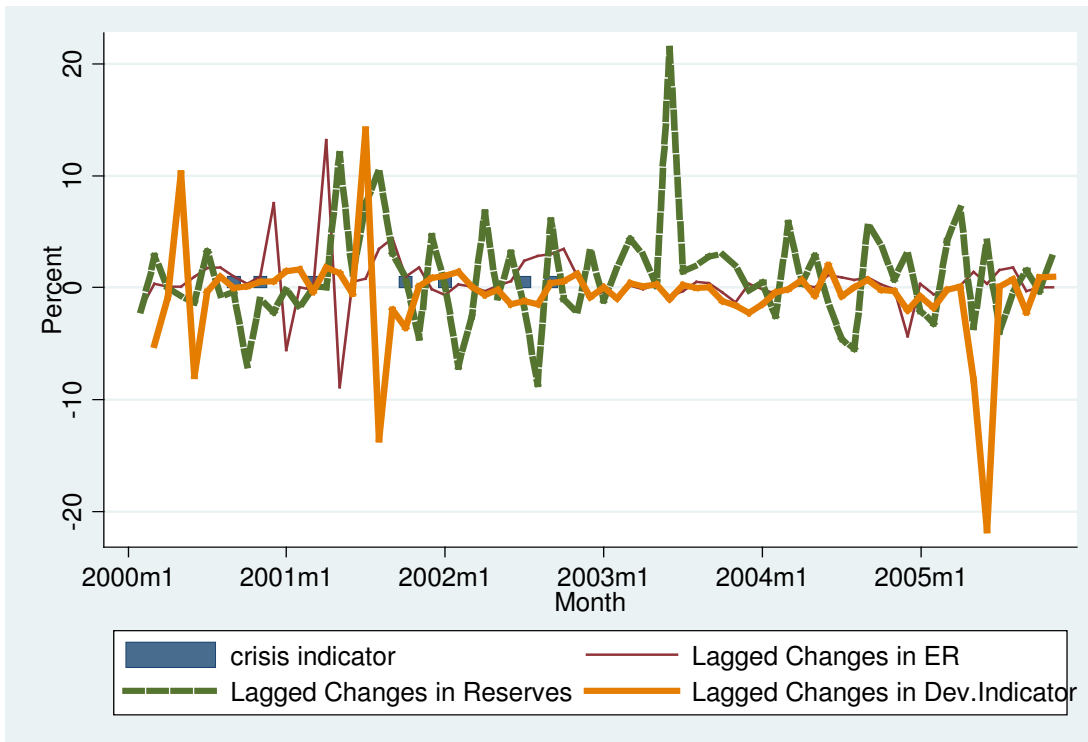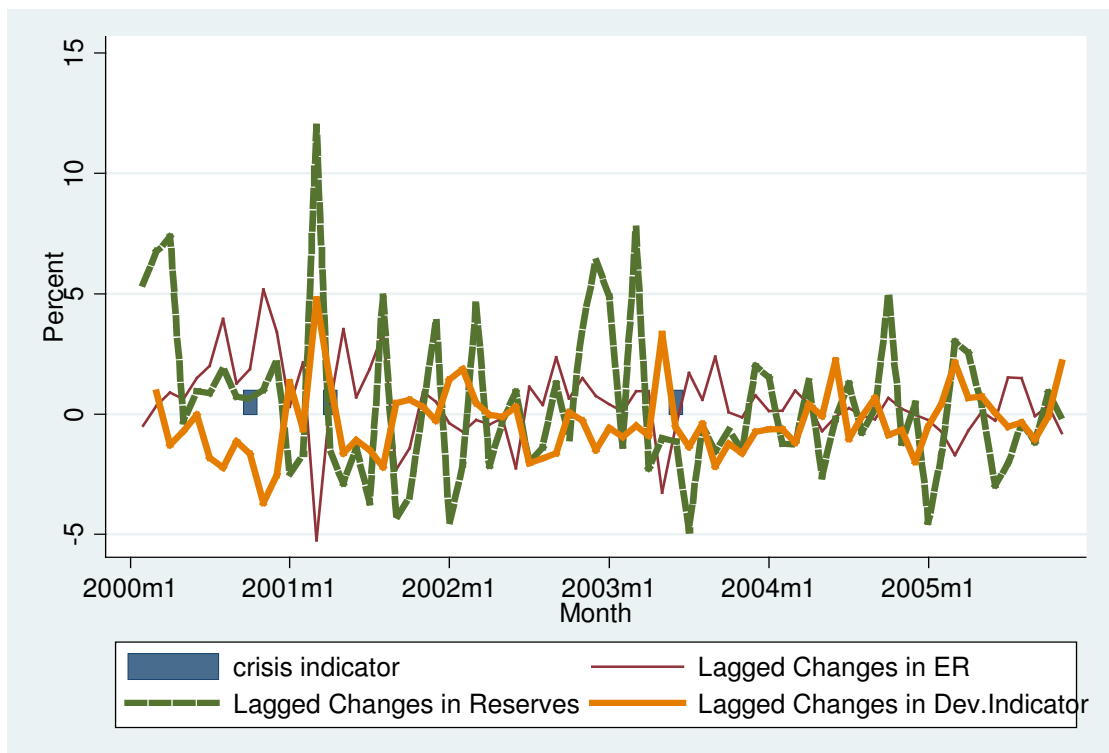
**Figure 21: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Malaysia**
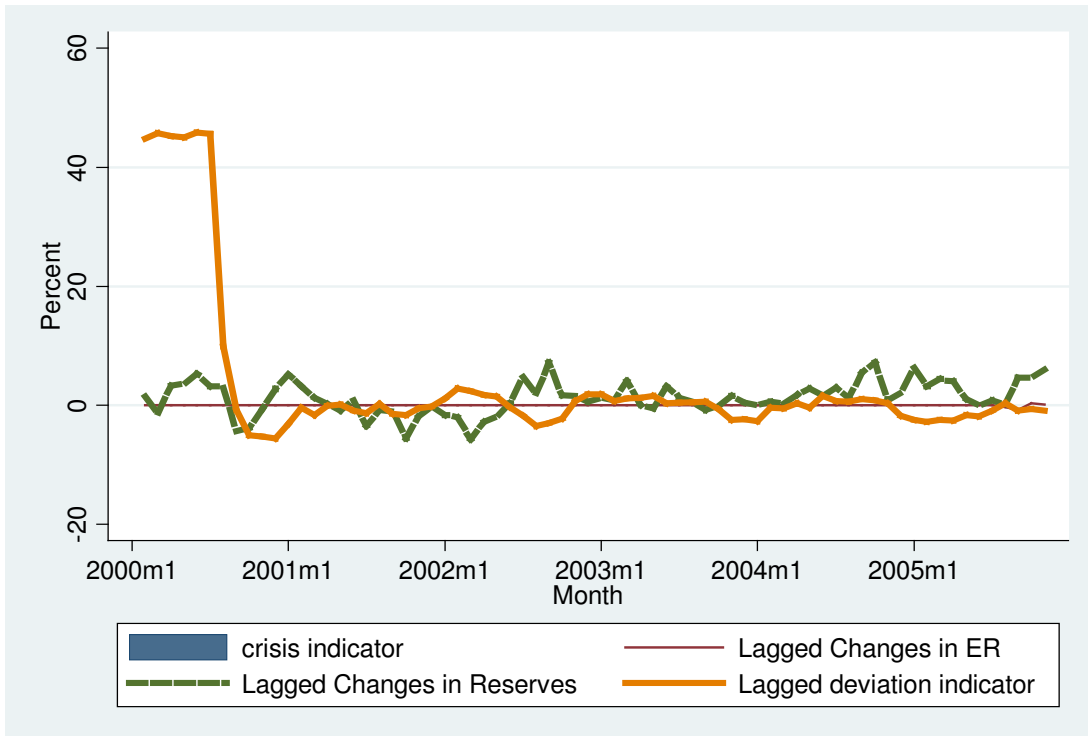


**Figure 22: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Malaysia**
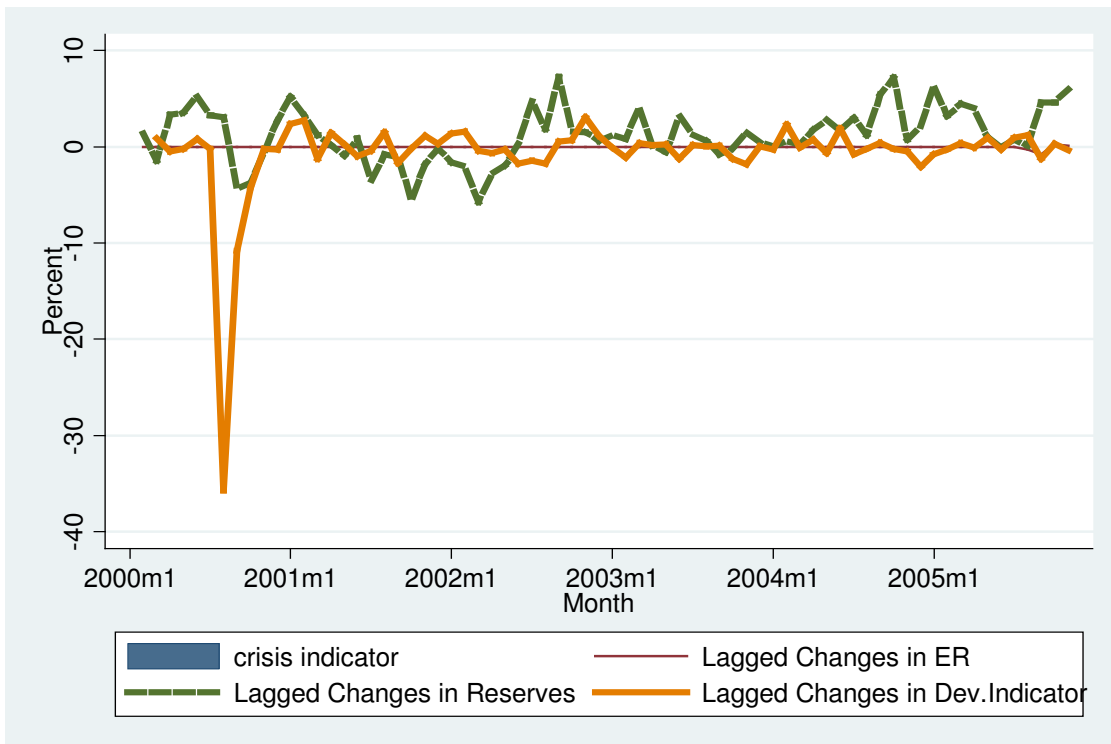
**Figure 23: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Malaysia**
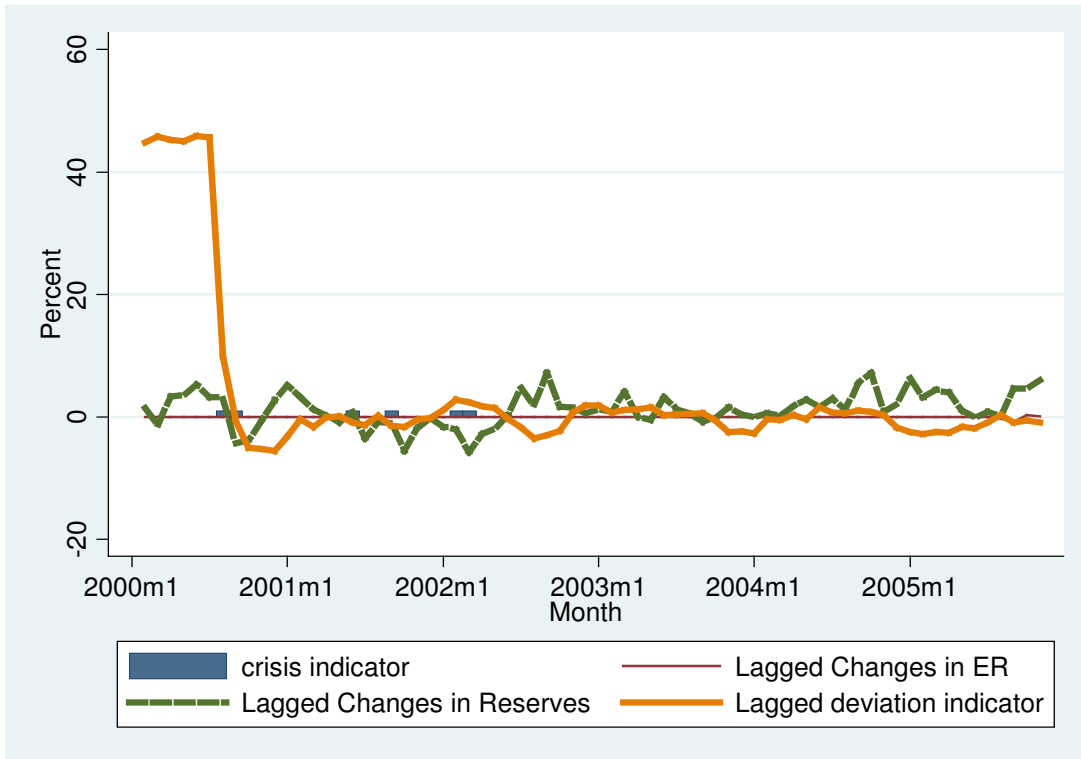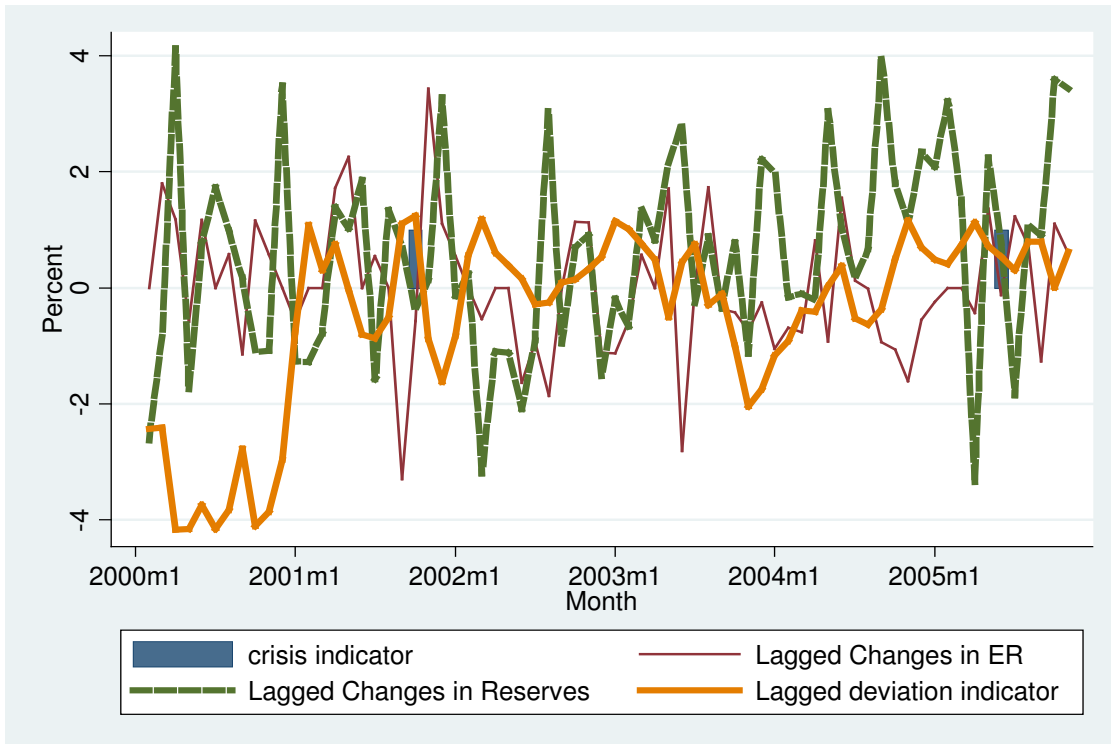


**Figure 24: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Malaysia**
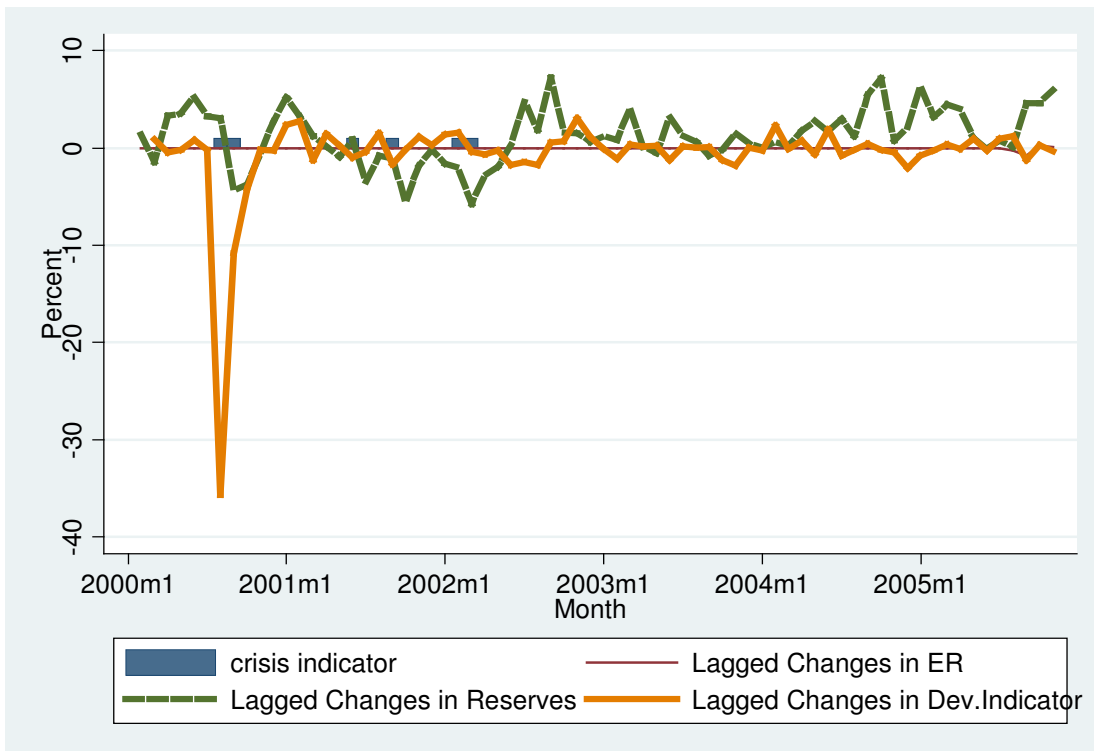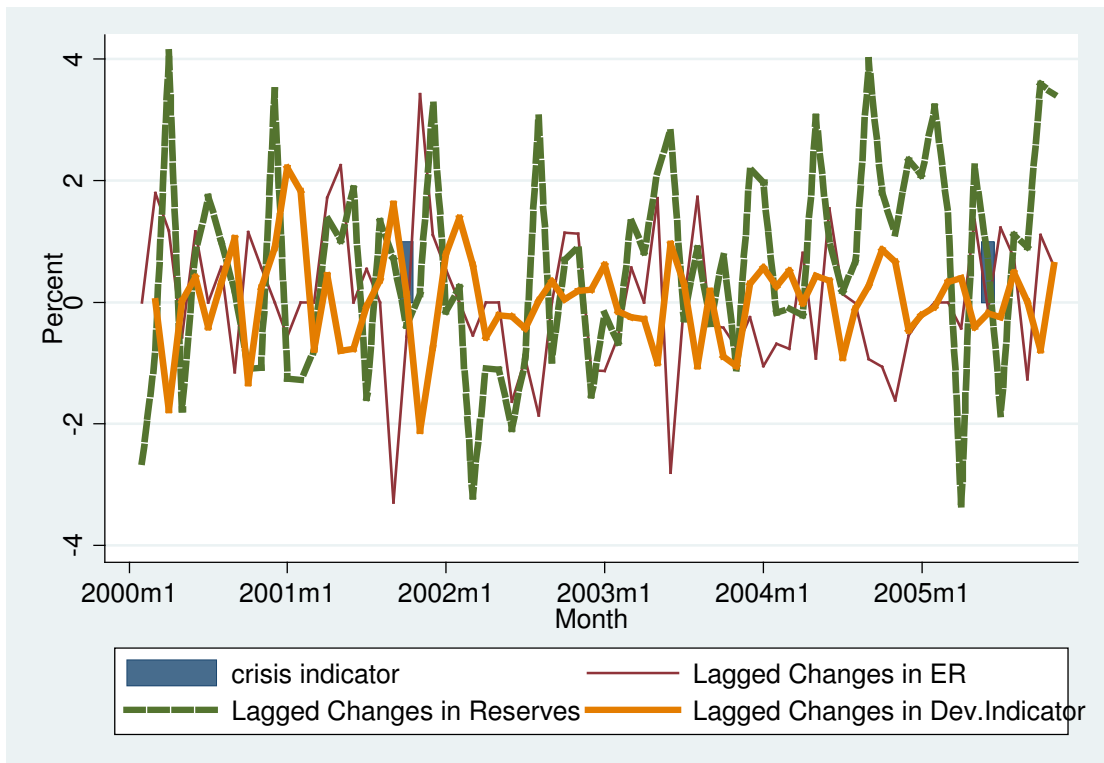
**Figure 25: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Philippines**



| crisis indicator | Lagged Changes in ER |
|---|---|
| Lagged Changes in Reserves | Lagged deviation indicator |
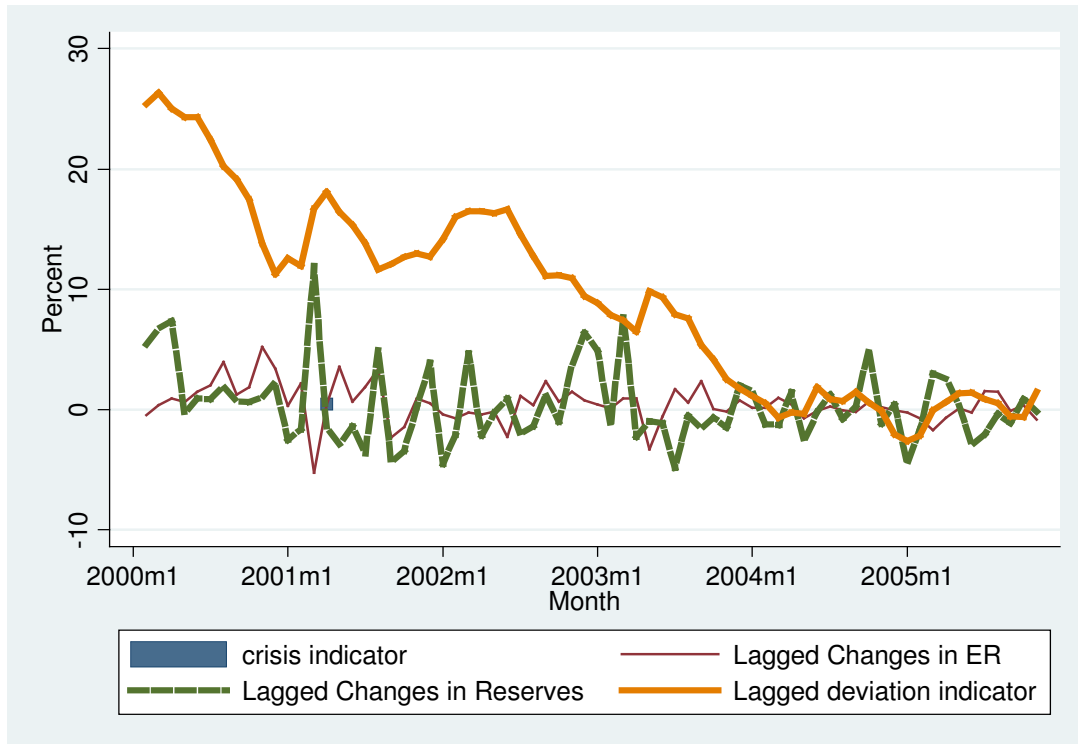
**Figure 26: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Philippines**



| crisis indicator | Lagged Changes in ER |
|---|---|
| Lagged Changes in Reserves | Lagged Changes in Dev.Indicator |
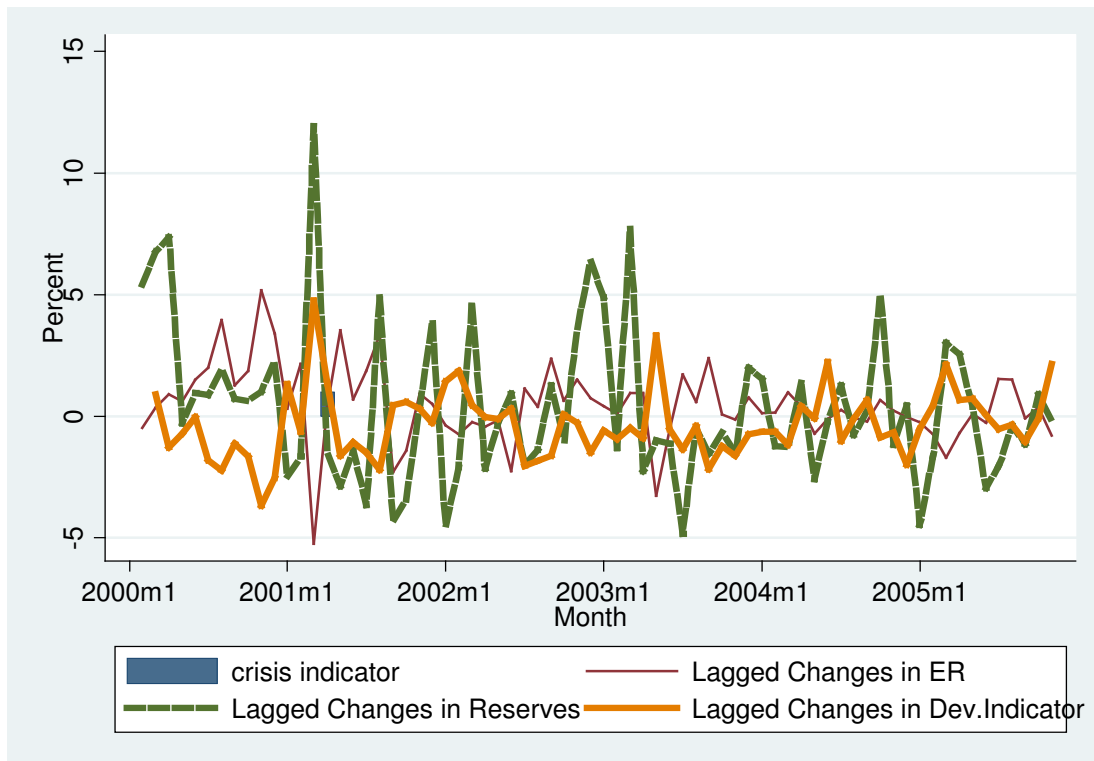
**Figure 27: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Philippines**
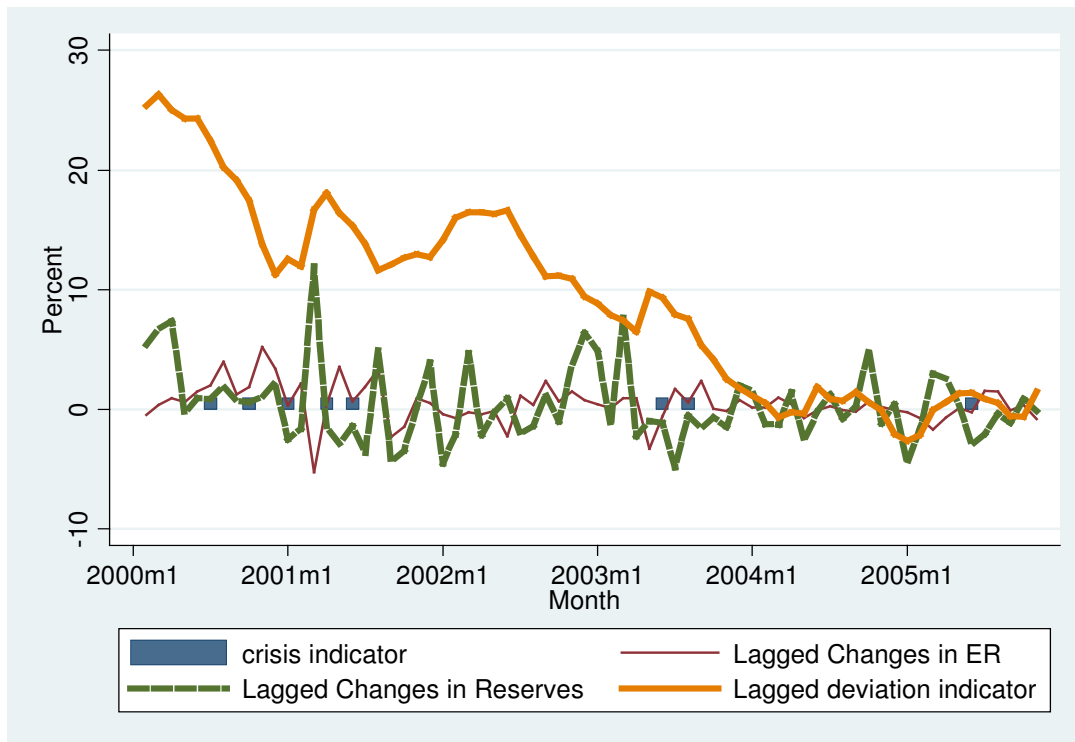


**Figure 28: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Philippines**
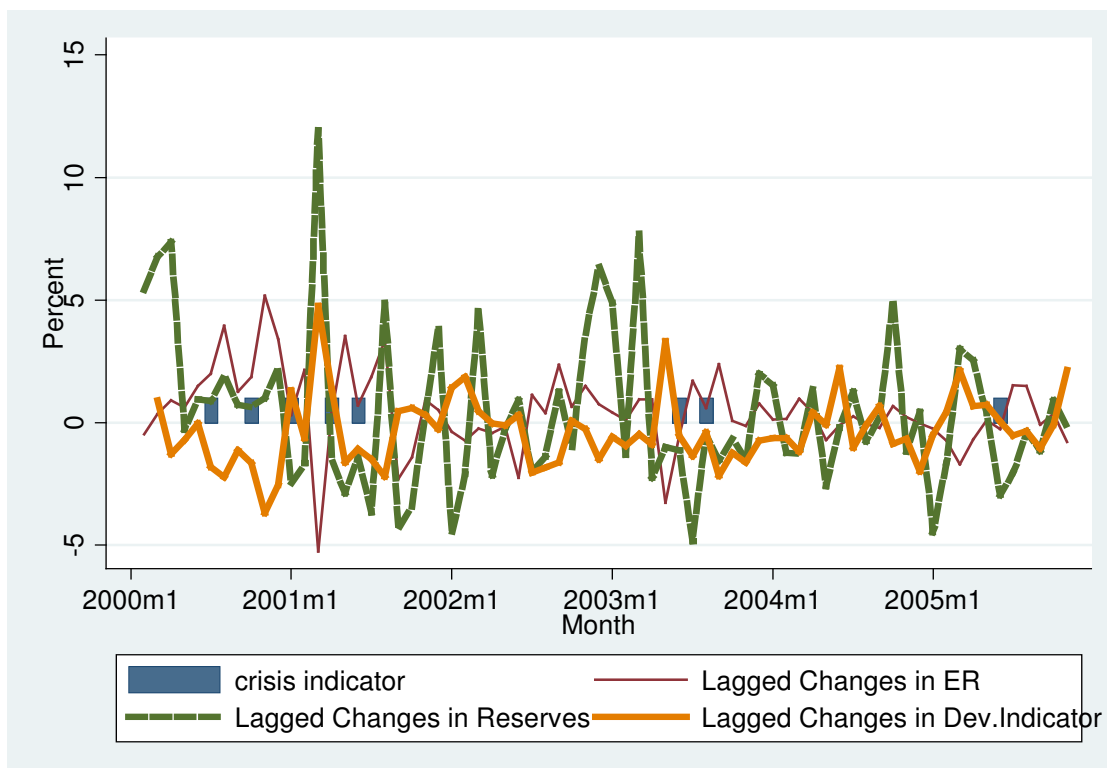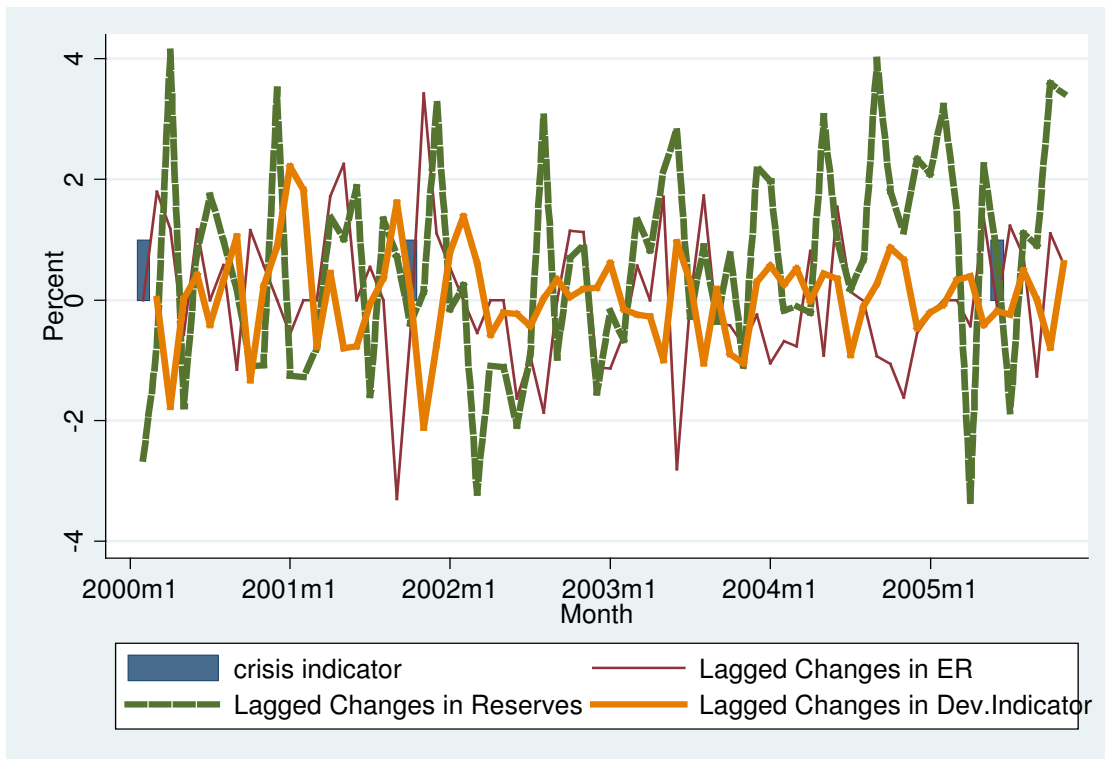
**Figure 29: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Singapore**
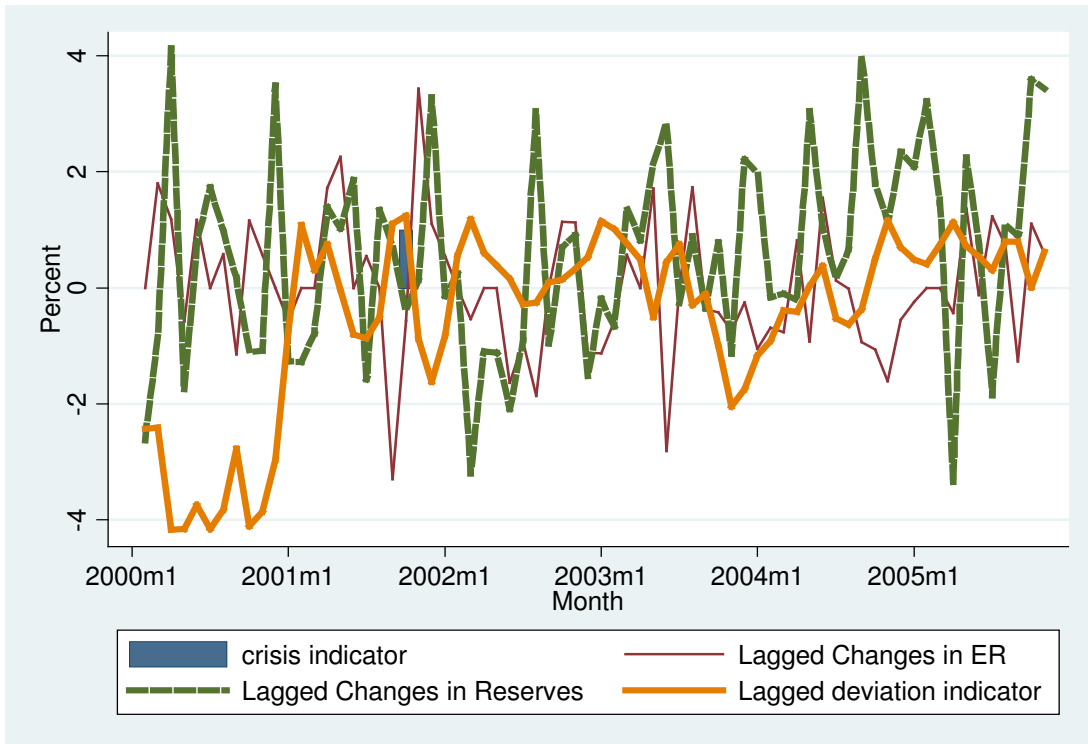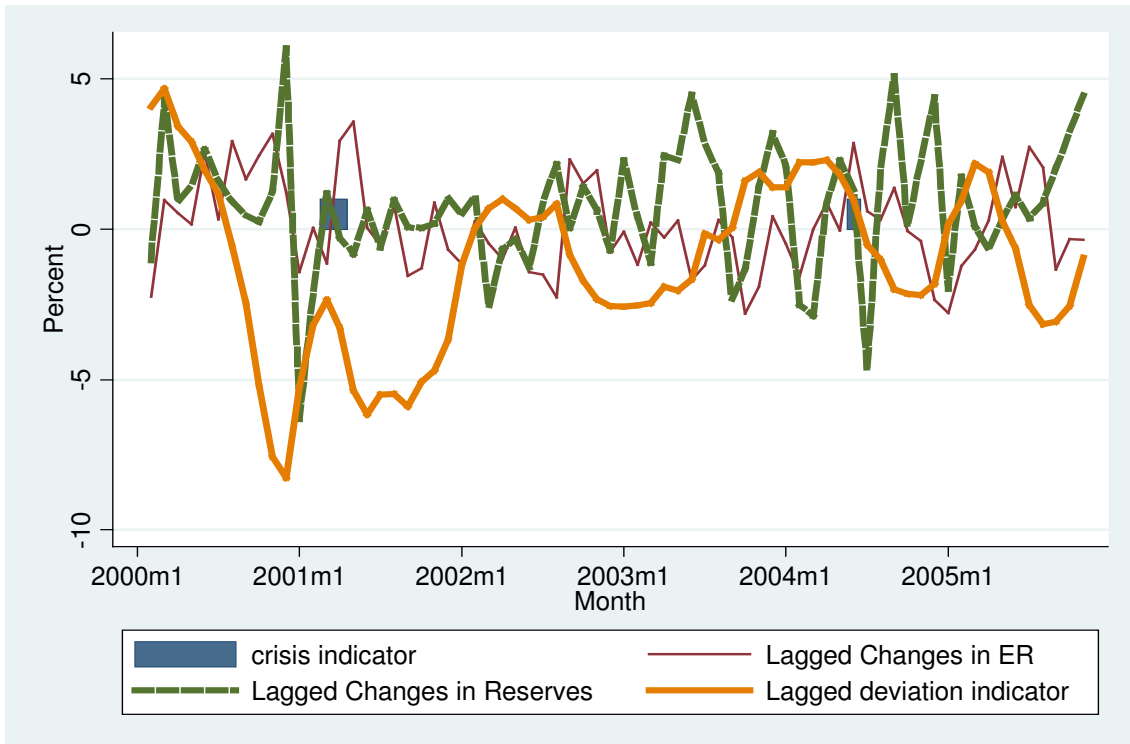


**Figure 30: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Singapore**
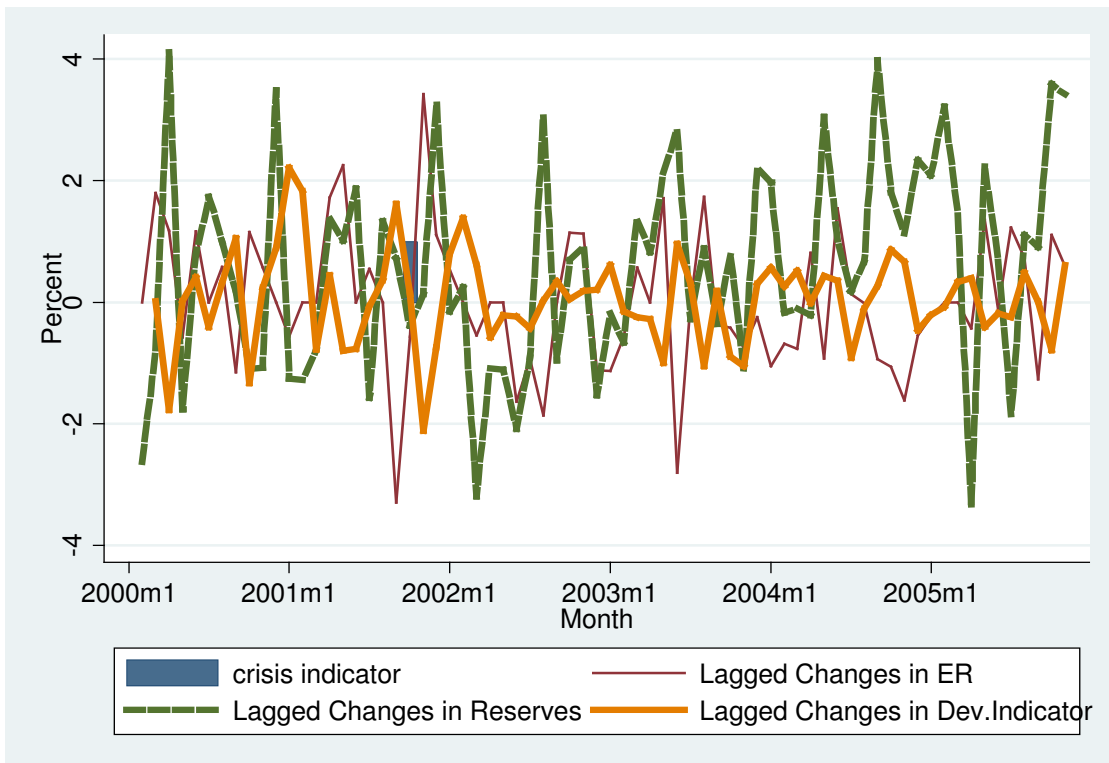
**Figure 31: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Singapore**
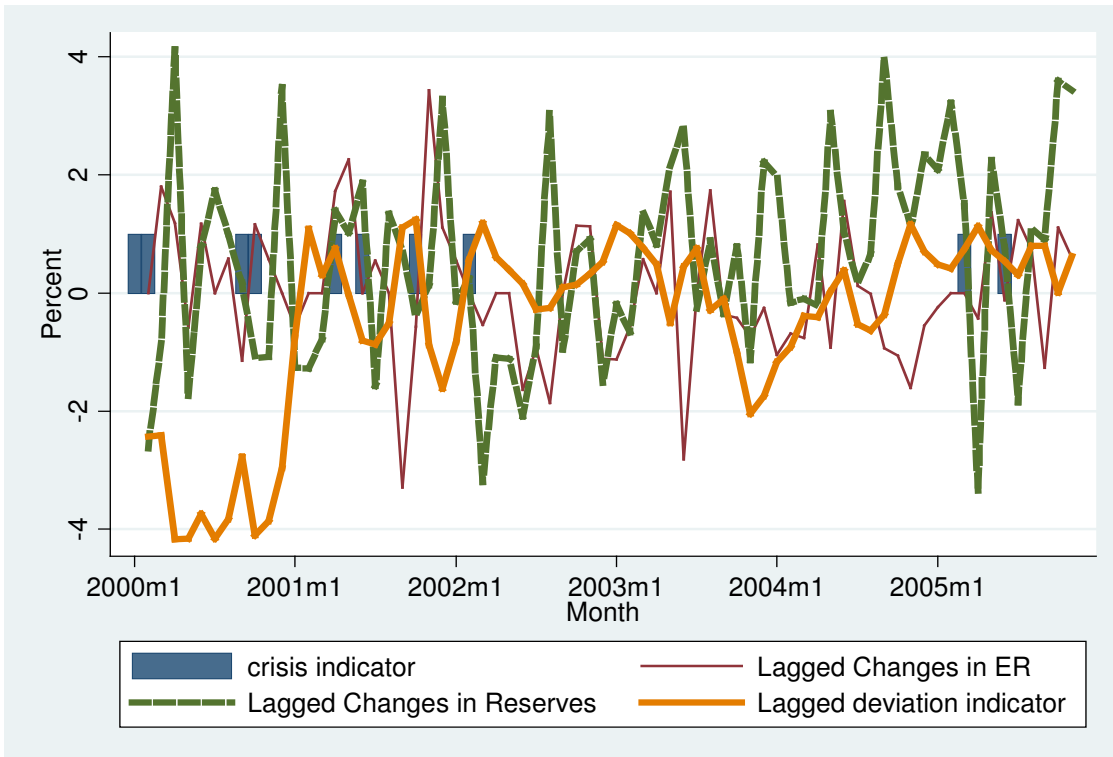


**Figure 32: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and change in deviation indicator: Singapore**
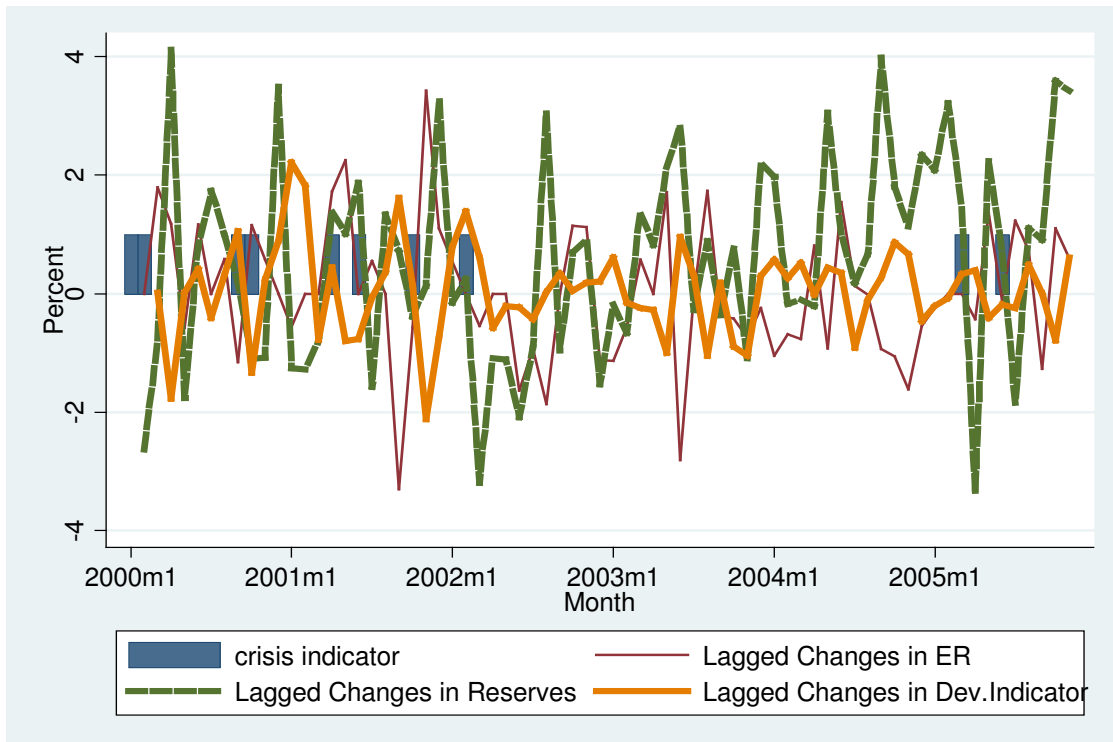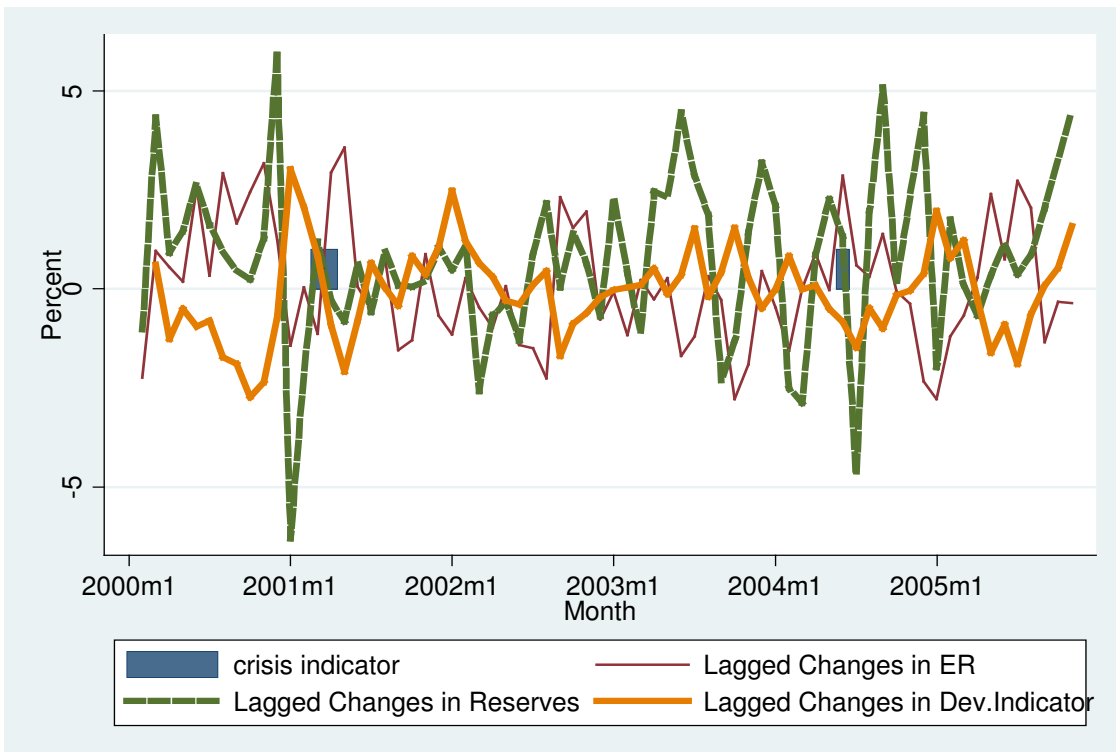
**Figure 33: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Thailand**
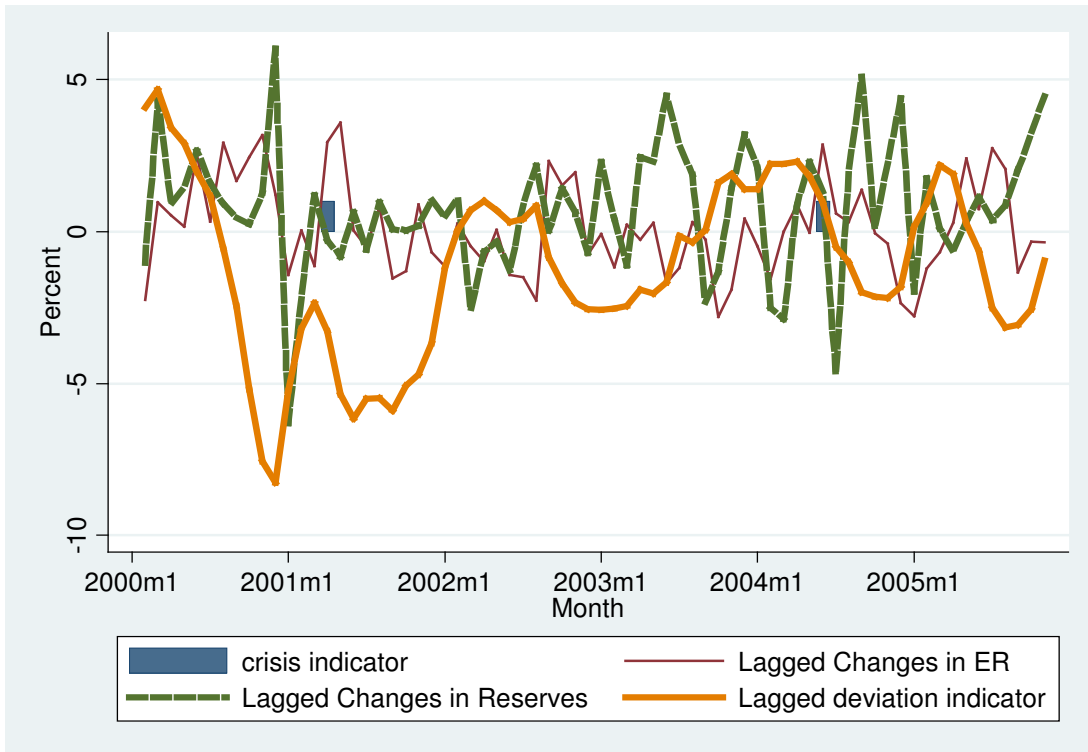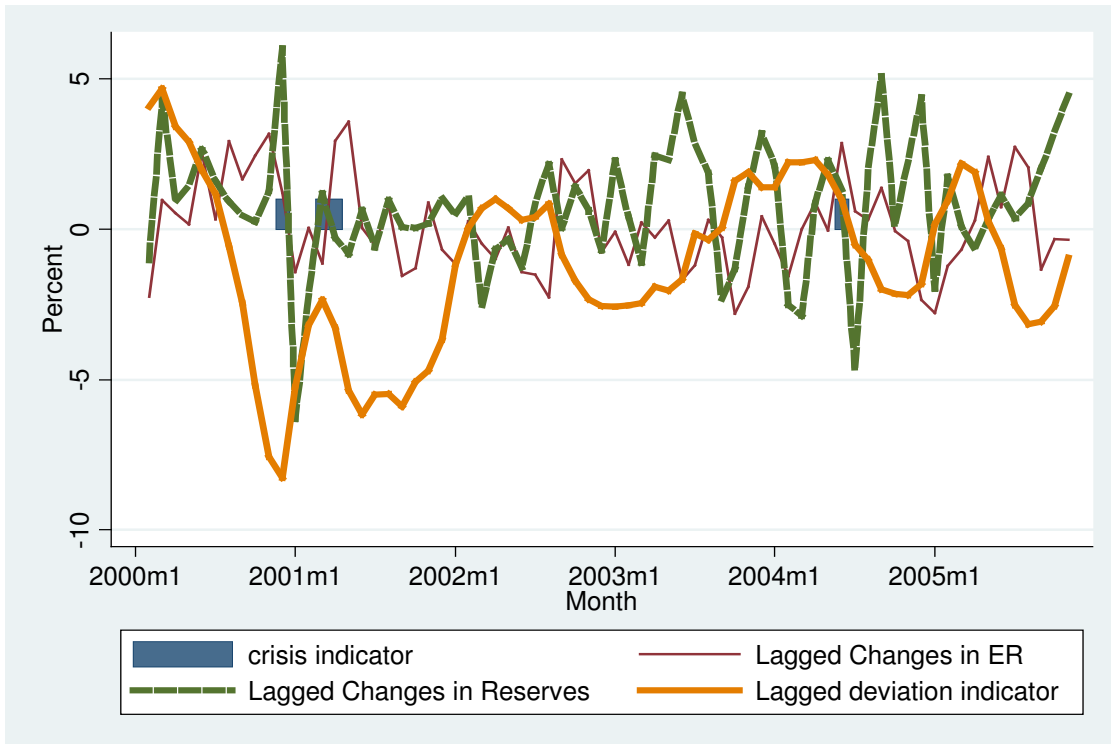


**Figure 34: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Thailand**
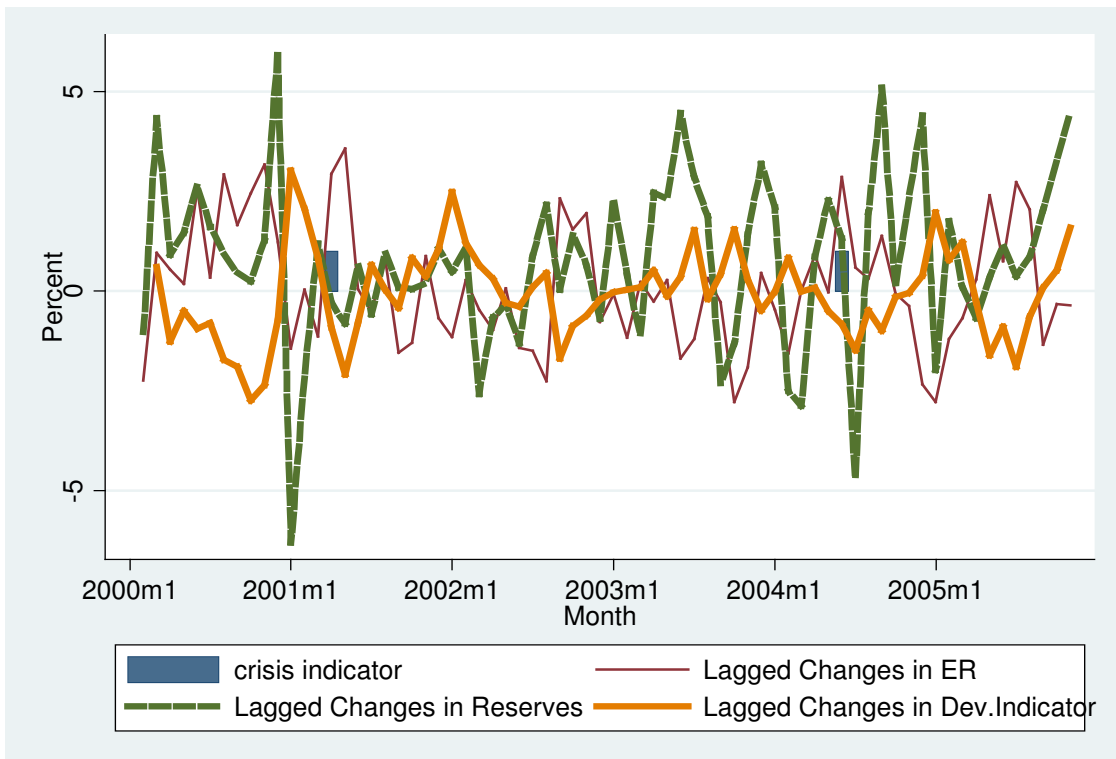
**Figure 35: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Thailand**
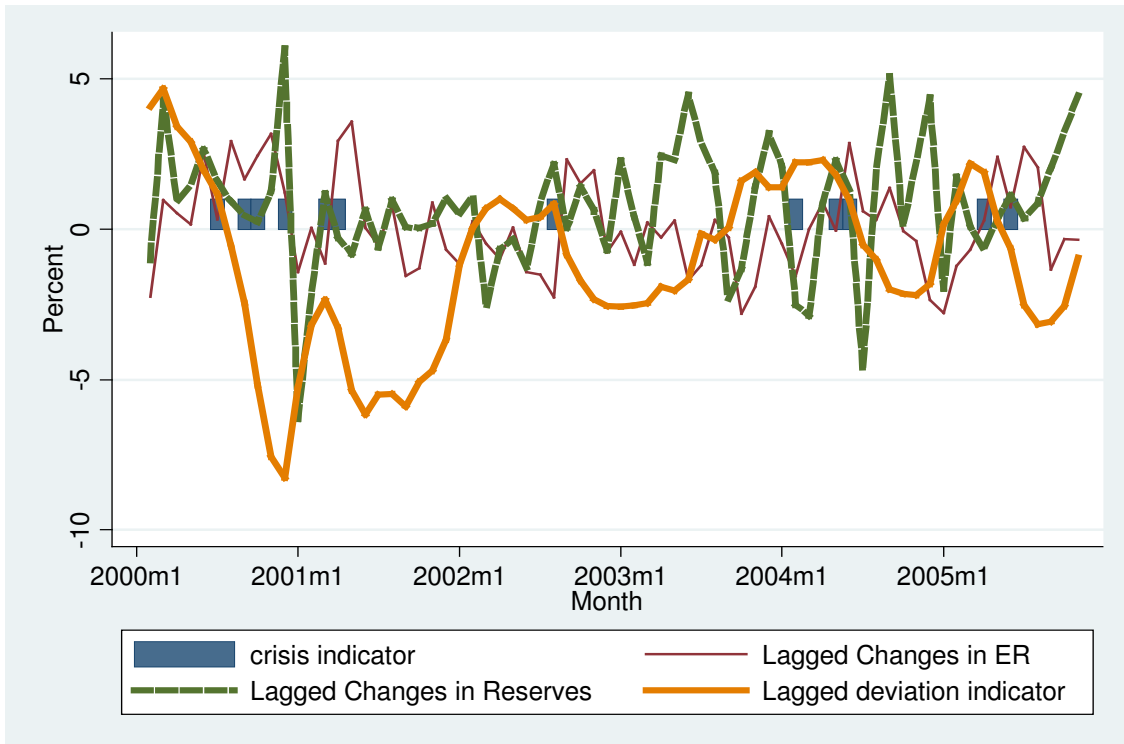


**Figure 36: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Thailand**
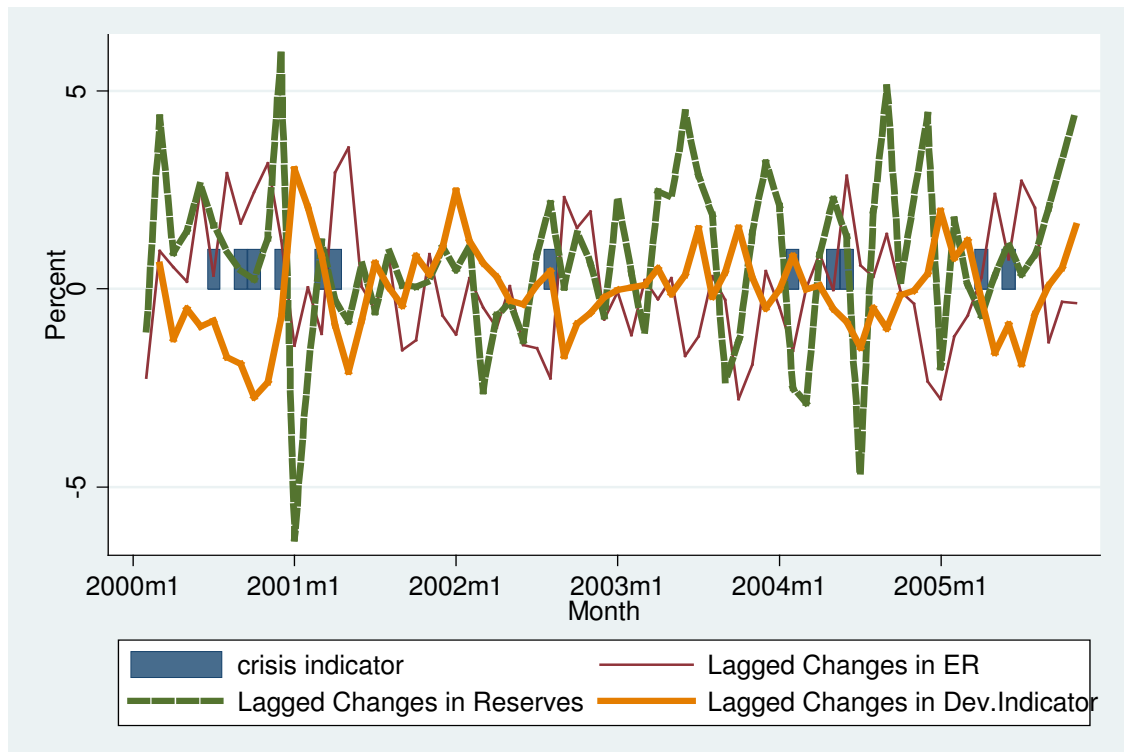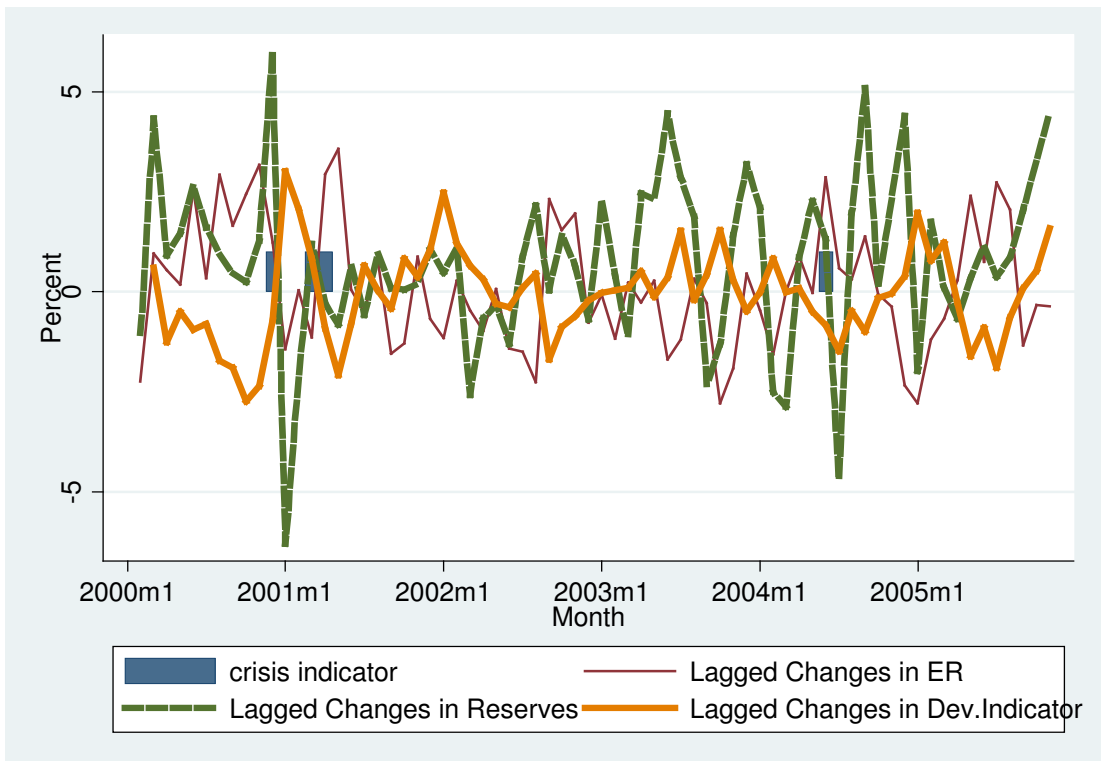
**Figure 37: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Vietnam**
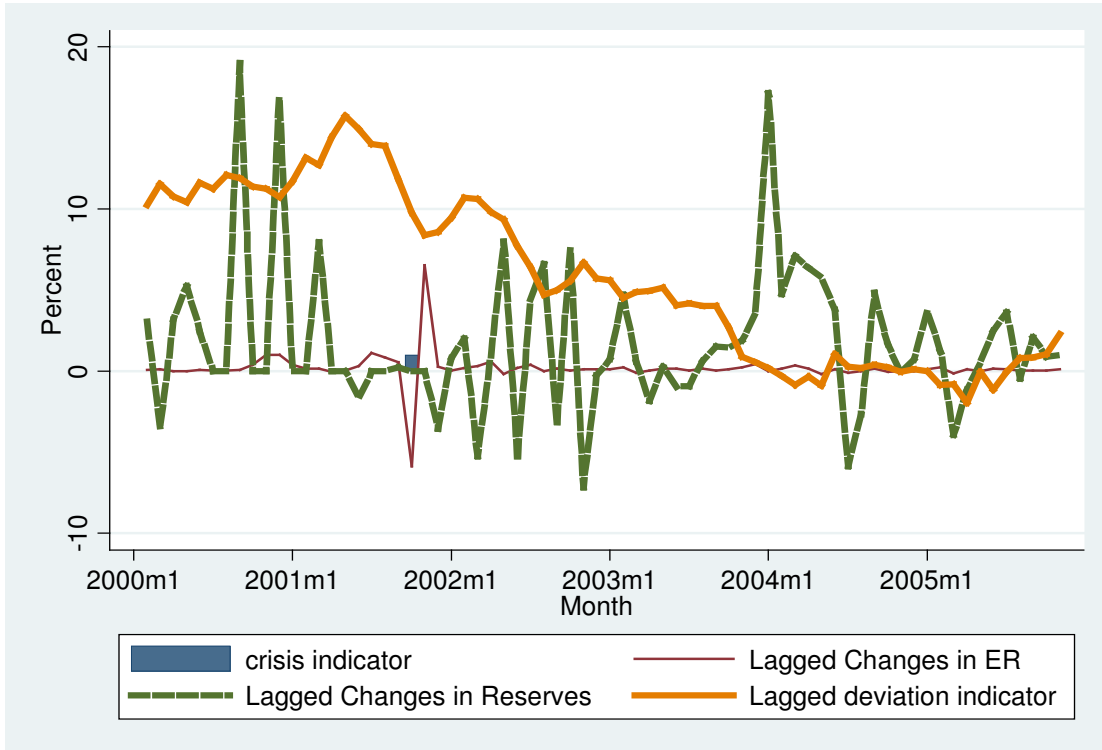


| crisis indicator | Lagged Changes in ER |
|---|---|
| Lagged Changes in Reserves | Lagged deviation indicator |
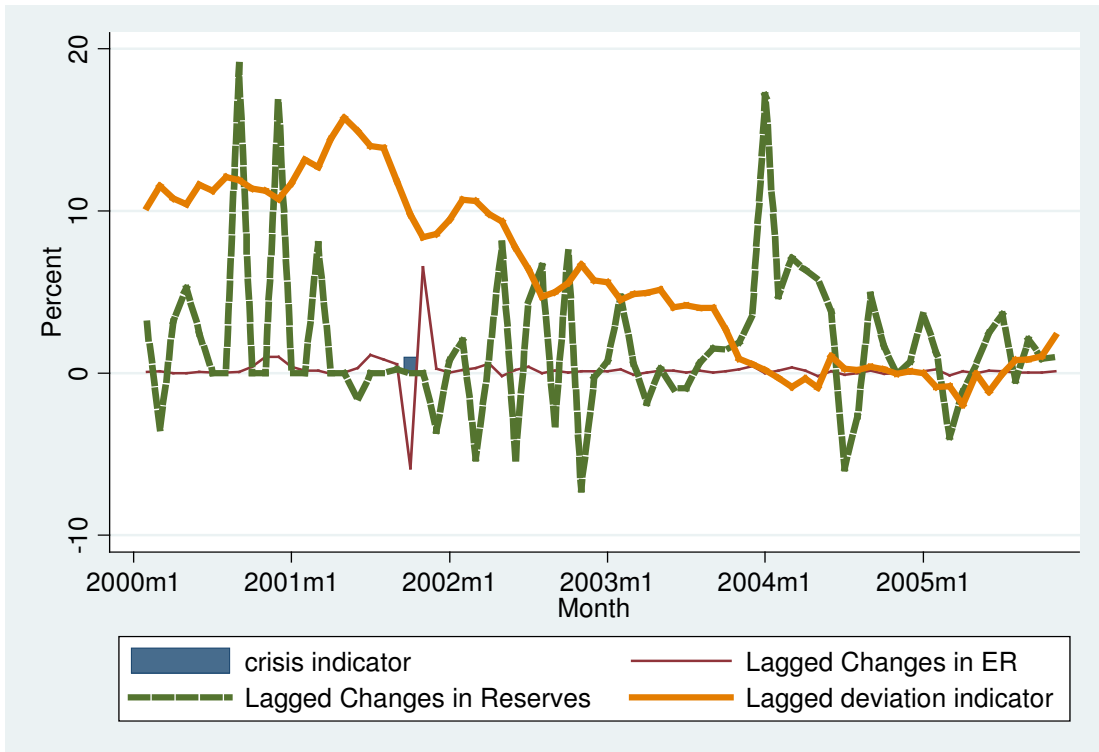
**Figure 38: Crisis indicator (2 standard deviations from the mean), exchange rate and international reserve changes and changes in deviation indicator: Vietnam**



| crisis indicator | Lagged Changes in ER |
|---|---|
| Lagged Changes in Reserves | Lagged Changes in Dev.Indicator |
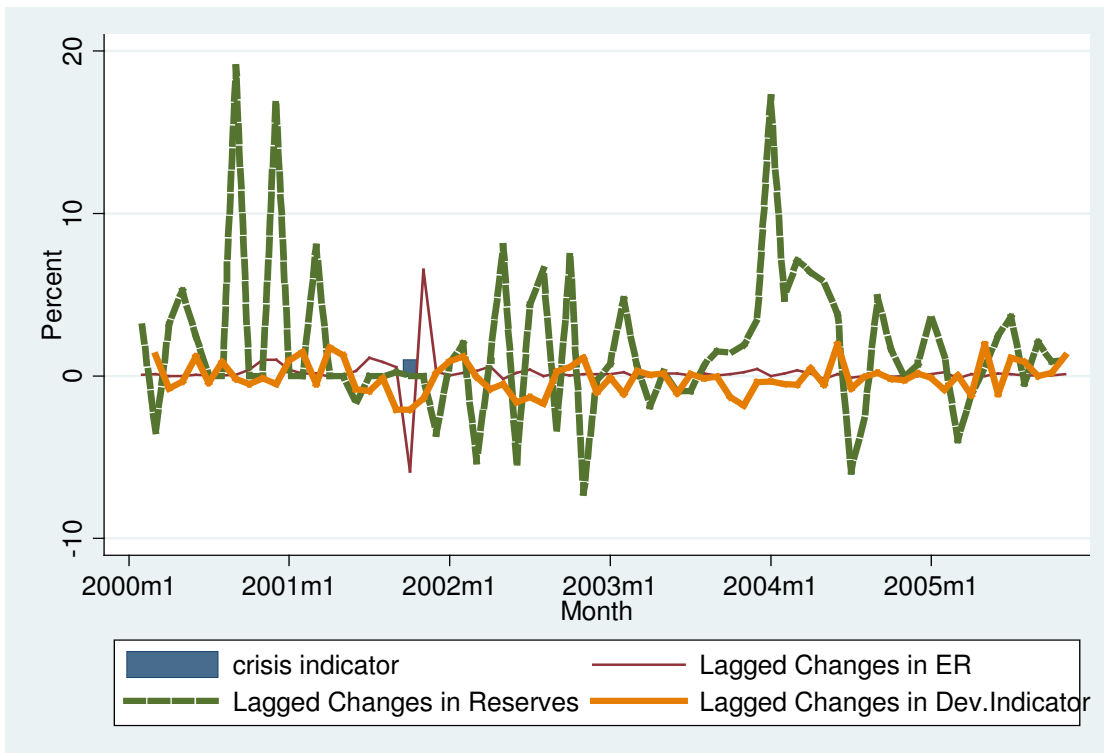
**Figure 39: Crisis indicator (1 standard deviation from the mean), exchange rate and international reserve changes and deviation indicator: Vietnam**
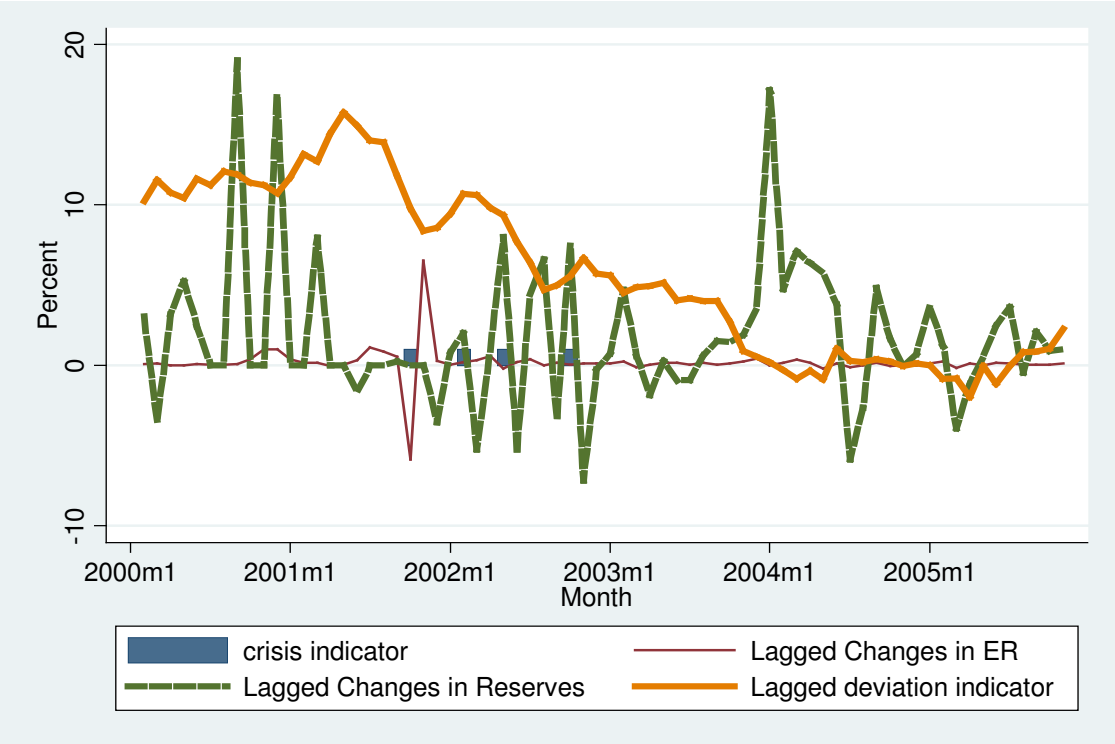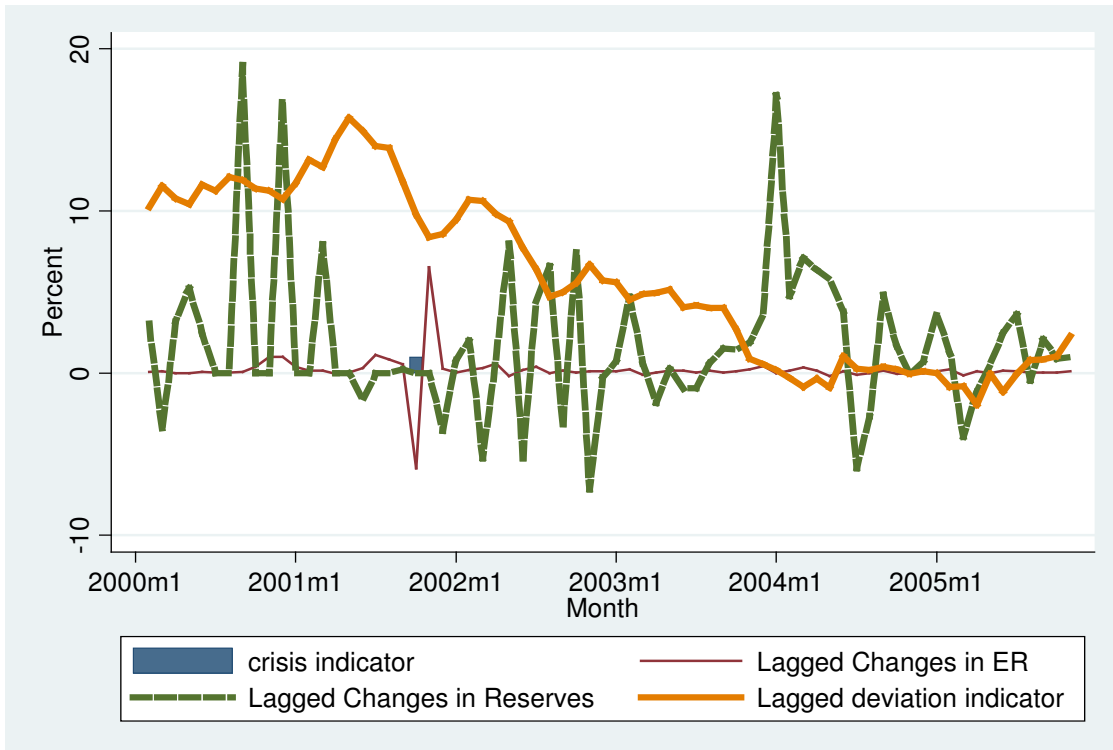


**Figure 40: Crisis indicator (1 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Vietnam**
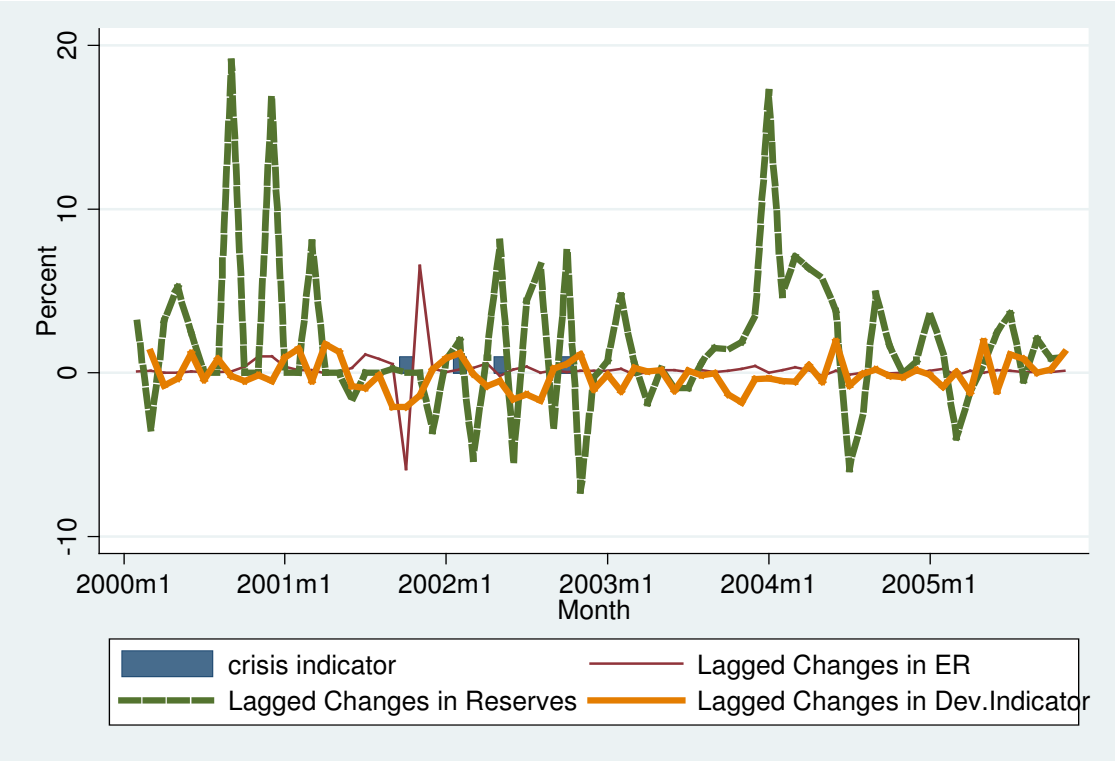
**Figure 41: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Cambodia**
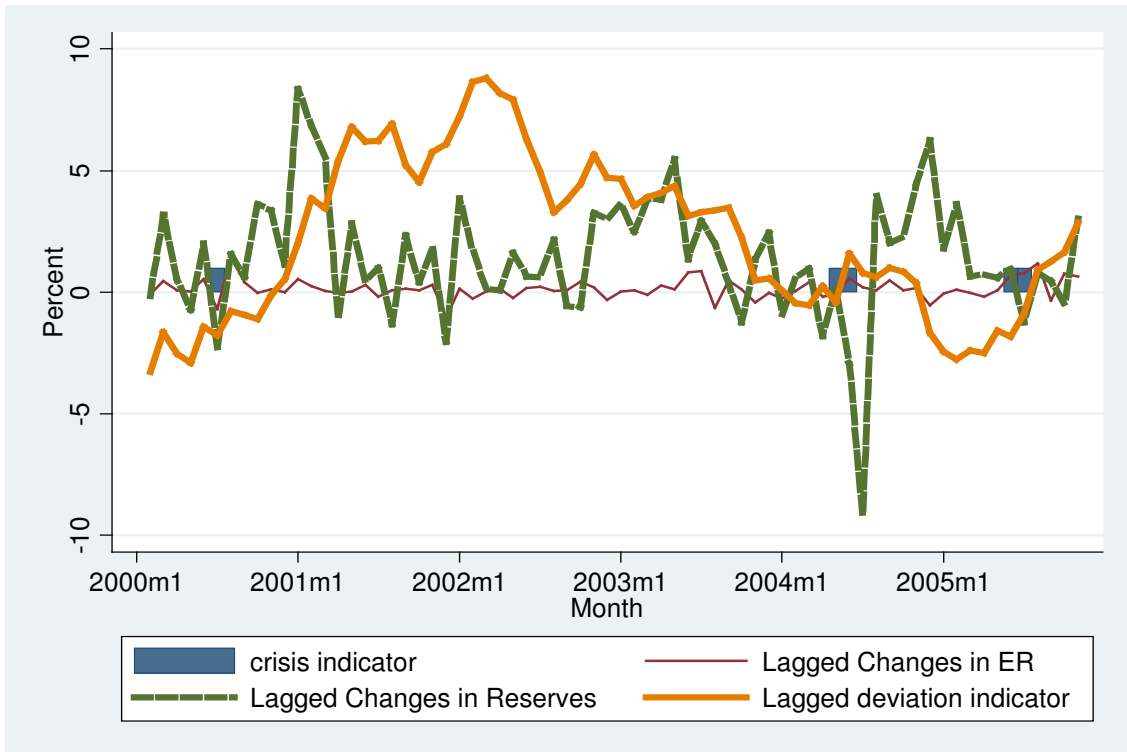


Figure 42: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Cambodia
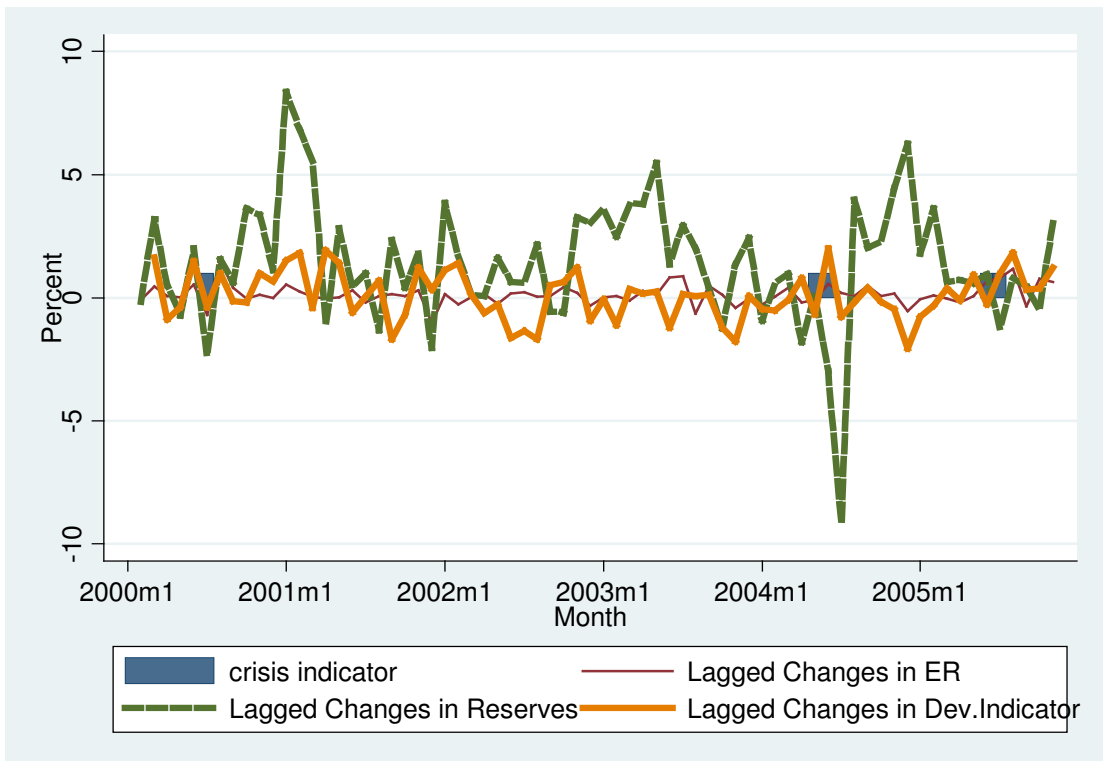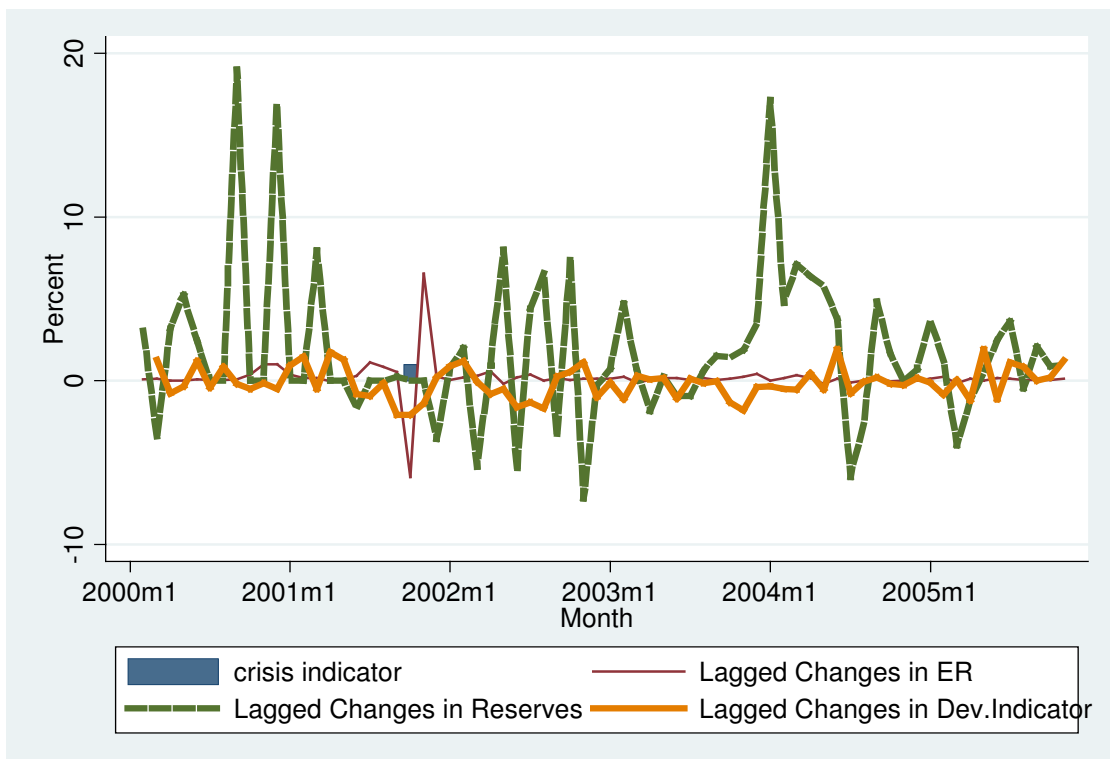
**Figure 43: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Cambodia**
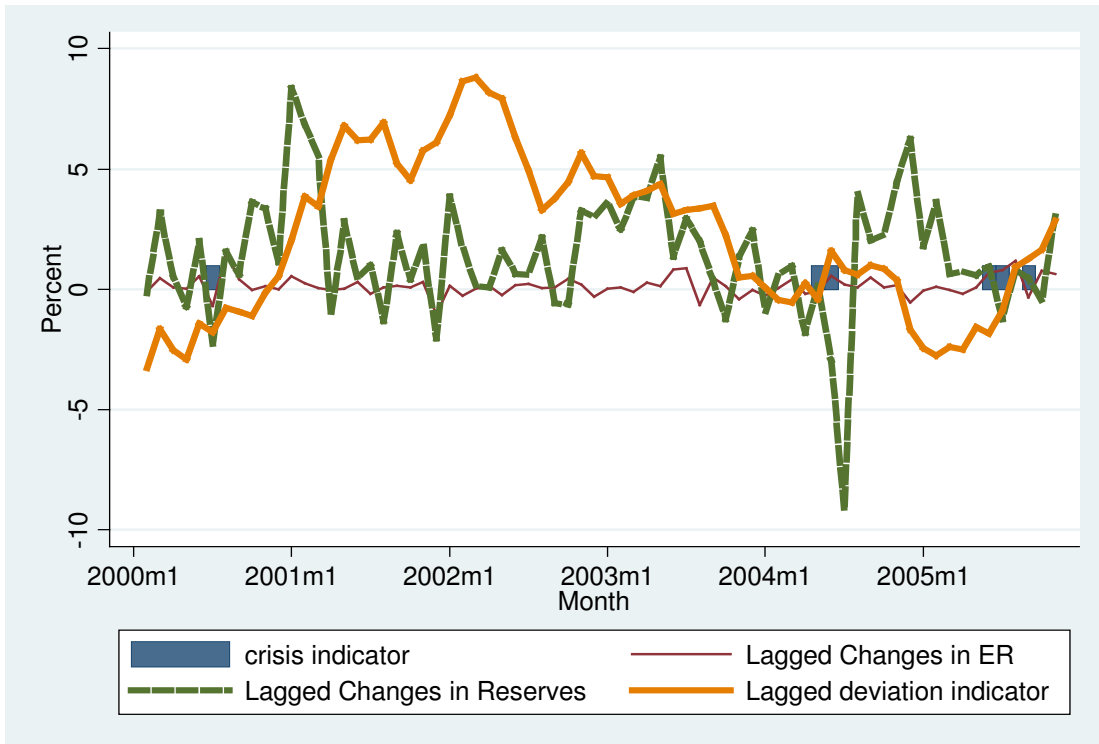


**Figure 44: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Cambodia**
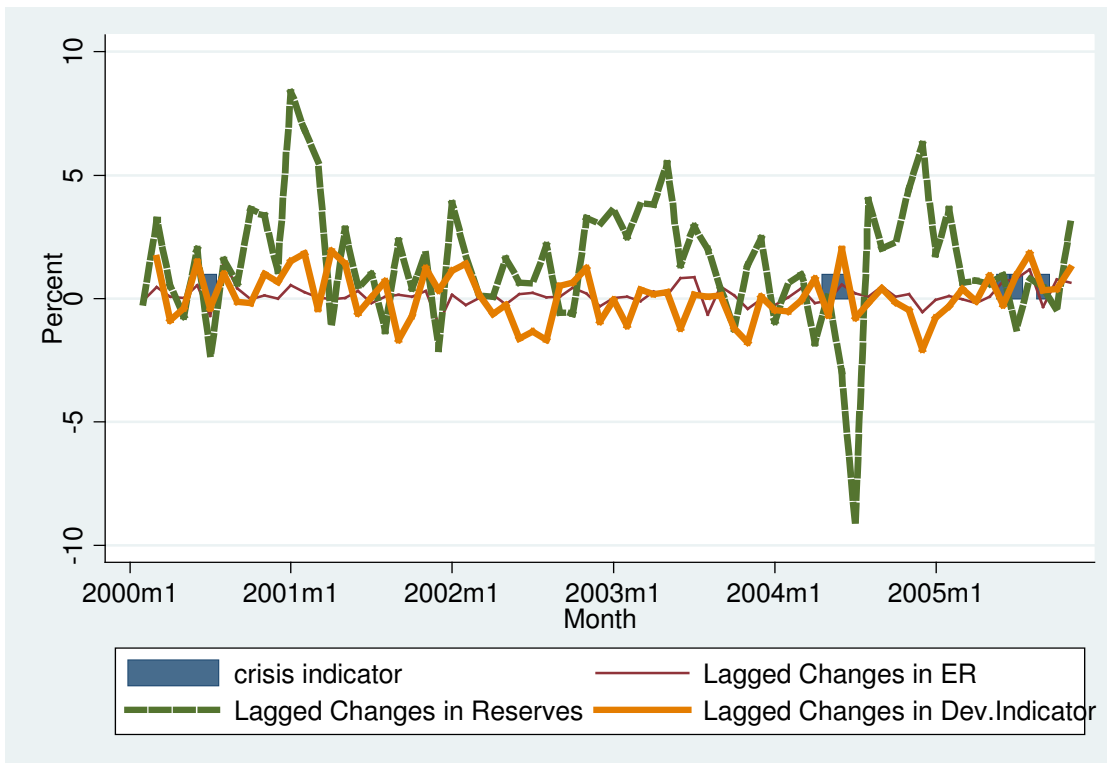
**Figure 45: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: China**
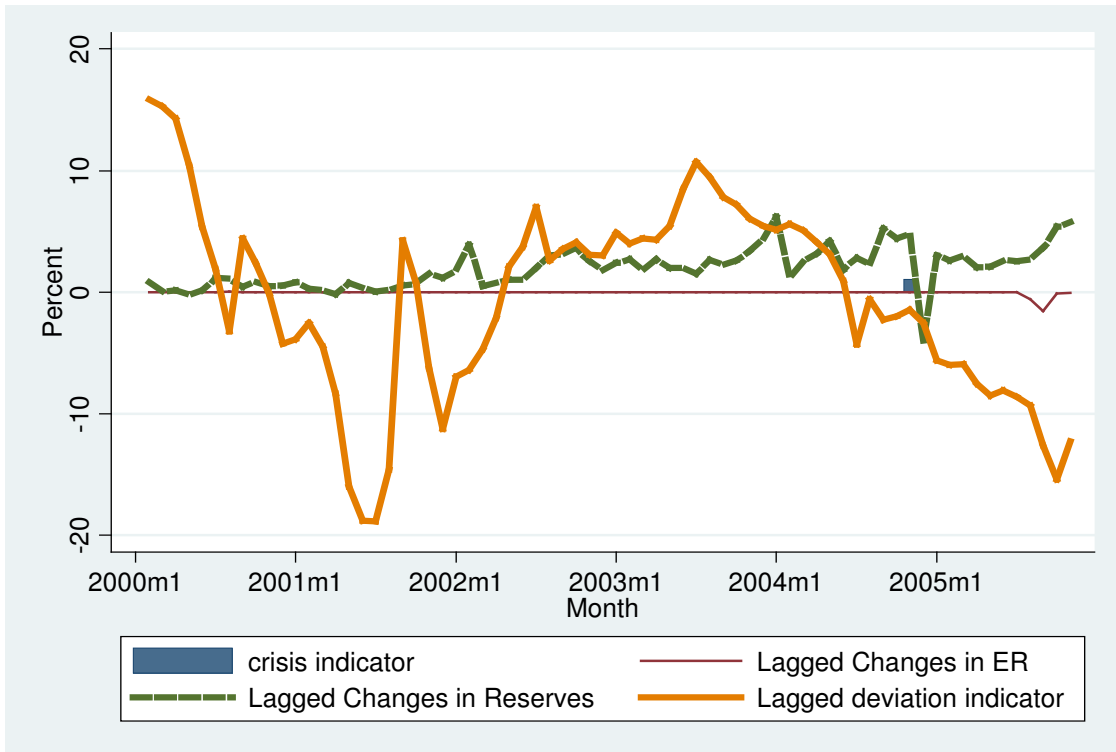


**Figure 46: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: China**
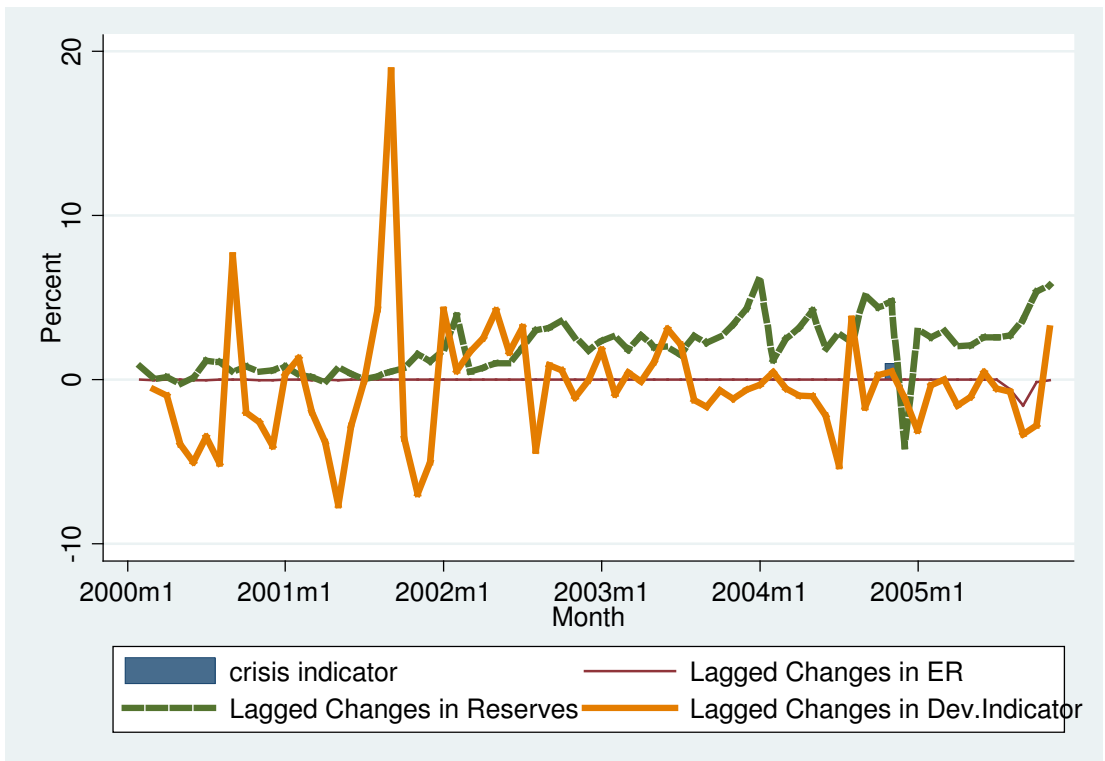
**Figure 47: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: China**
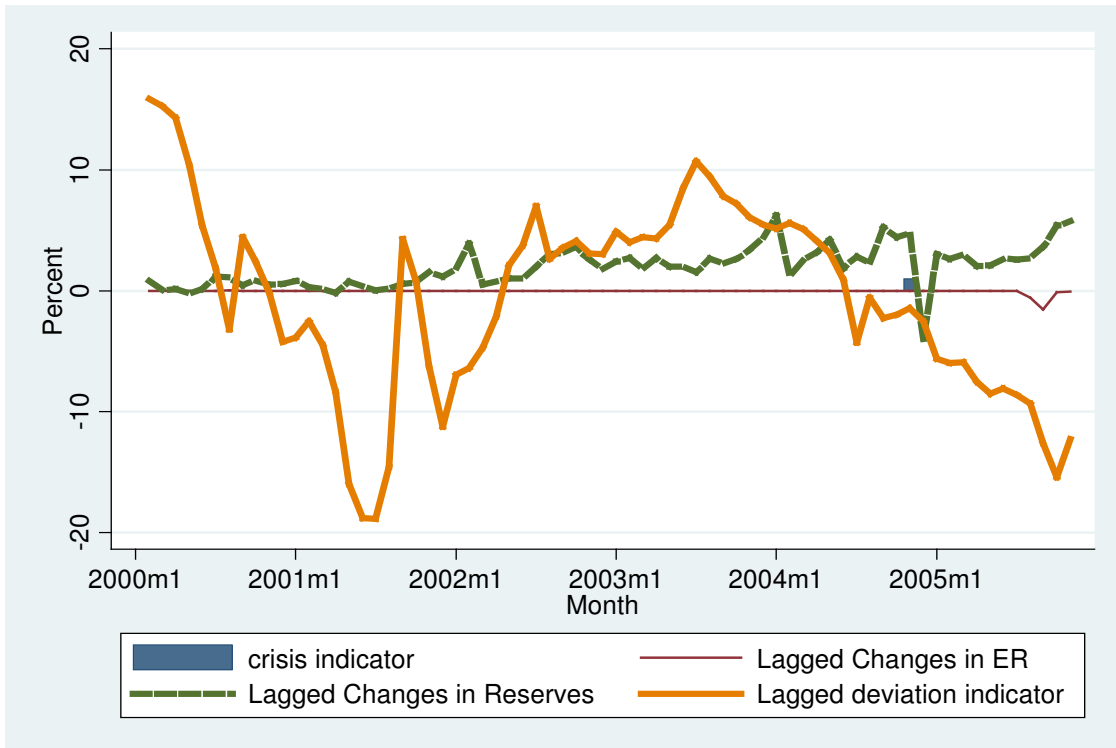


**Figure 48: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: China**
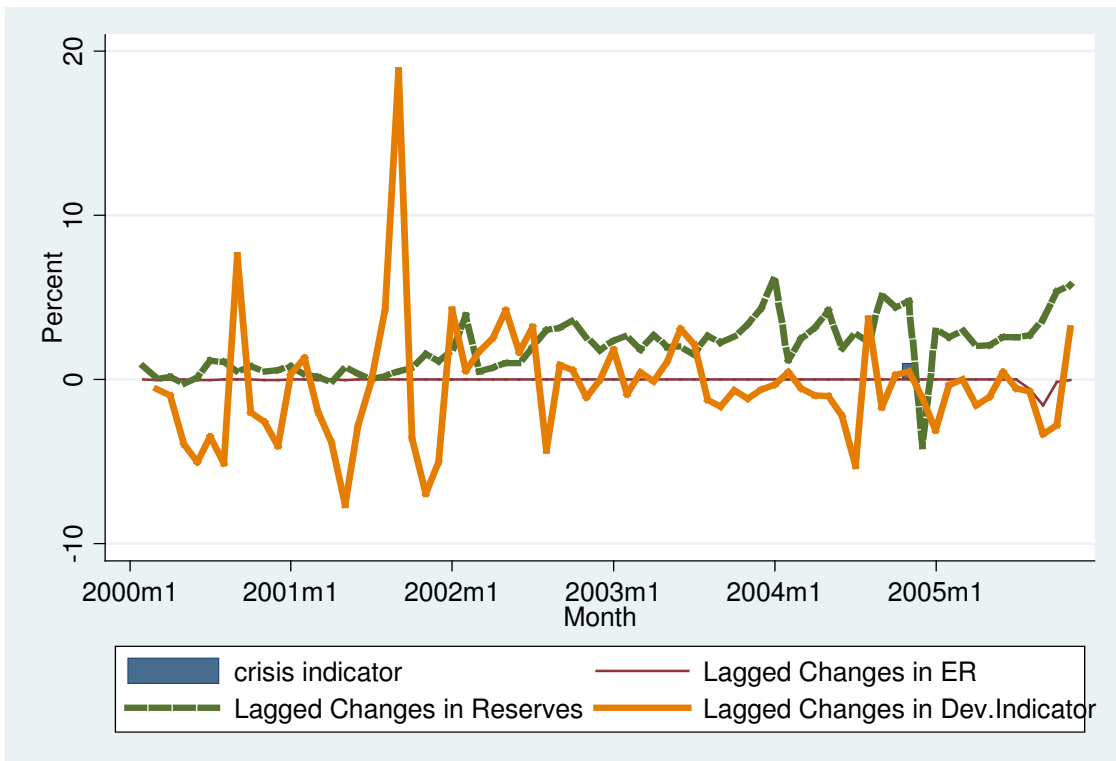
**Figure 49: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Indonesia**
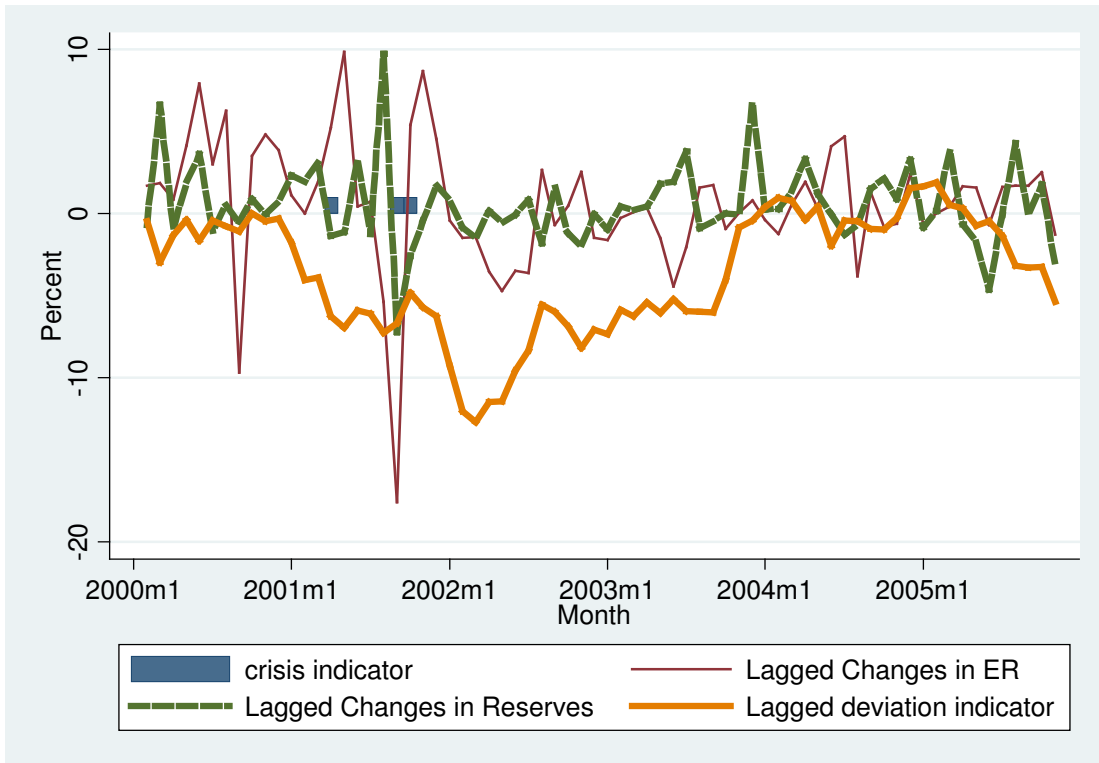


**Figure 50: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Indonesia**
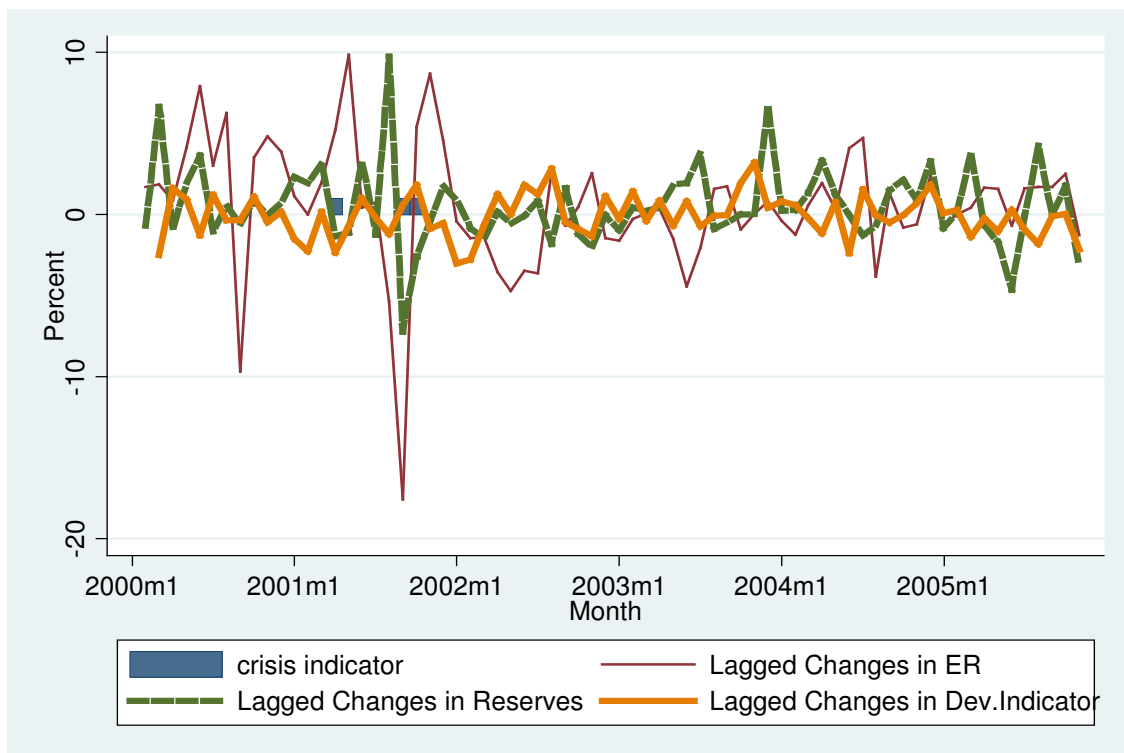
**Figure 51: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Indonesia**
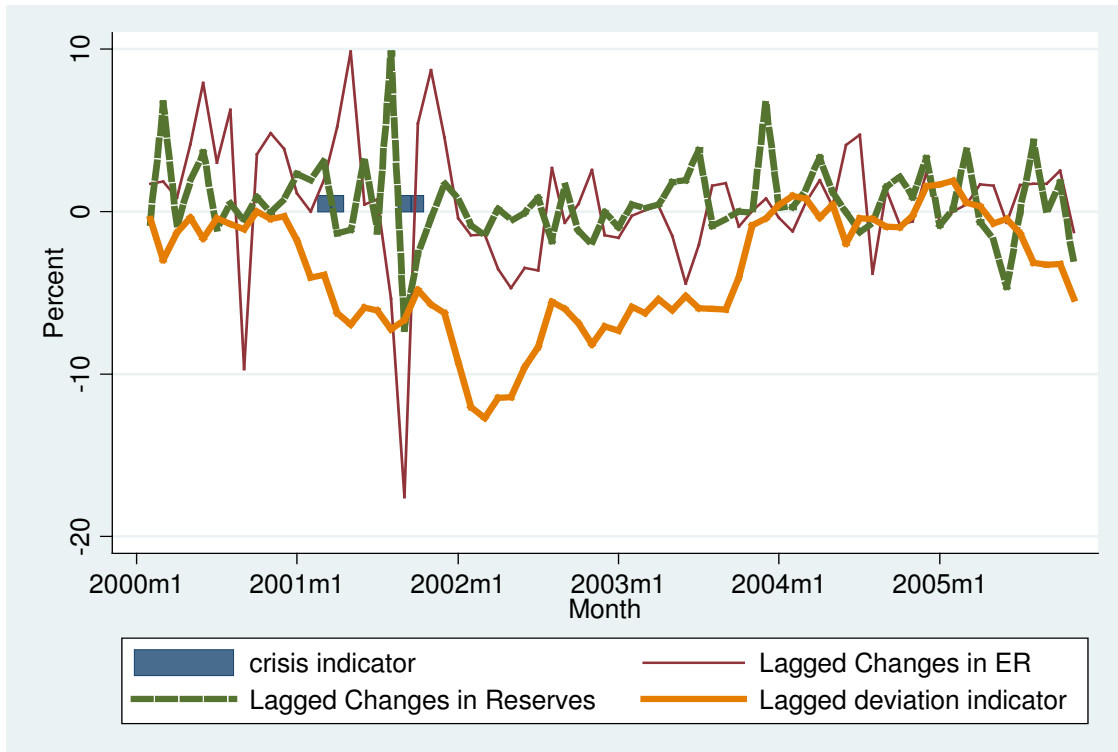


**Figure 52: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Indonesia**
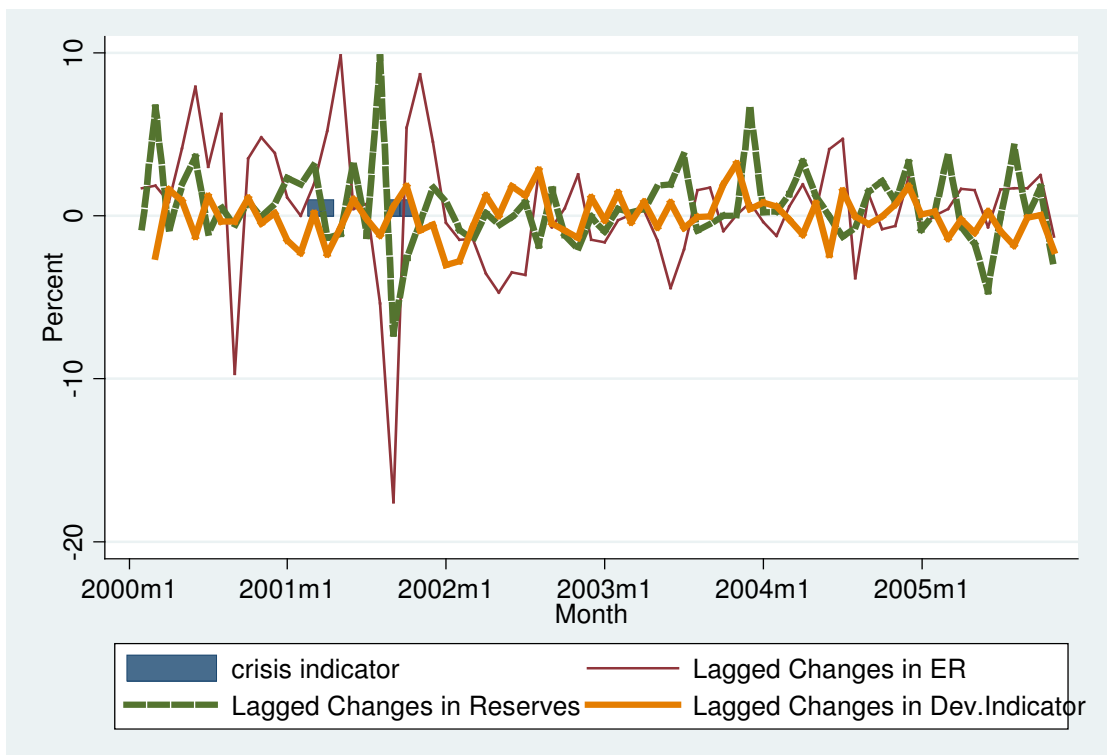
**Figure 53: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Korea**



**Figure 54: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Korea**

**Figure 55: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Korea**



**Figure 56: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Korea**

**Figure 57: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Laos**



**Figure 58: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Laos**

**Figure 59: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Laos**



| | crisis indicator | | Lagged Changes in ER |
|---|---|---|---|
| | Lagged Changes in Reserves | | Lagged deviation indicator |

**Figure 60: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Laos**



| | crisis indicator | | Lagged Changes in ER |
|---|---|---|---|
| | Lagged Changes in Reserves | | Lagged Changes in Dev.Indicator |

**Figure 61: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Malaysia**



**Figure 62: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Malaysia**

**Figure 63: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Malaysia**



**Figure 64: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Malaysia**

**Figure 65: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Philippines**



**Figure 66: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Philippines**

**Figure 67: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Philippines**



**Figure 68: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Philippines**

**Figure 69: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Singapore**



**Figure 70: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Singapore**

**Figure 71: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Singapore**
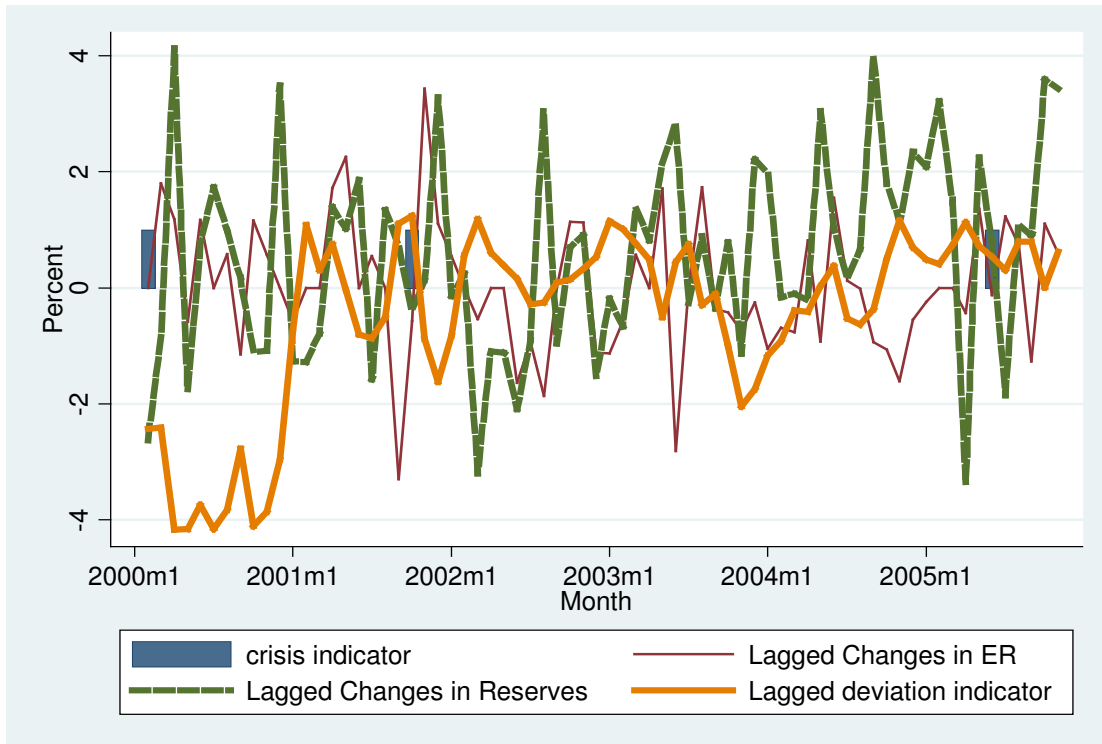


**Figure 72: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Singapore**

**Figure 73: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Thailand**



**Figure 74: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Thailand**

**Figure 75: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Thailand**



**Figure 76: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Thailand**

**Figure 77: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Vietnam**



**Figure 78: Crisis indicator (1.75 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Vietnam**
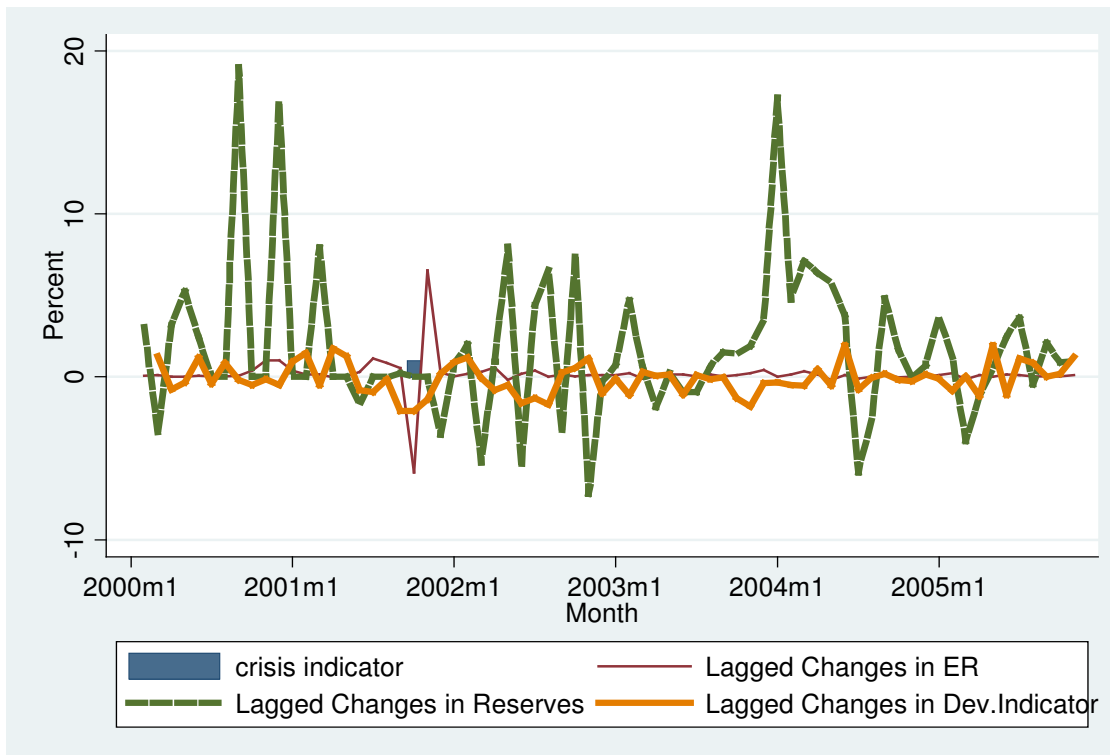
**Figure 79: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and deviation indicator: Vietnam**



**Figure 80: Crisis indicator (1.5 standard deviations from the mean), exchange rate and international reserve changes and change in deviation indicator: Vietnam**
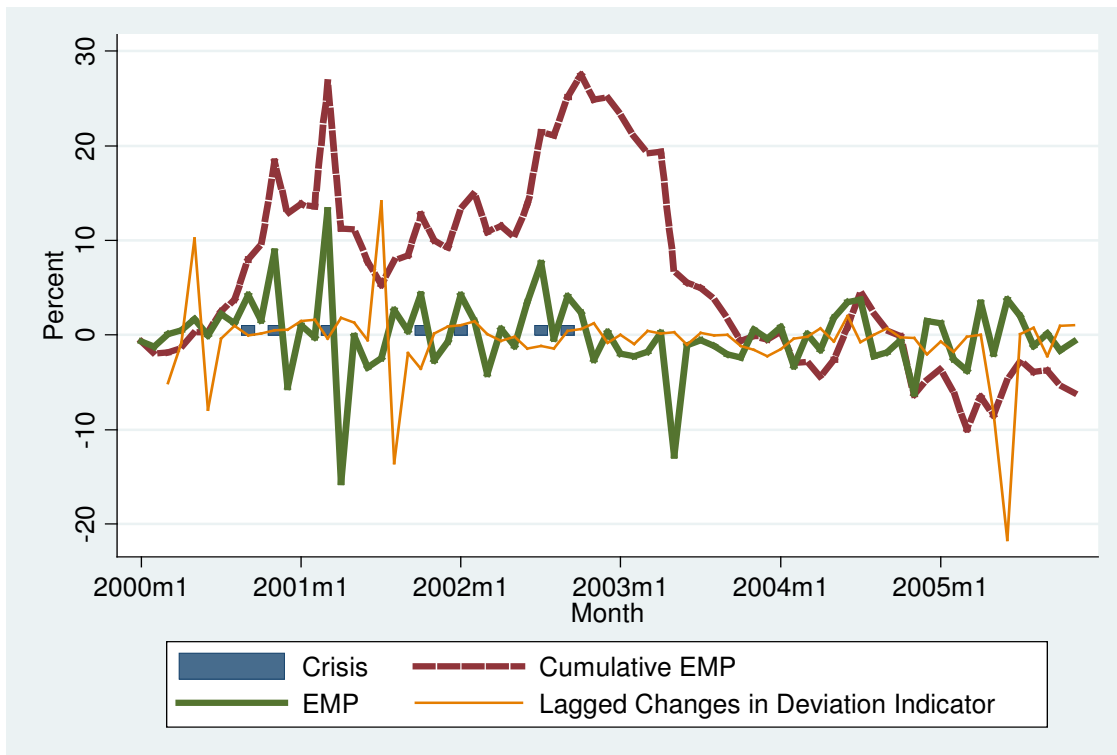
**Figure 81: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Cambodia**
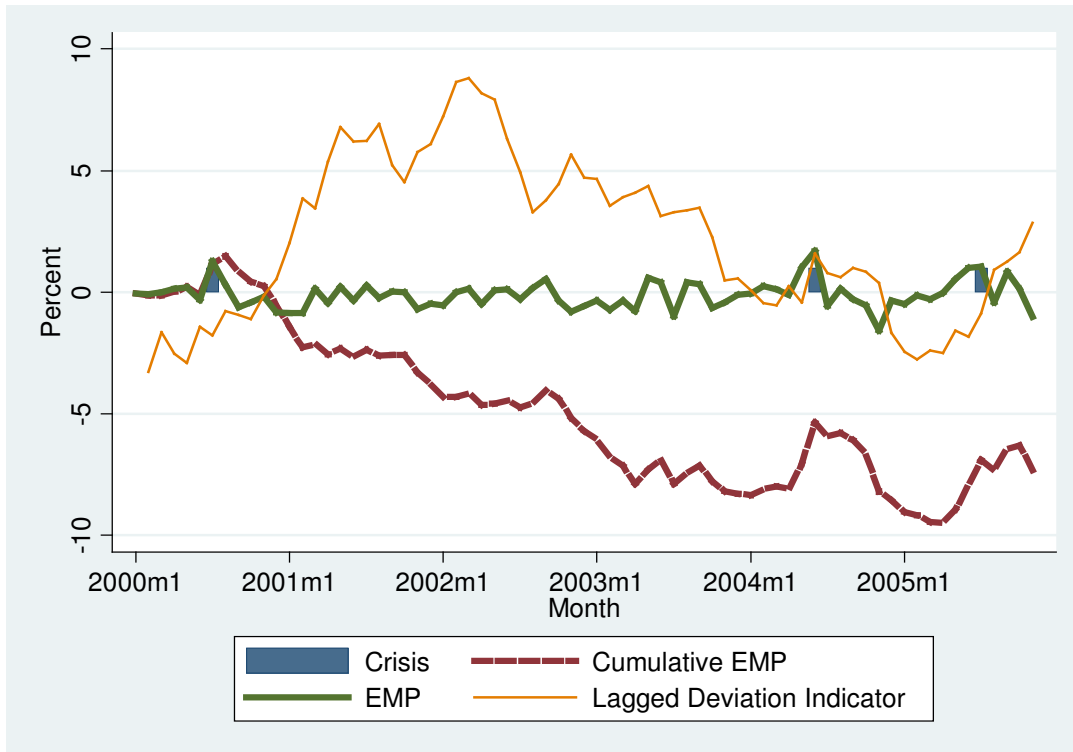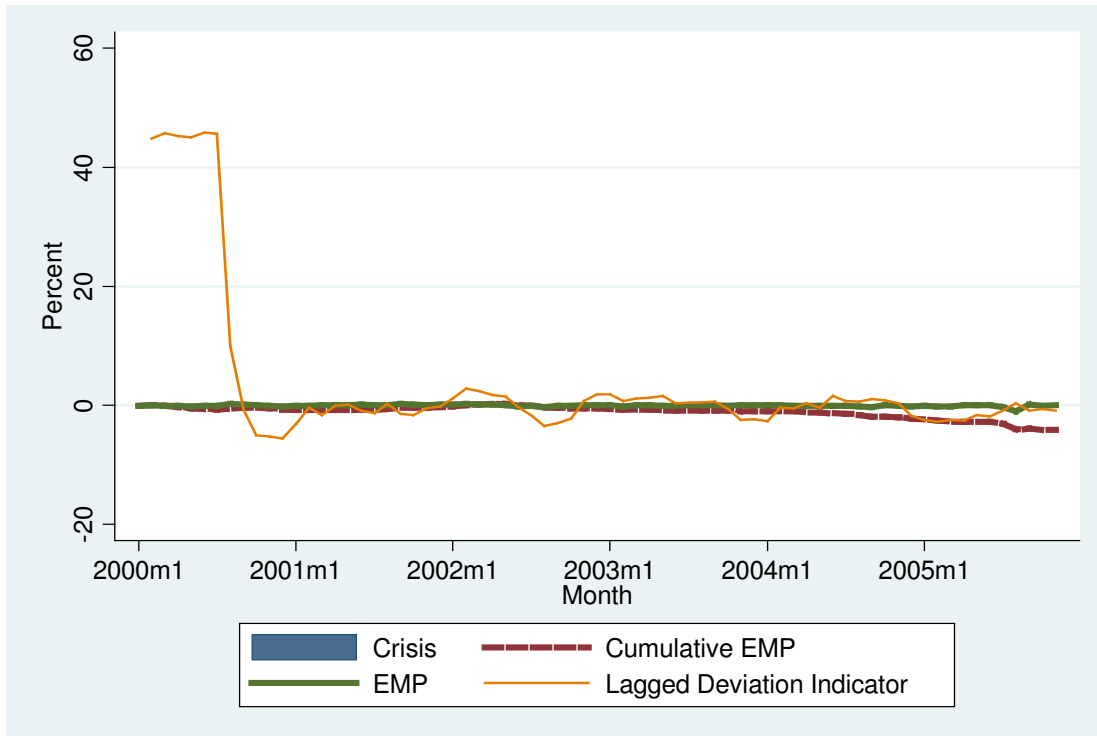


**Figure 82: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Cambodia**
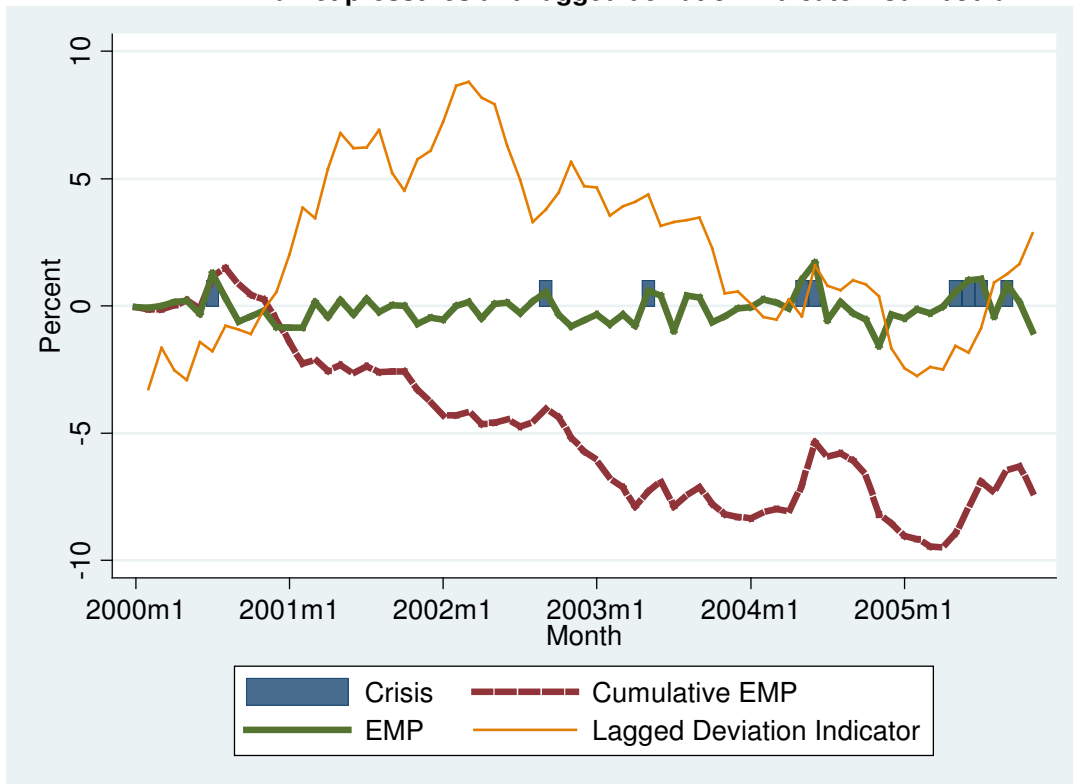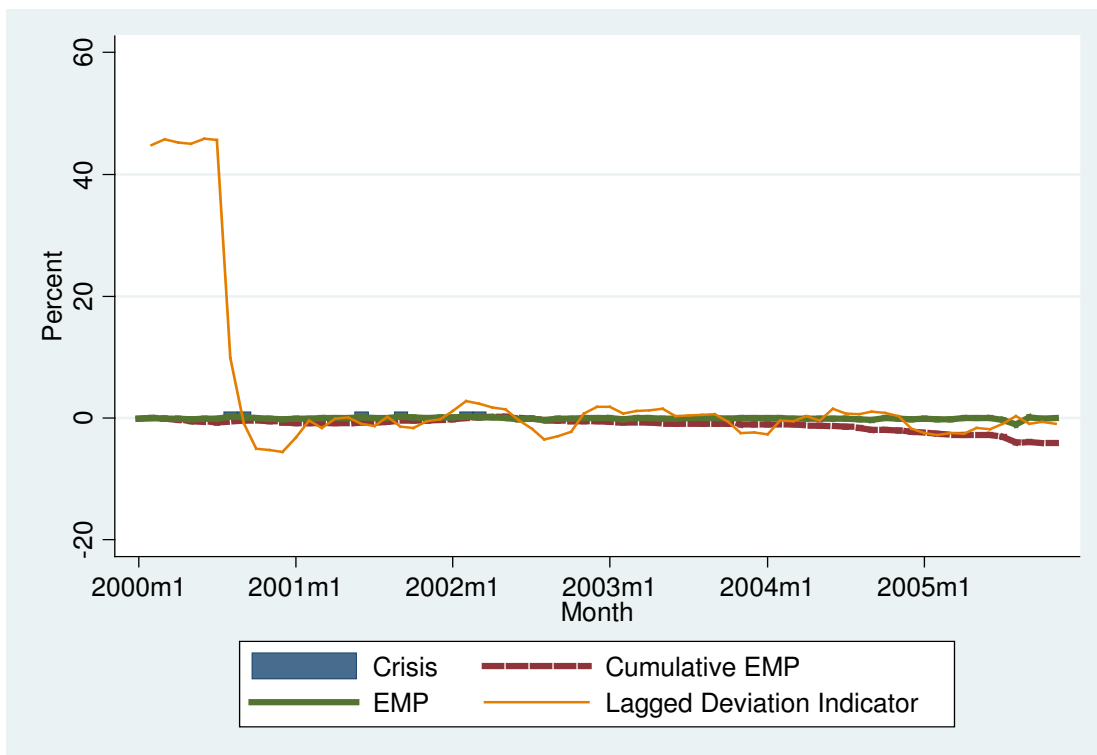
**Figure 83: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Cambodia**
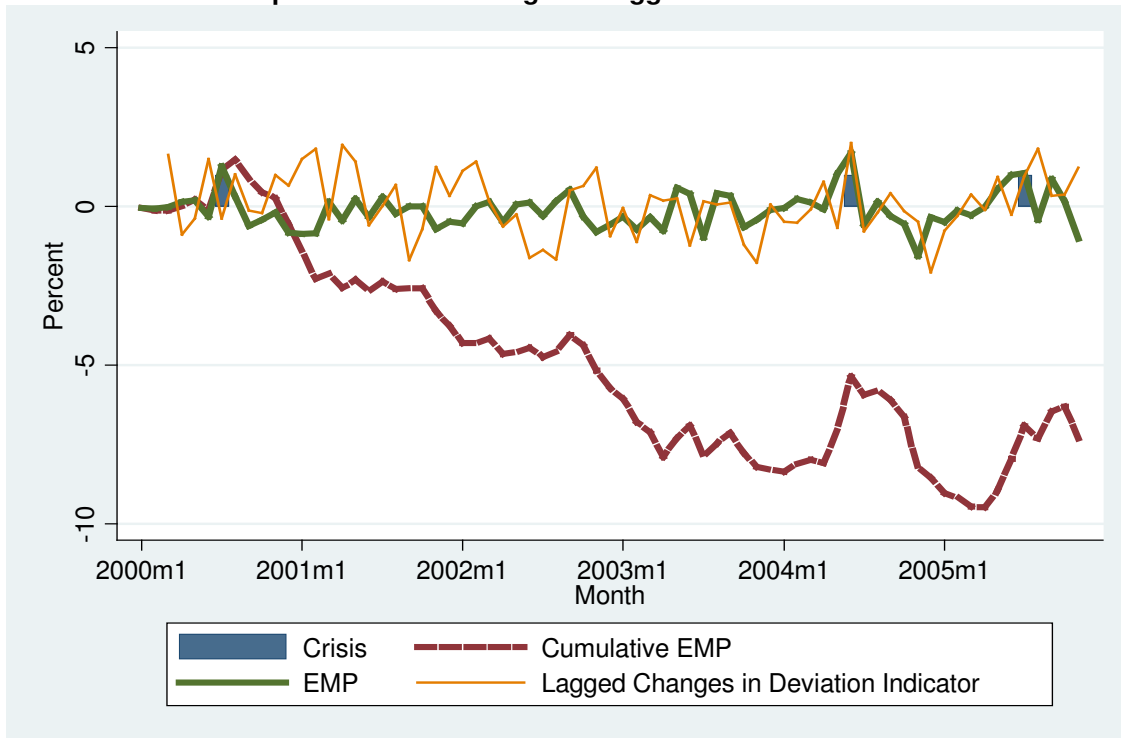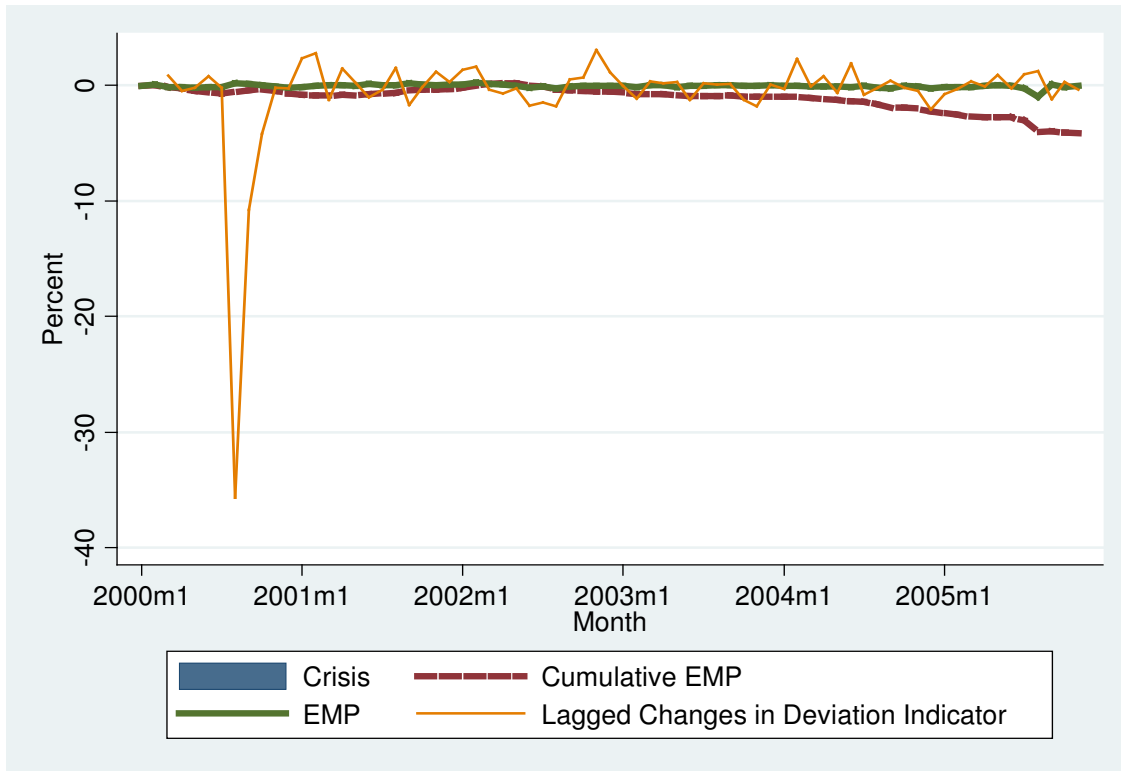


**Figure 84: Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Cambodia**
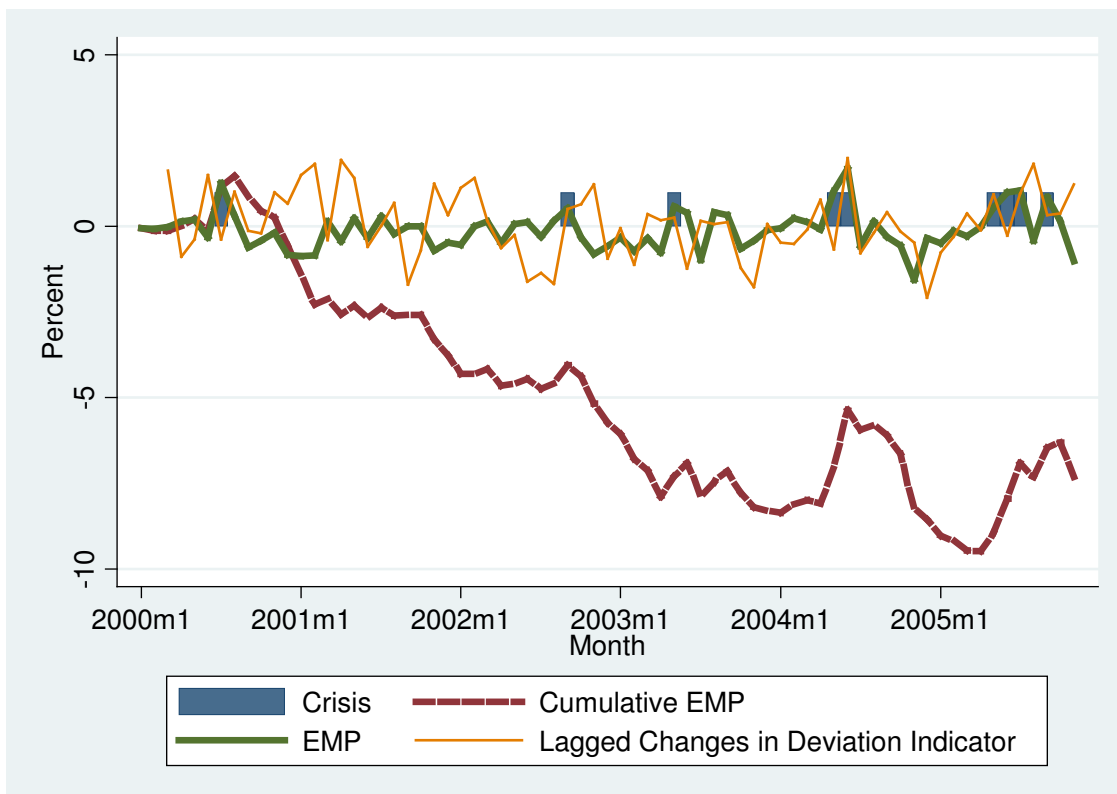
**Figure 85: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: China**
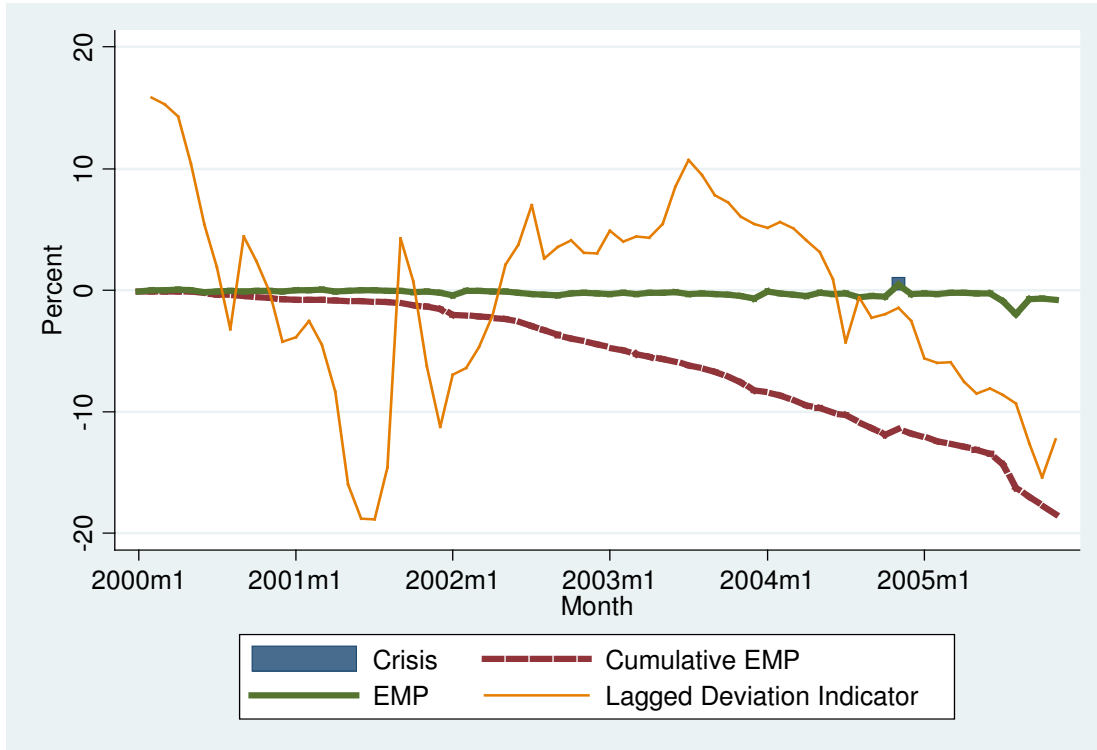


**Figure 86: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: China**
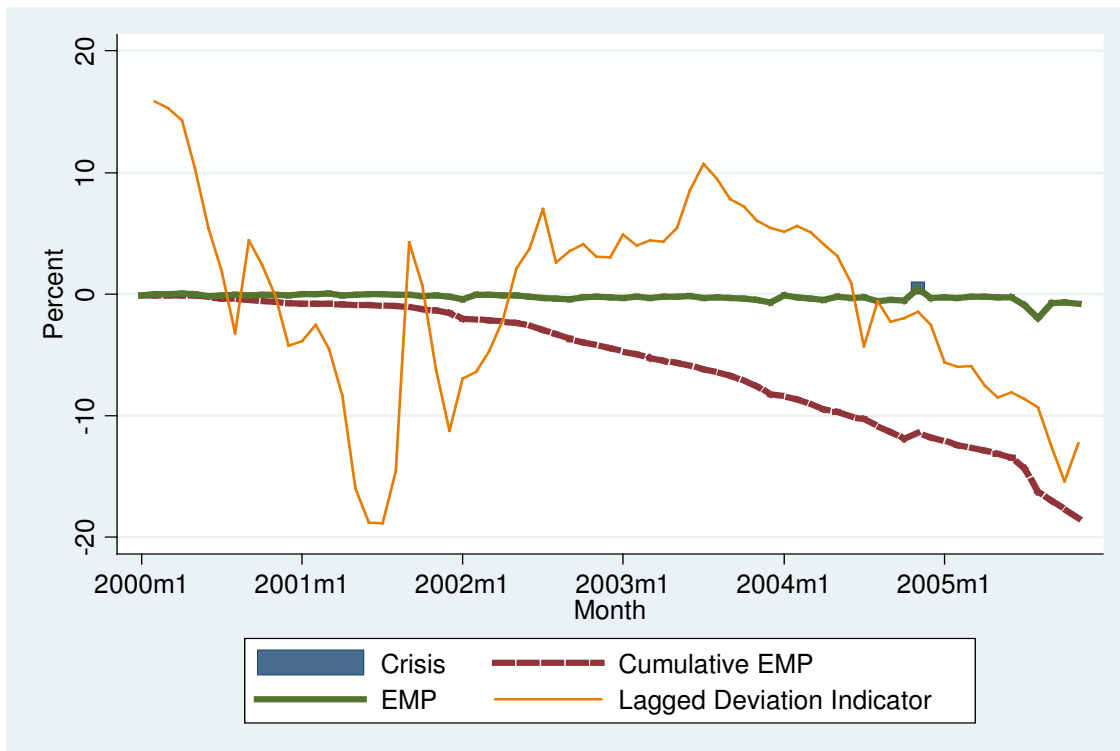
**Figure 87: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: China**
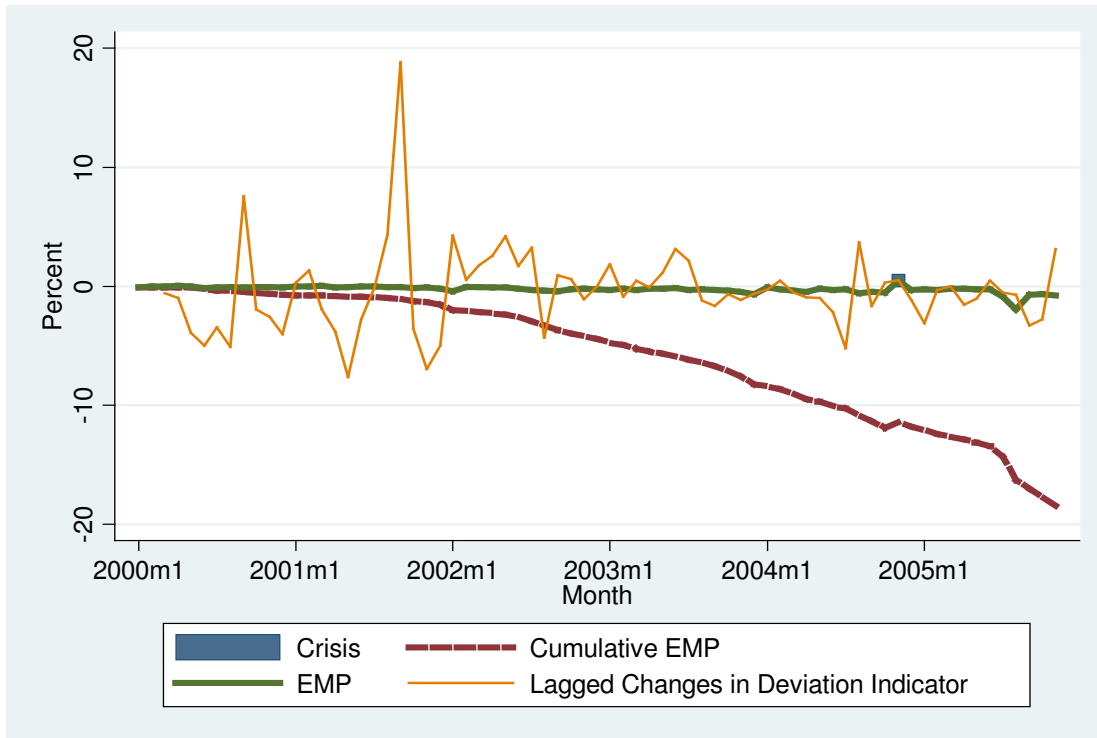


**Figure 88 Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: China**
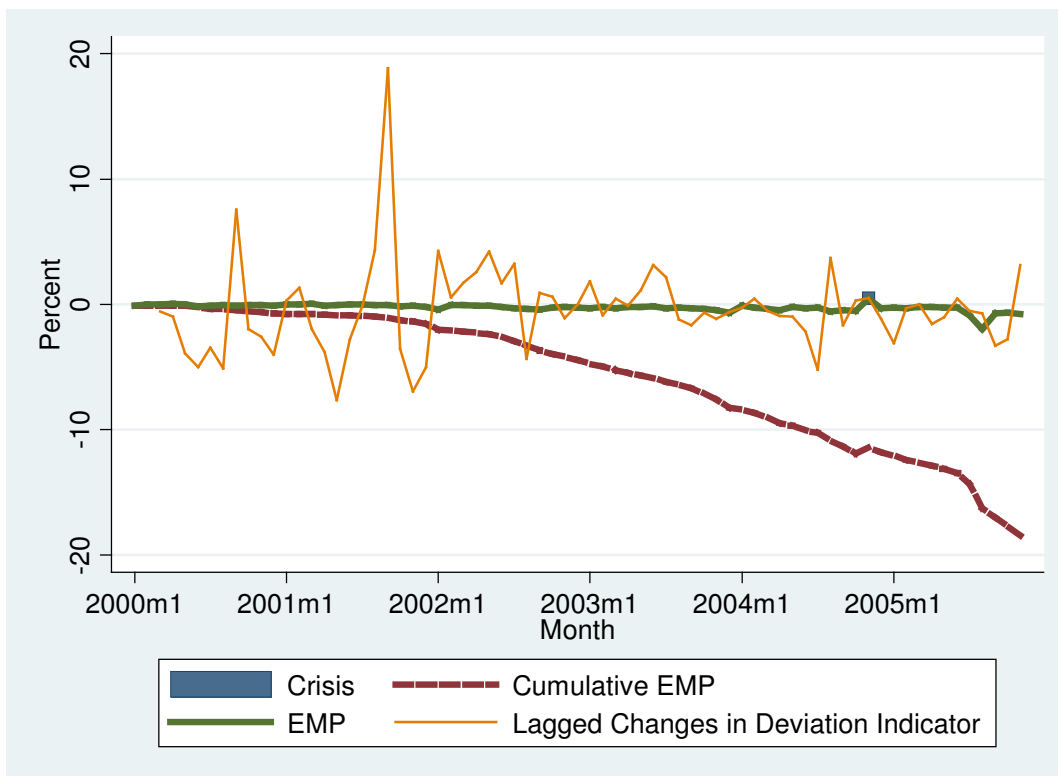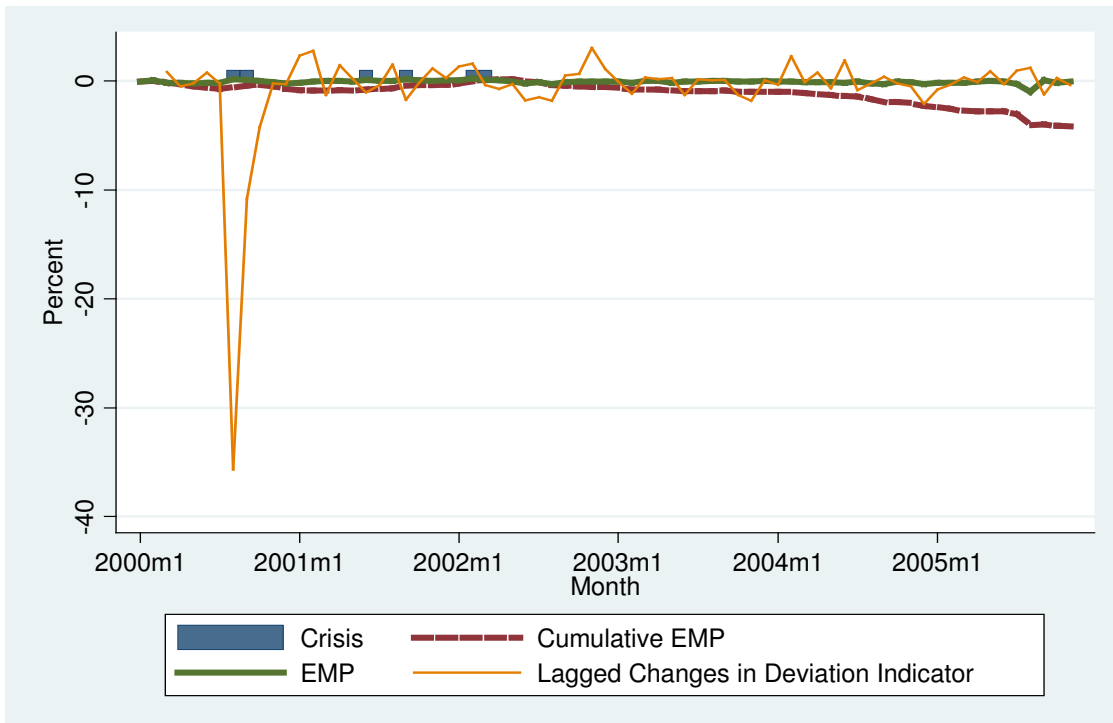
**Figure 89: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Indonesia**
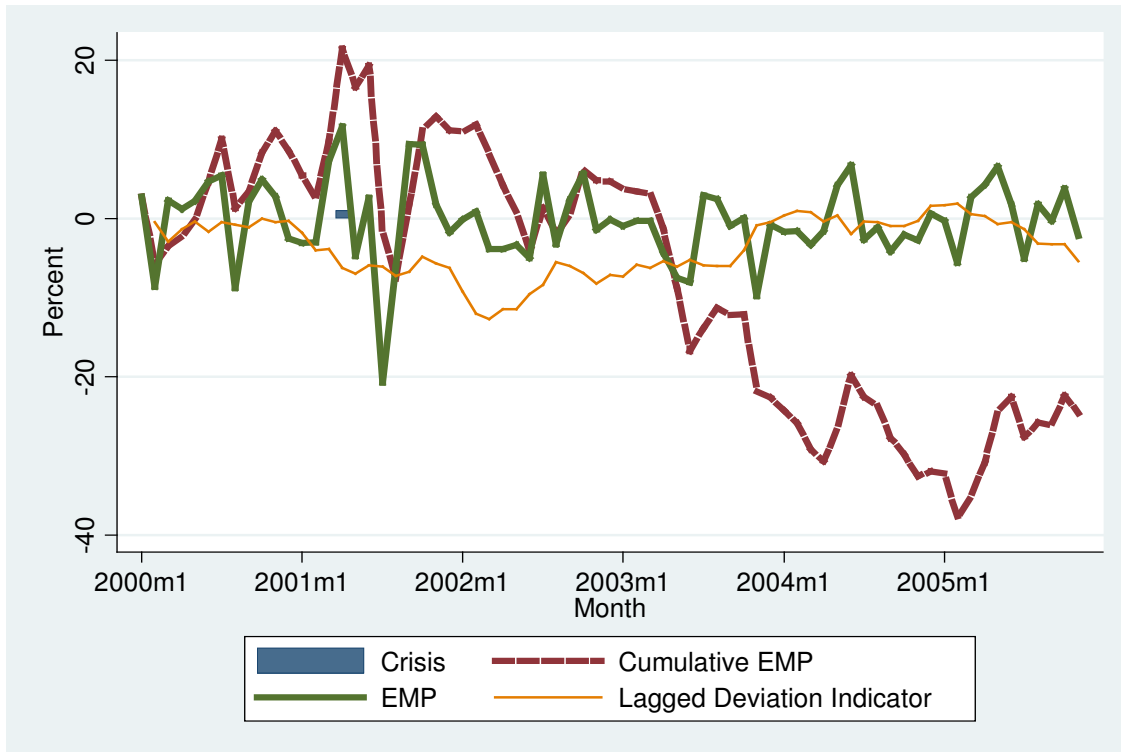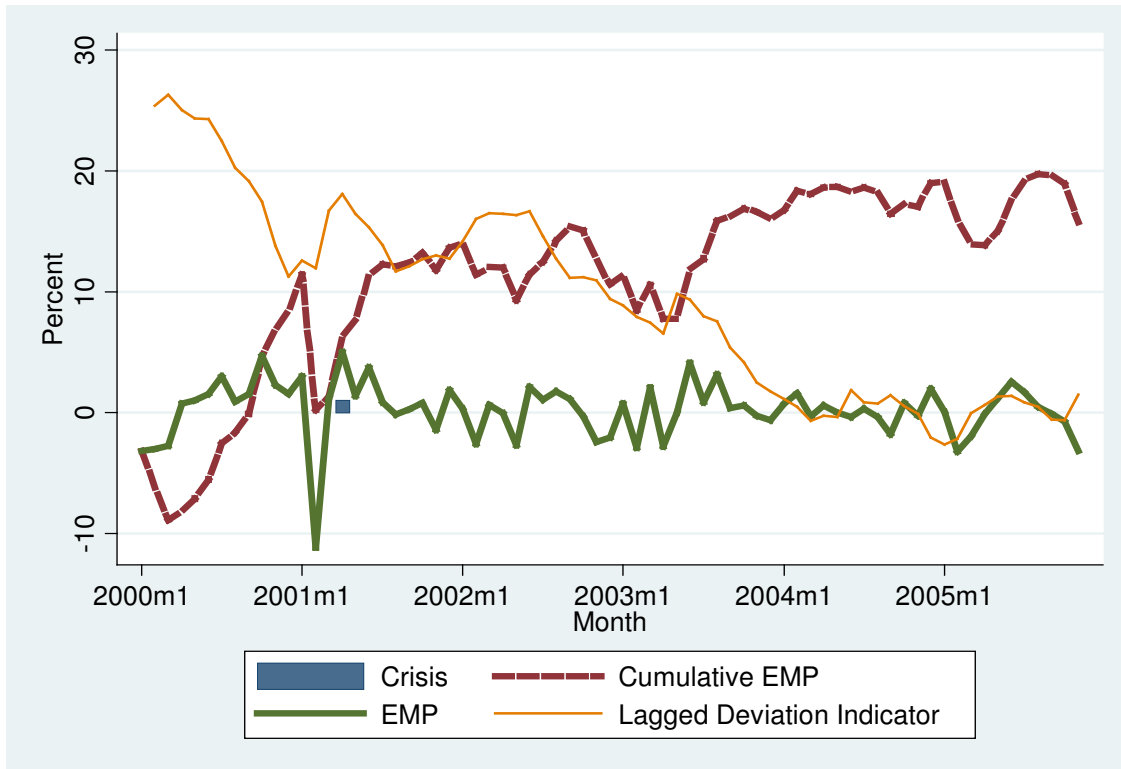


**Figure 90: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Indonesia**
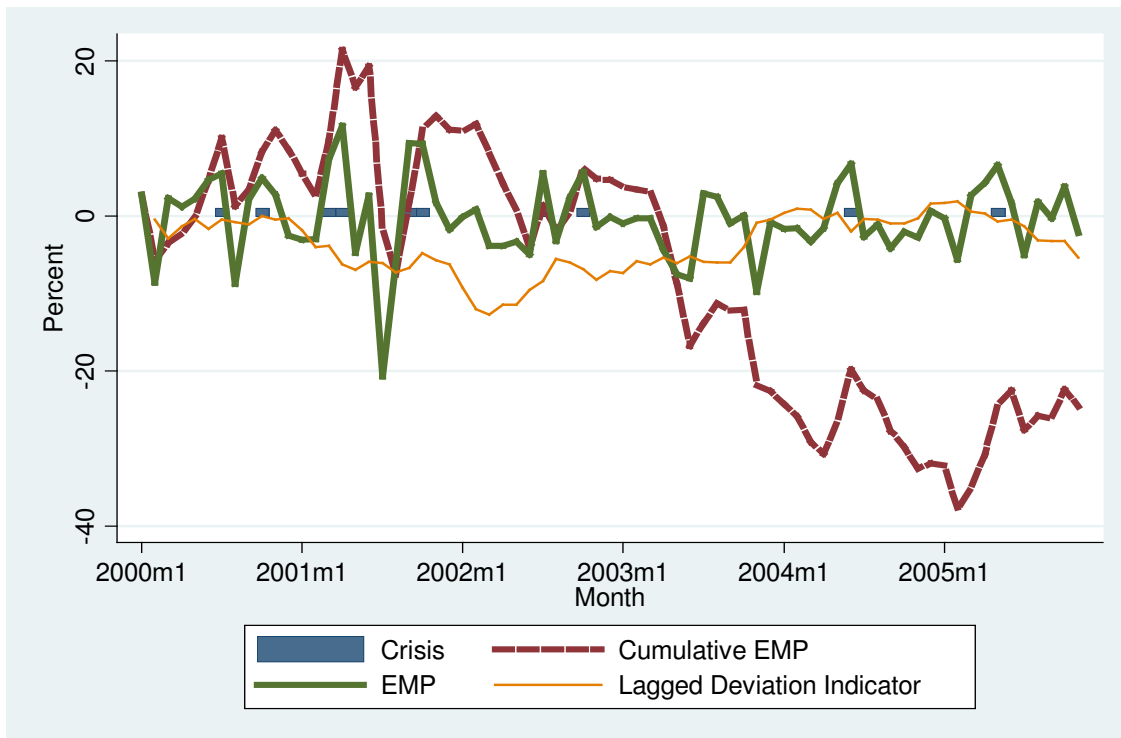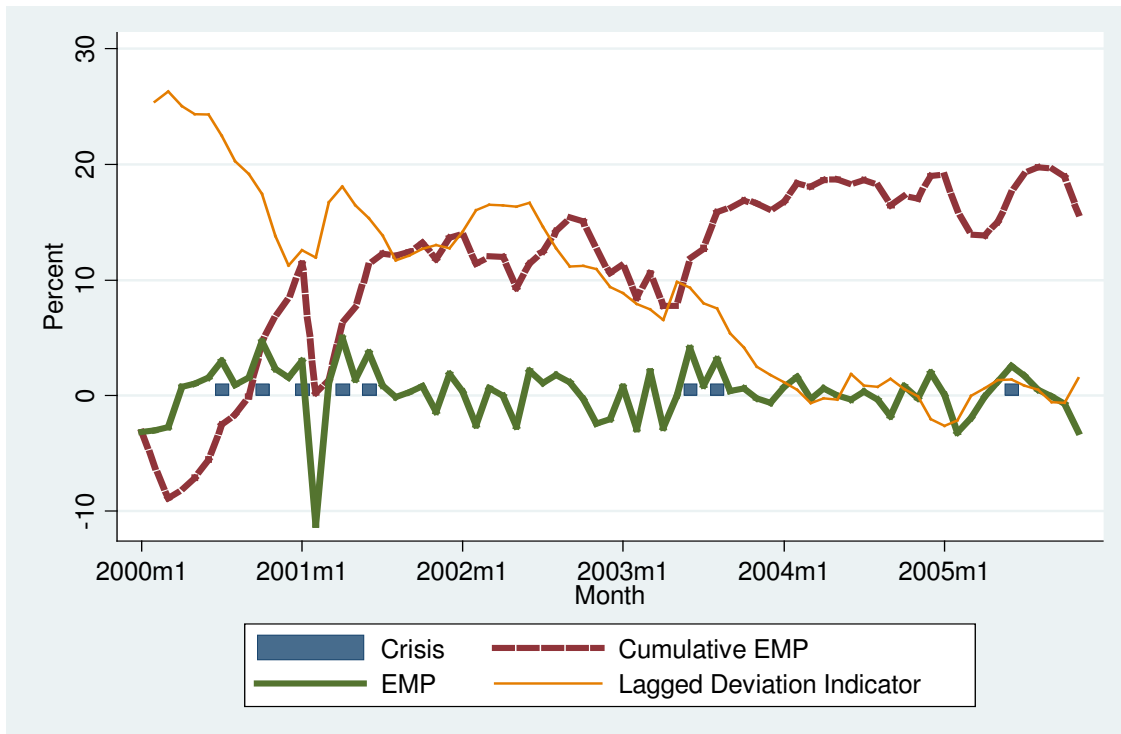
**Figure 91: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Indonesia**
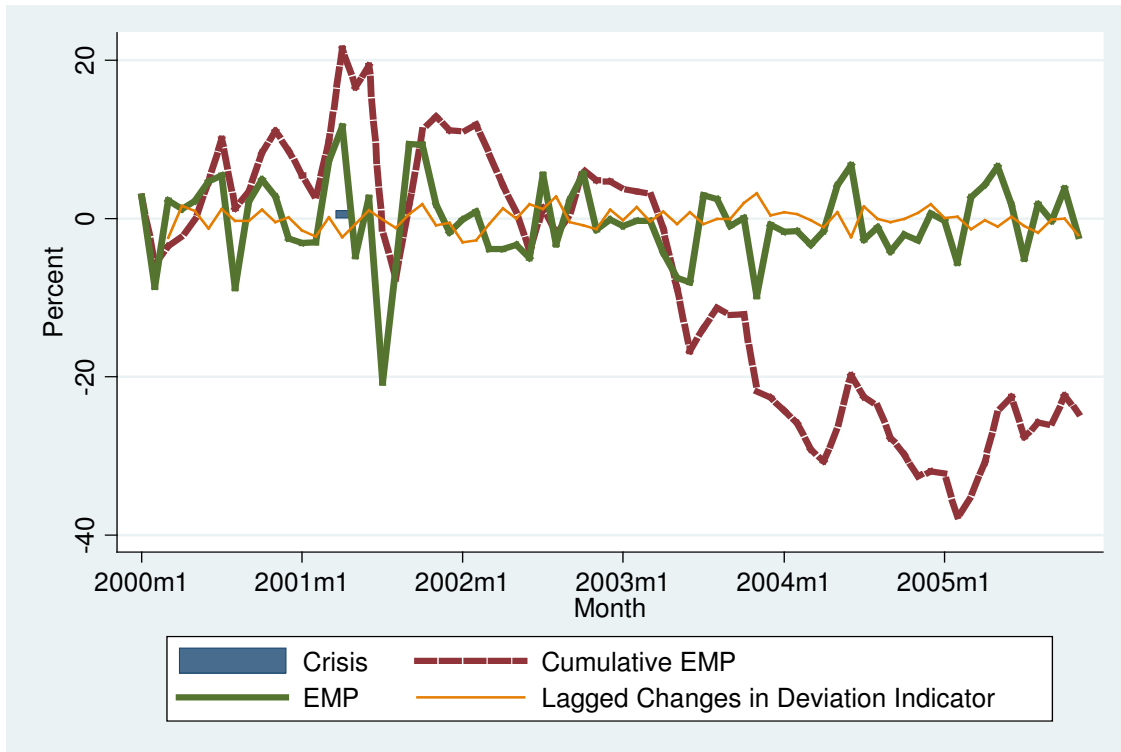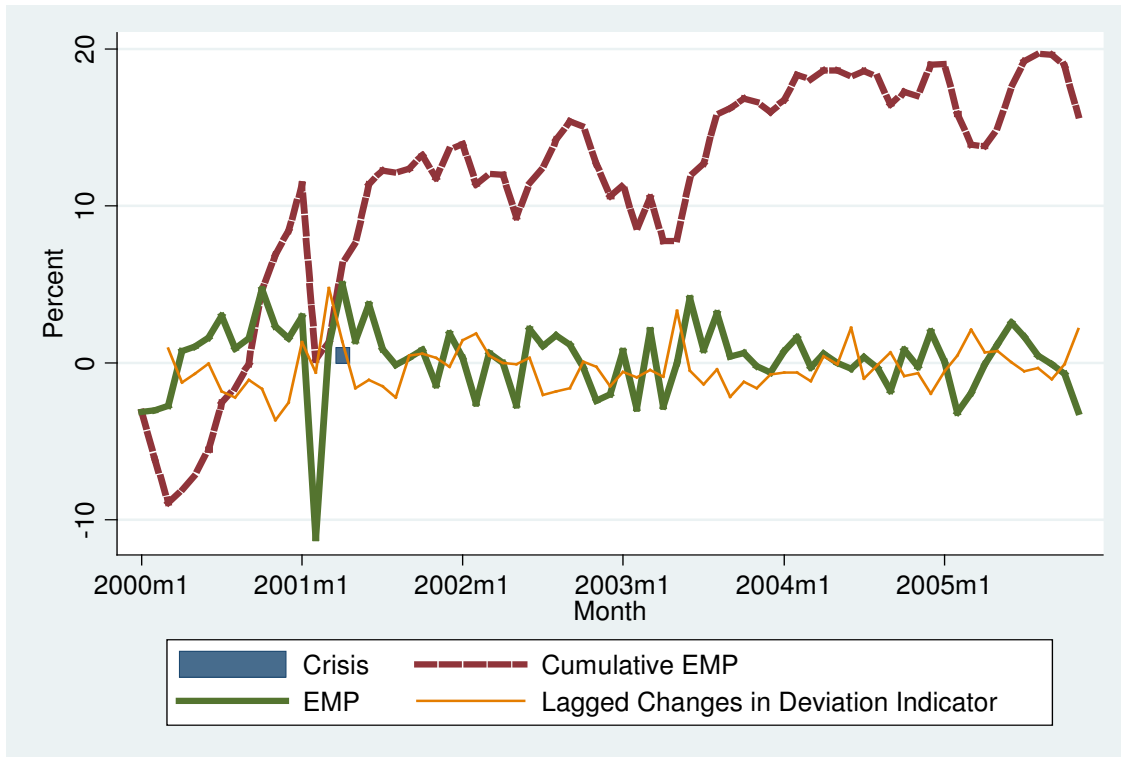


**Figure 92 Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Indonesia**
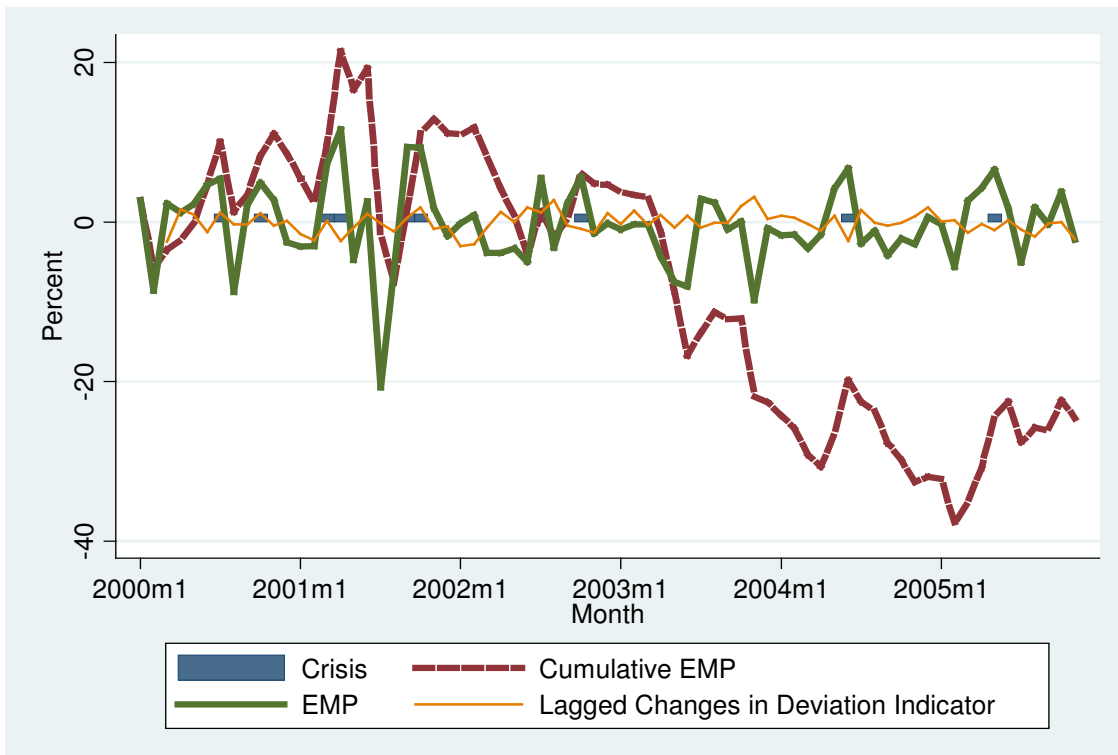
**Figure 93: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Korea**
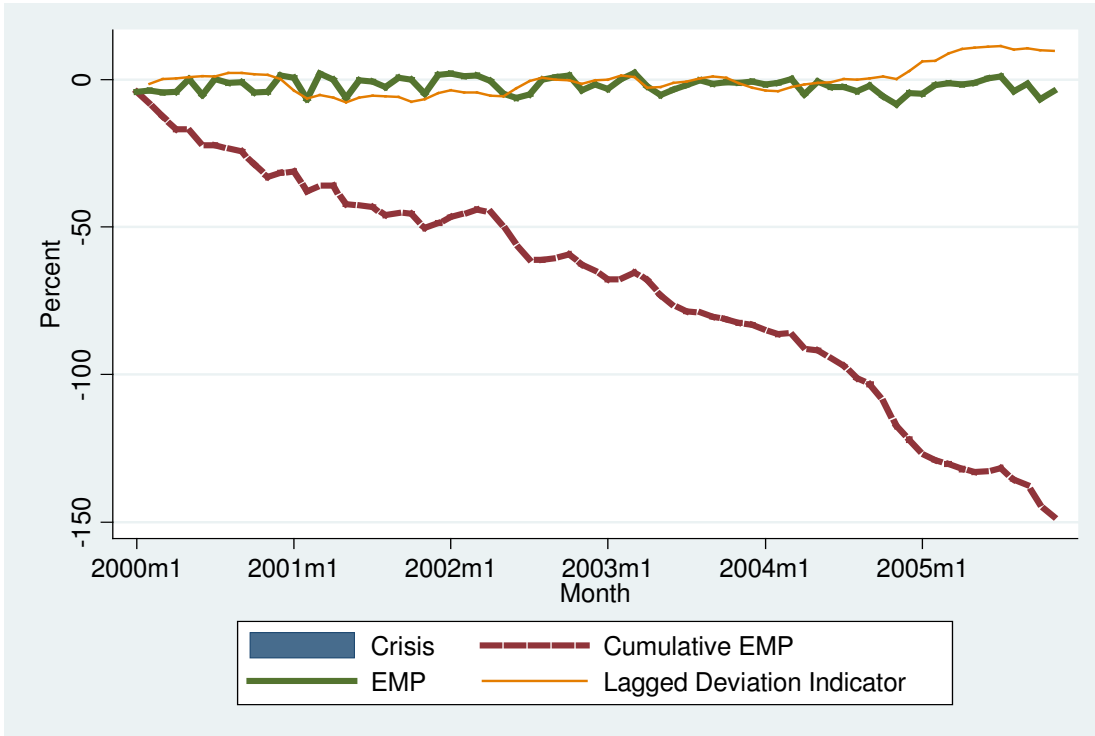


**Figure 94: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Korea**
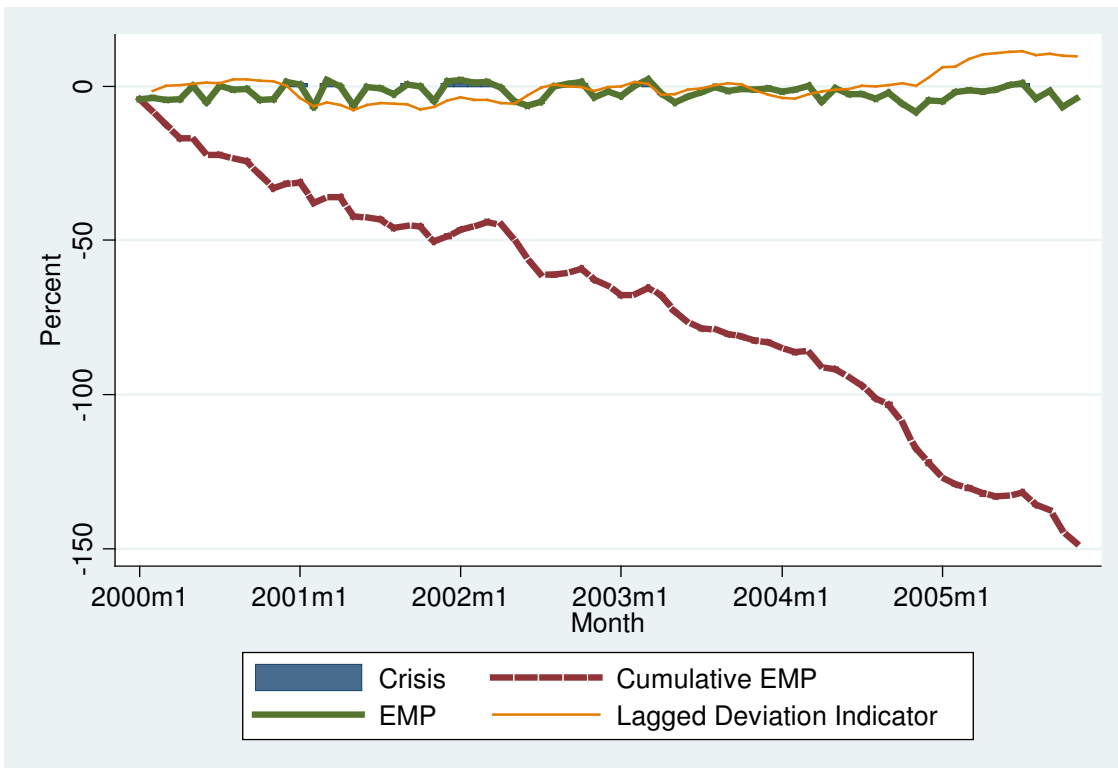
**Figure 95: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Korea**
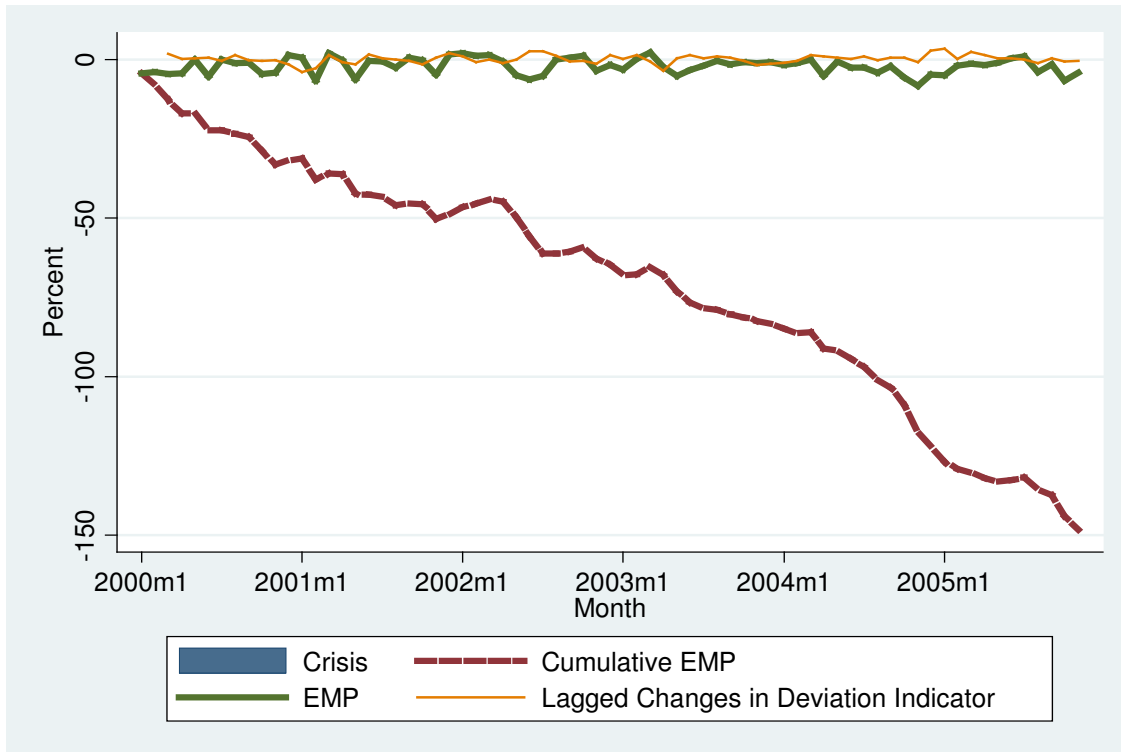


**Figure 96: Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Korea**
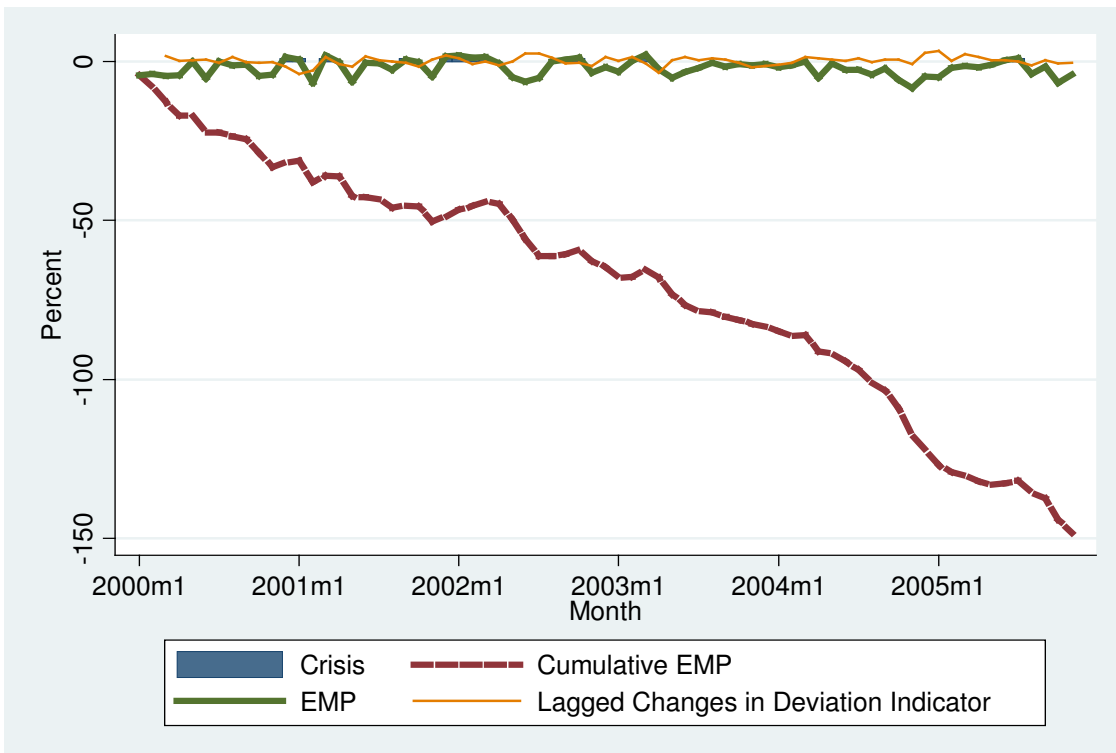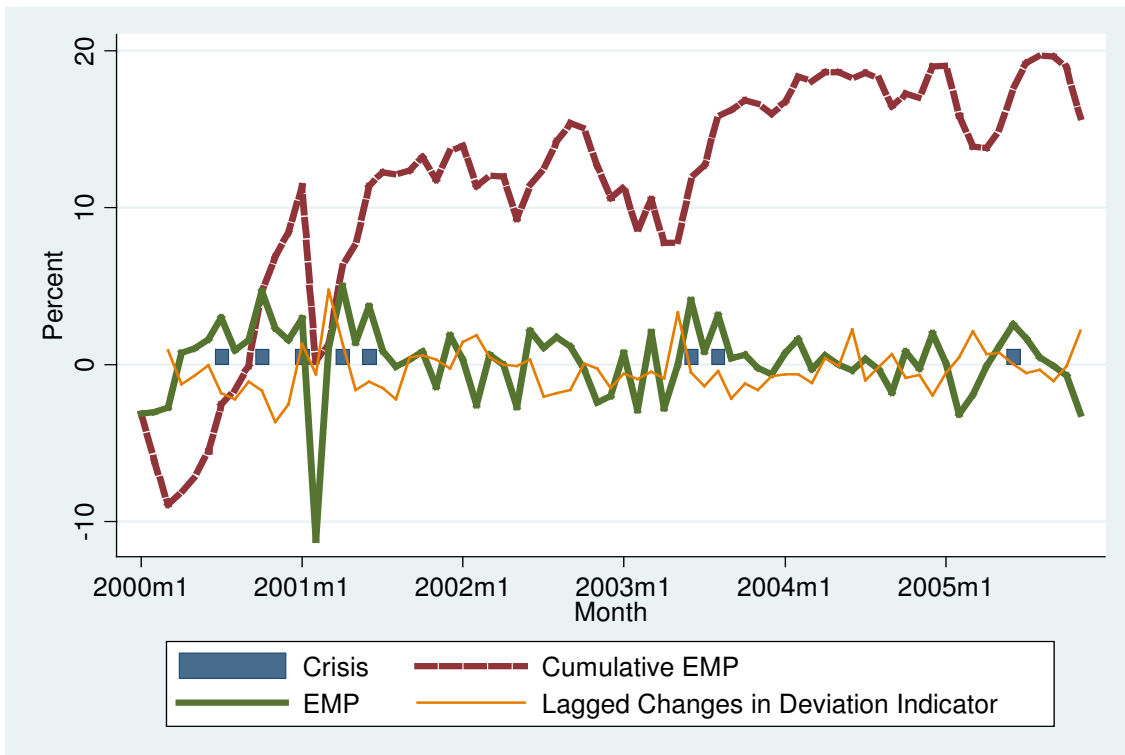
**Figure 97: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Laos**
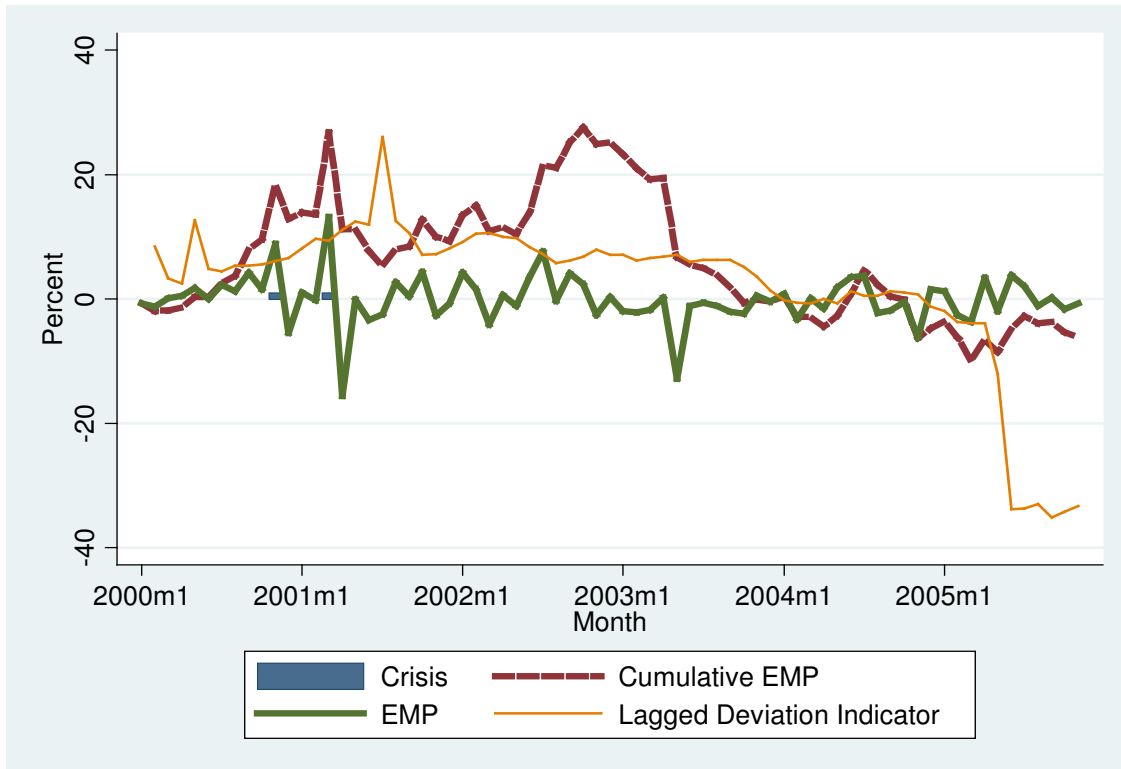


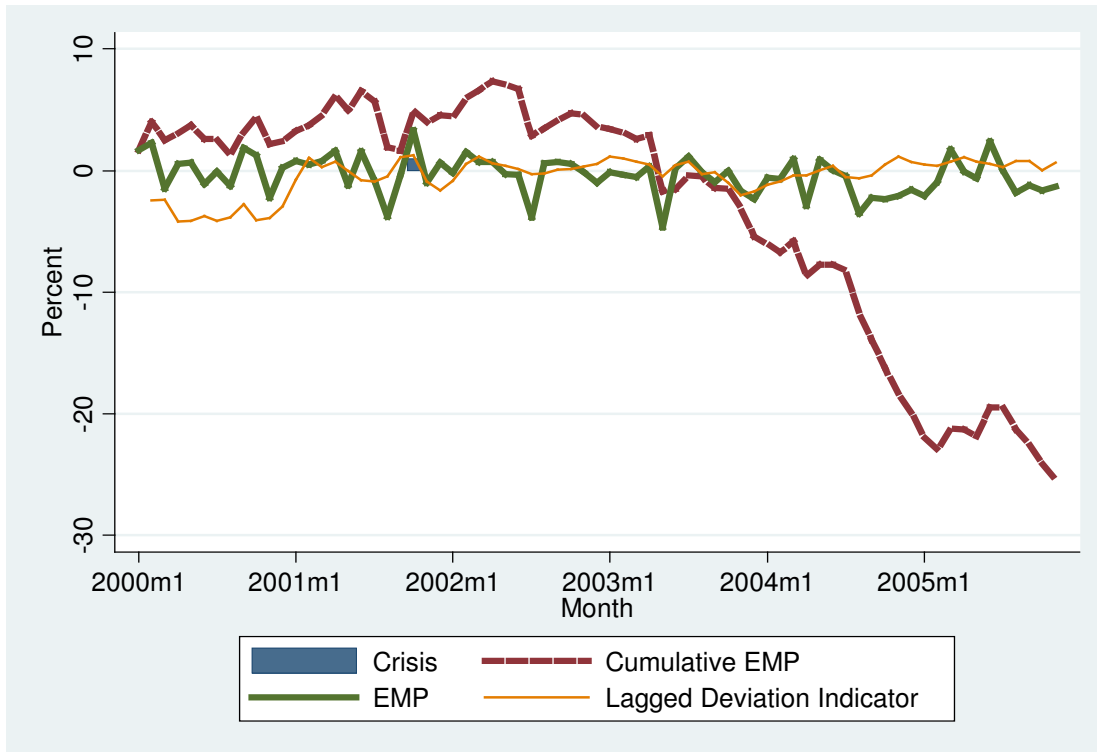**Figure 98: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Laos**
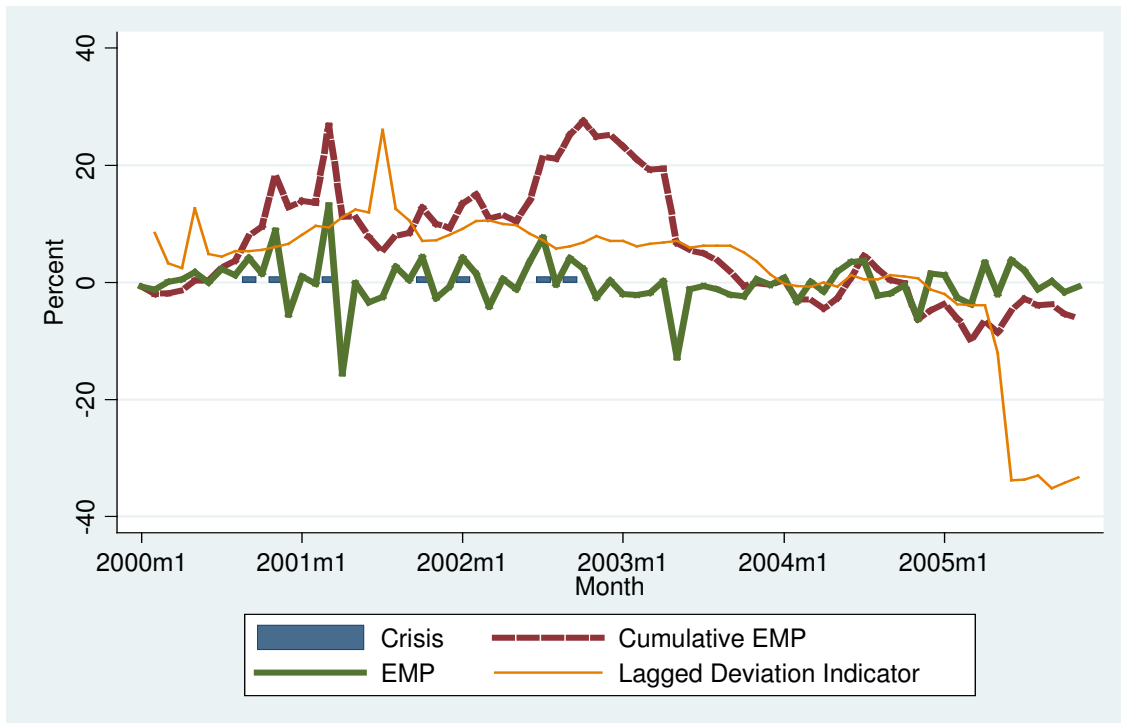
**Figure 99: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Laos**
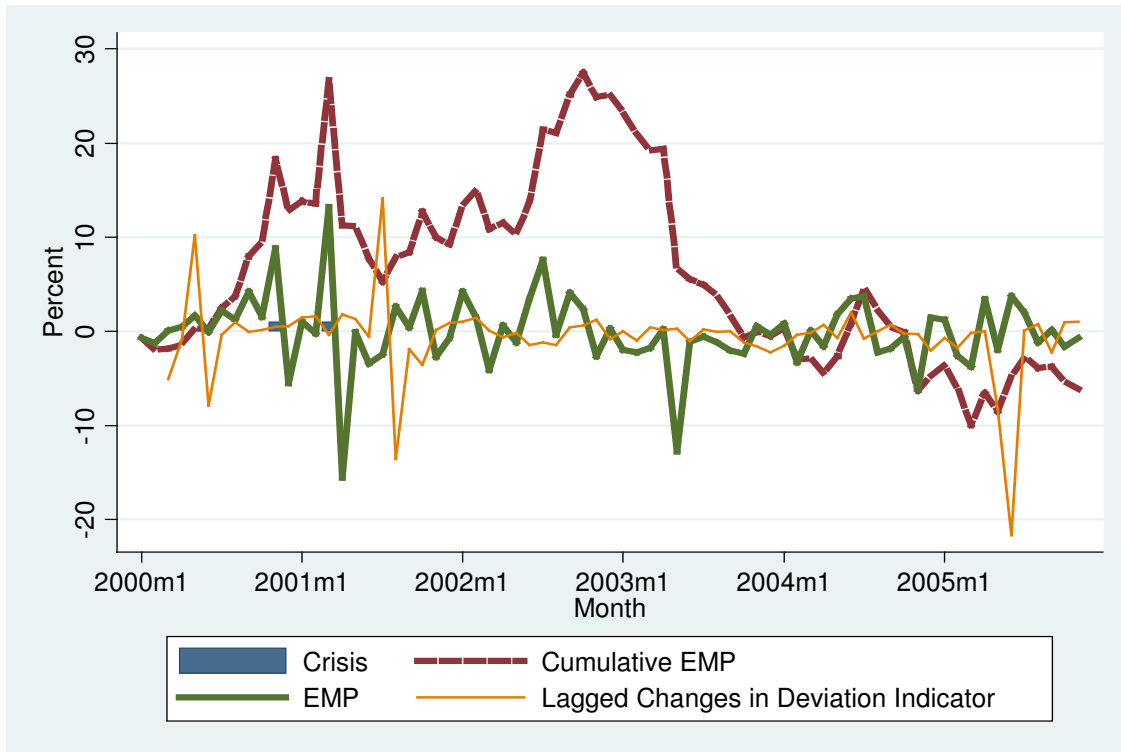


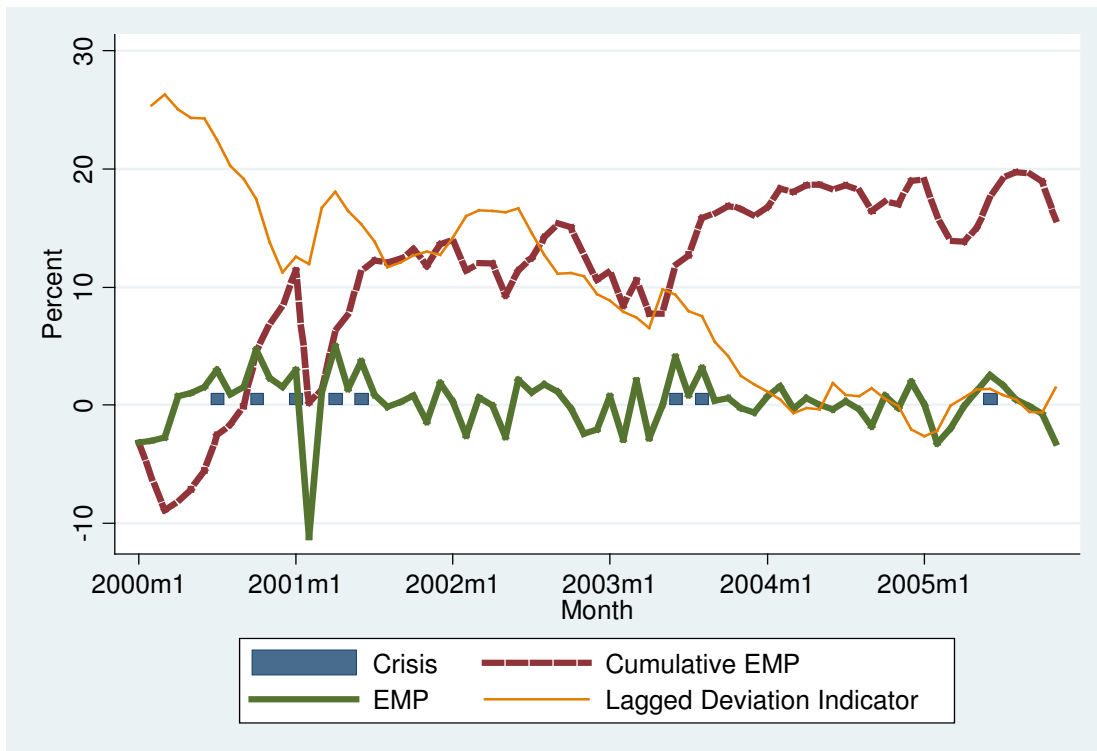**Figure 100: Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Laos**

**Figure 101: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Malaysia**



**Figure 102: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Malaysia**

**Figure 103: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Malaysia**
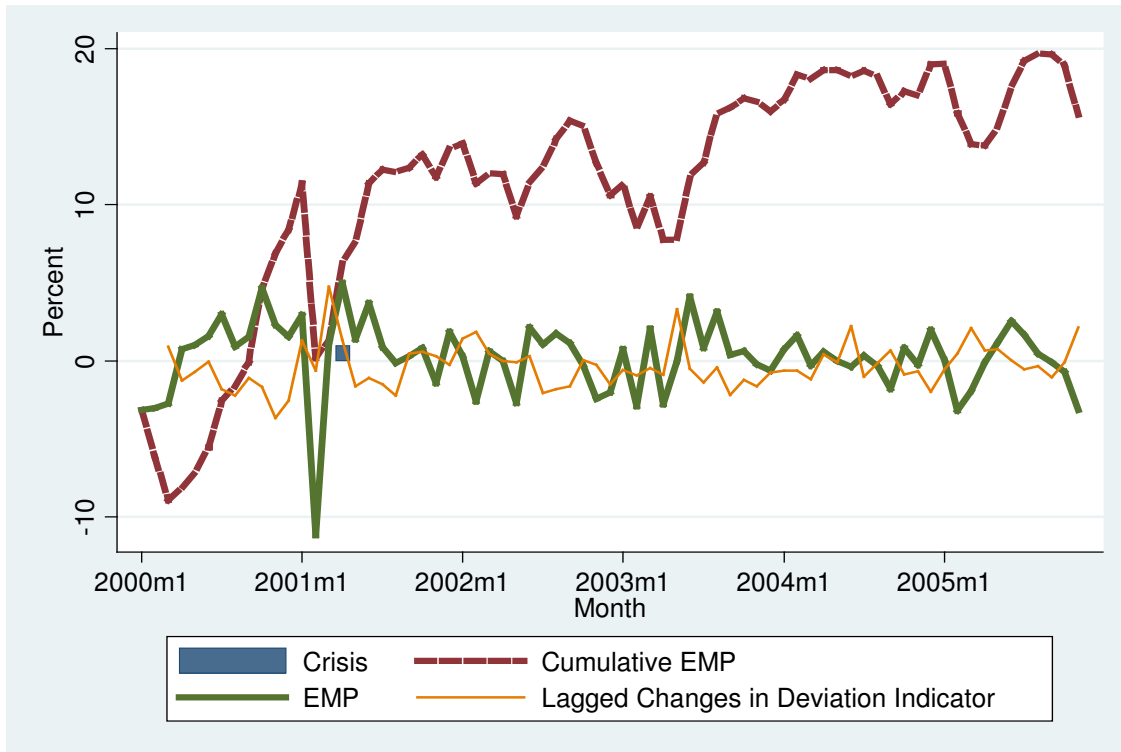


**Figure 104: Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Malaysia**
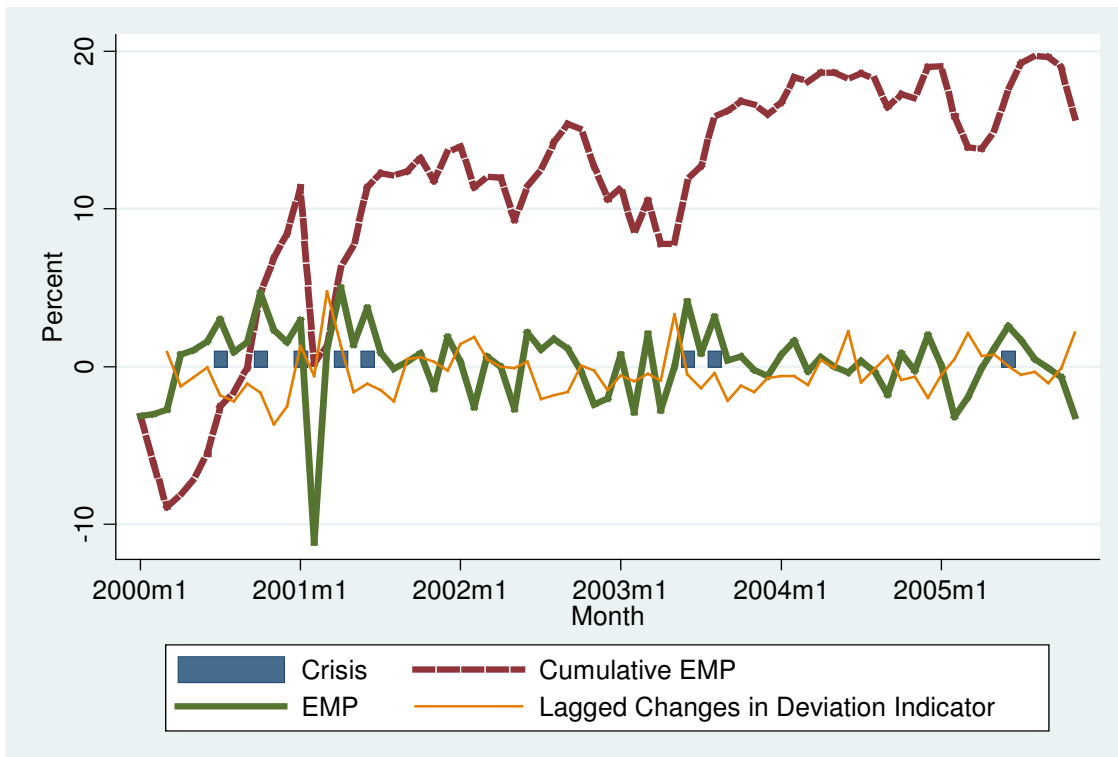
**Figure 105: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Philippines**
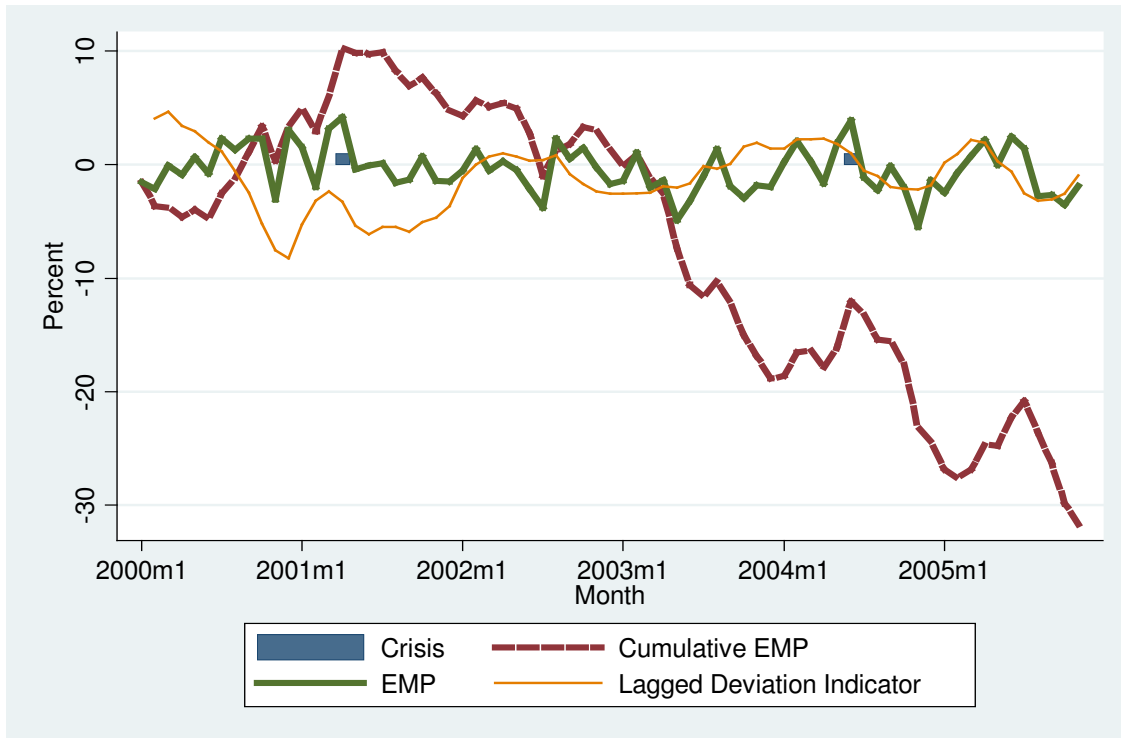


**Figure 106: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Philippines**

**Figure 107: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Philippines**



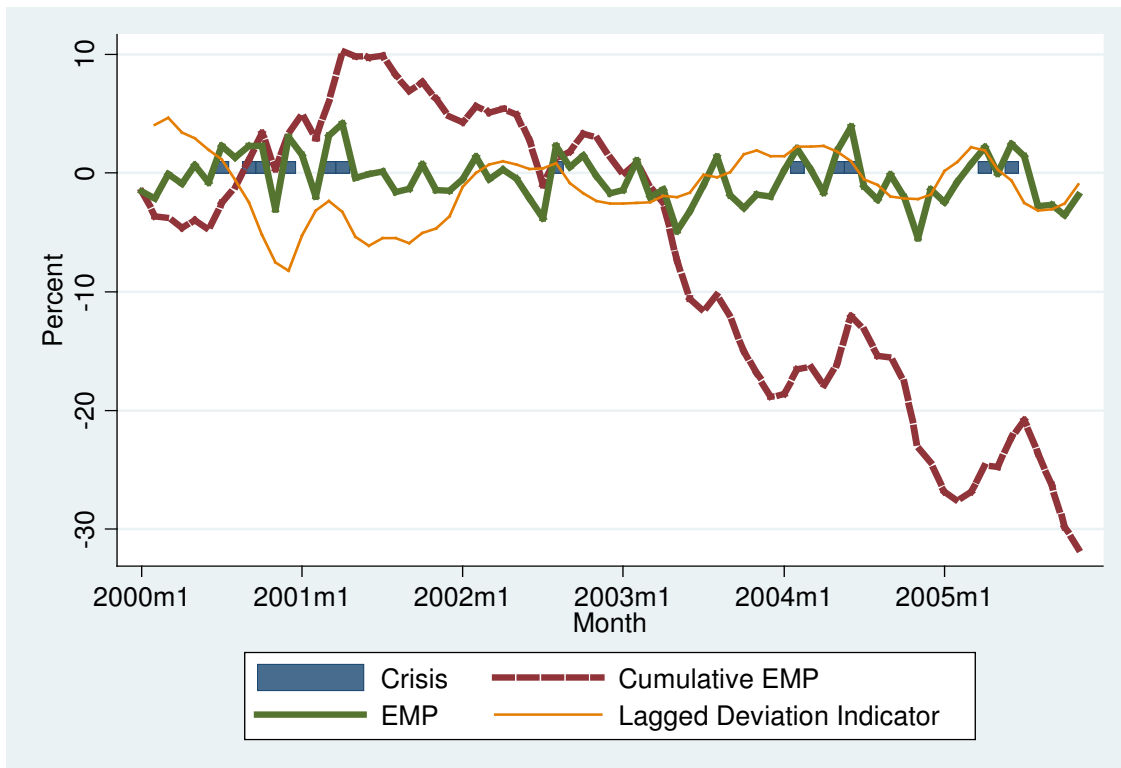**Figure 108: Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Philippines**

**Figure 109: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Singapore**



**Figure 110: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Singapore**

**Figure 111: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Singapore**



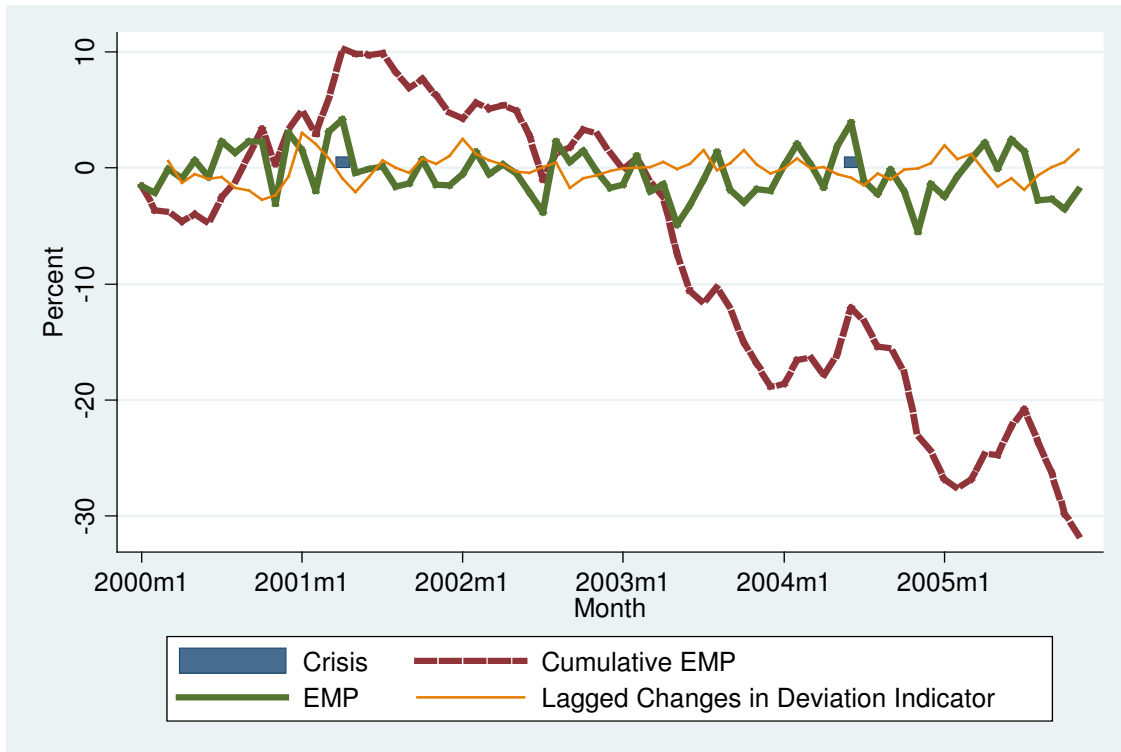**Figure 112: Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Singapore**
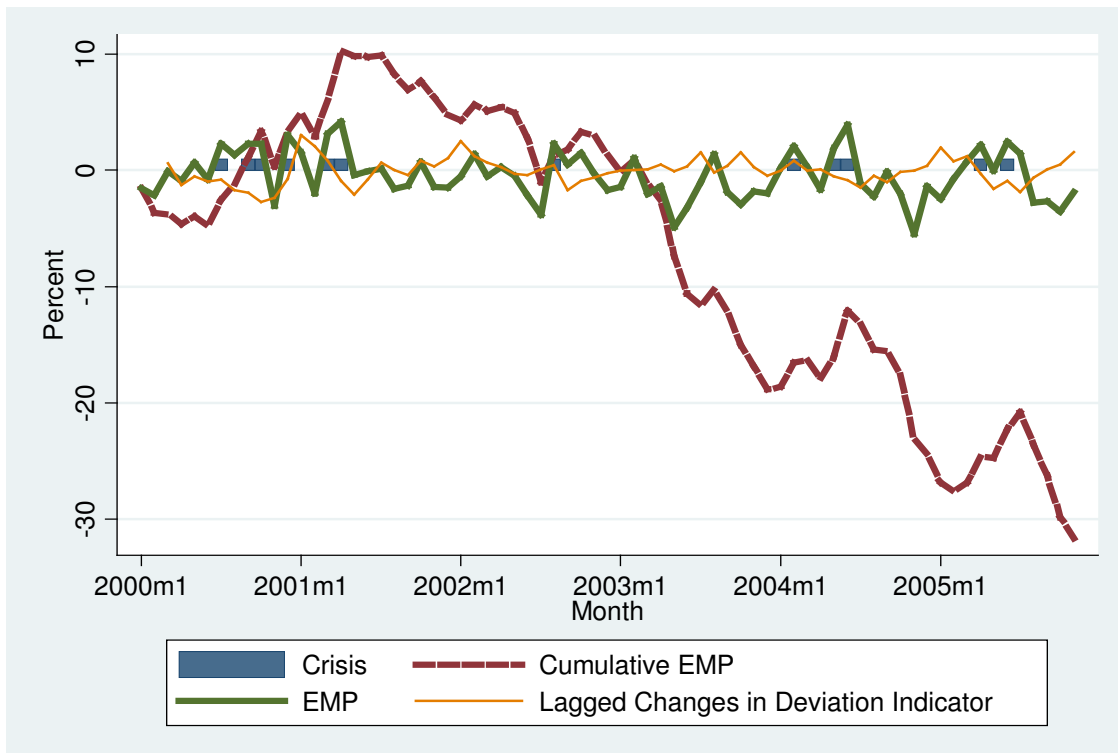
**Figure 113: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Thailand**



**Figure 114: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Thailand**
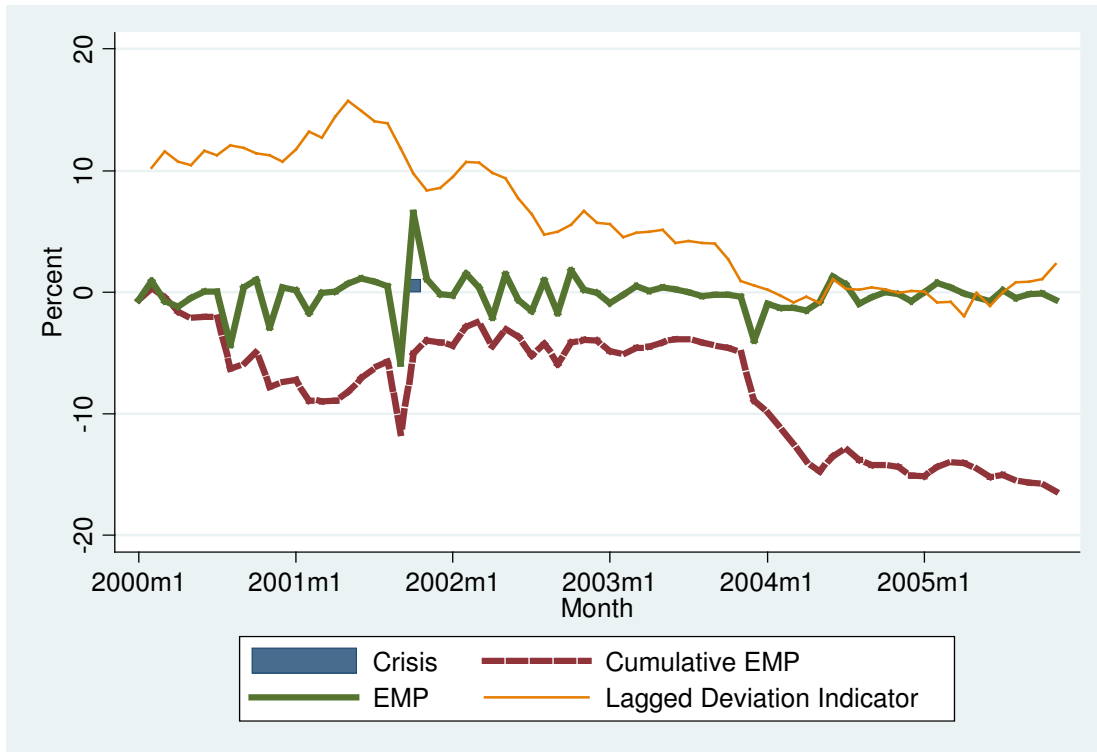
**Figure 115: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Thailand**



**Figure 116: Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Thailand**

**Figure 117: Crisis indicator (2 standard deviations from the mean), exchange market pressures and lagged deviation indicator: Vietnam**



**Figure 118: Crisis indicator (1 standard deviation from the mean), exchange market pressures and lagged deviation indicator: Vietnam**
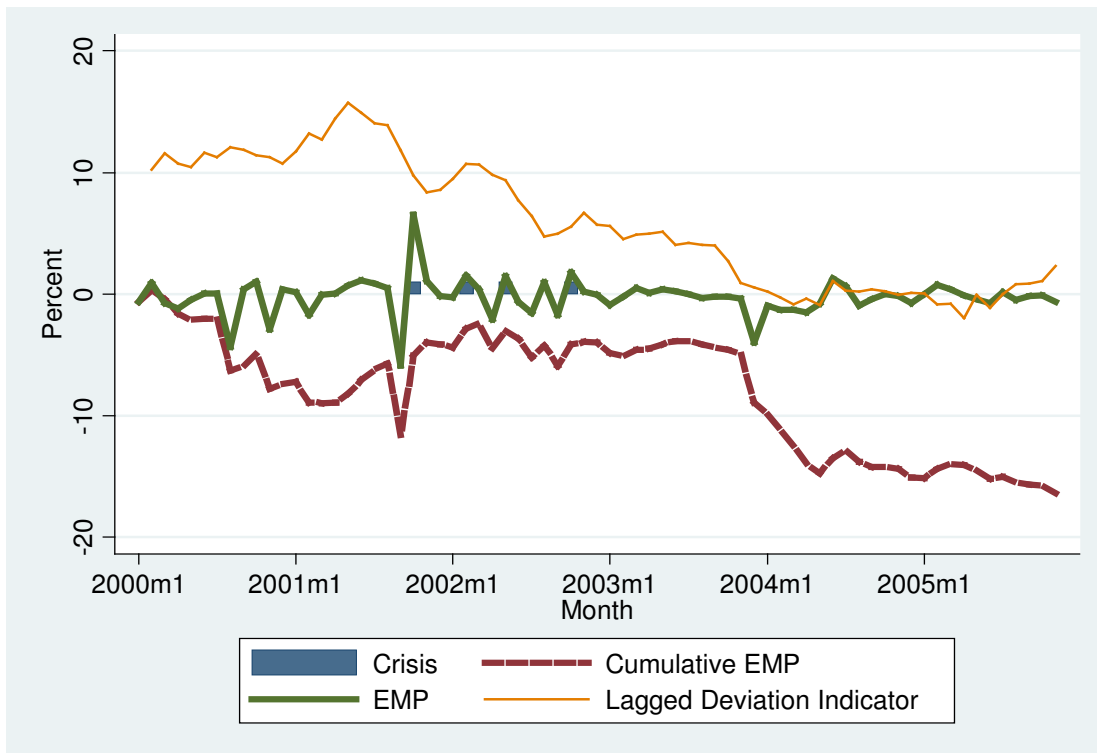
**Figure 119: Crisis indicator (2 standard deviations from the mean), exchange market pressures and changes in lagged deviation indicator: Vietnam**
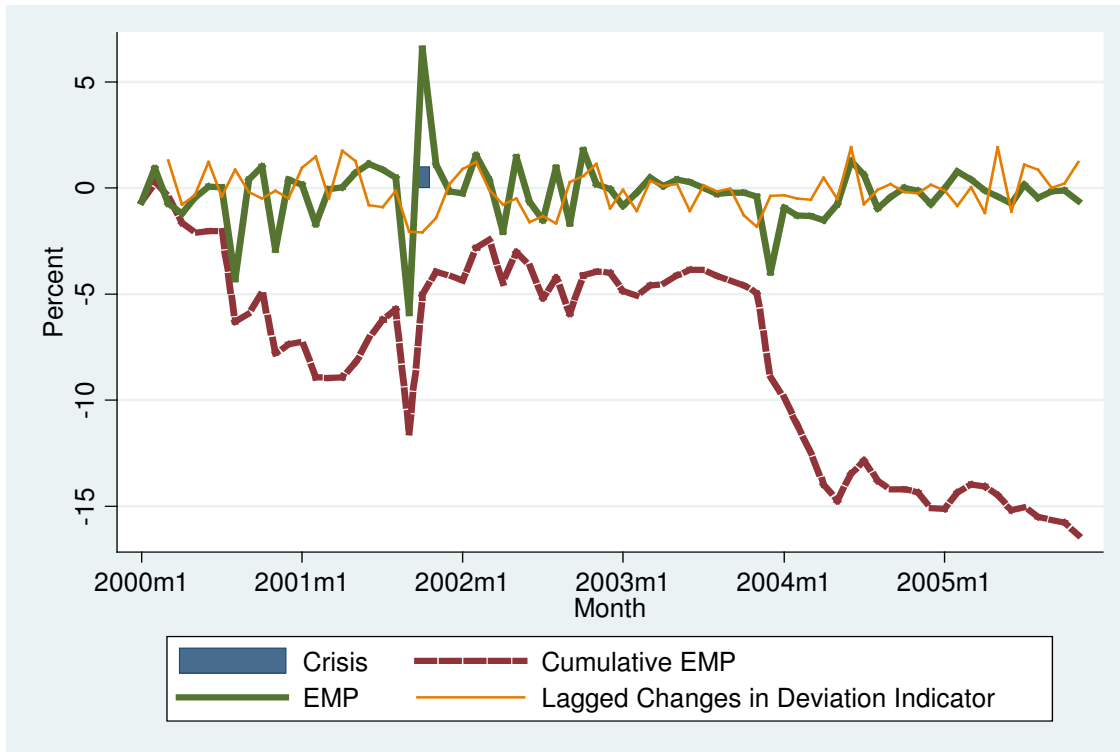


**Figure 120: Crisis indicator (1 standard deviation from the mean), exchange market pressures and changes in lagged deviation indicator: Vietnam**