AMU Deviation Indicator

for Coordinated Exchange Rate Policies in East Asia and its relation with effective exchange rates

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Motivation

- Regional Cooperation and Surveillance process
  - Chiang Mai Initiative and Swap Agreement
  - Regular meetings as ASEAN+3 Finance Deputy Ministers Meeting for surveillance
- Ogawa and Shimizu (2005) proposed the creation of an Asian Monetary Unit (AMU) and AMU Deviation Indicators for East Asian currencies in order to contribute to coordinated exchange rate policies in East Asia.
- How can we actually use the AMU and AMU deviation Indicators for stabilization of effective exchange rates?

Lessons from the Asian Currency Crisis

- East Asian countries had the following problems:

(1) Double mismatch of financial institutions' B/S in terms of currencies and maturities

(2) Officially or *de facto* dollar pegging exchange rate policy

(3) No regional financial cooperation in East Asia for currency crisis prevention and management

Two initiatives for regional monetary and financial cooperation

- **Chiang Mai Initiative (CMI)** of ASEAN+3 Finance Minister Meeting (ASEAN+3)

(1) Establish a network of currency swap agreements for currency crisis managements

(2) Conduct a surveillance process for currency crisis prevention

- **Asian Bond Market Initiative (ABMI)** of ASEAN+3 and **Asian Bond Fund (ABF) Initiative** of EMEAP

(1) Foster and develop domestic bond markets

(2) Promote cross-boarder transactions of local currency denominated and regional monetary unit denominated bonds

Current problem: Coordination failure in exchange rate systems

- A variety of exchange rate systems among East Asian countries (IMF classification)

(1) Flexible: Japan, Korea, Philippines

(2) Managed floating: Thailand, Singapore, Indonesia, New ASEAN Countries

(3) Fixed: China and Malaysia (Managed floating since July 2005)

(4) Currency Board (Strictly fixed): Hong Kong and Brunei

- Possibility of misalignments of intra-regional exchange rates among East Asian currencies caused by the US$ depreciation under the coordination failure of exchange rate systems

Coordination of exchange rate policy in East Asia

- East Asian countries have strong economic relationships with each other within the intra-region as well as the United States and European countries. It is important for them to stabilize effective exchange rates.
- It is the most desirable for East Asian countries to stabilize both exchange rates among the intra-regional currencies and their exchange rates against outside currencies such as the US$ and the euro.

-> stabilize exchange rates of East Asian currencies against a **common G3 currency** (US$, euro, and JPY) basket

- It is the second best that they should stabilize intra-regional exchange rate in a situation where regional production networks have been establishing.

-> stabilize exchange rates of East Asian currency against a **common regional monetary unit**.

Purposes for RMU

- RMUs can serve as a useful benchmark in monitoring foreign exchange market in order to judge whether the currency is overvalued or undervalued compared to the neighbour countries with strong trade relationship.
- Ogawa and Shimizu (2005) proposed an **Asian Monetary Unit (AMU)**

  Joint Project of Hi-Stat and RIETI for AMU and AMU Deviation Indicator. (see in websites http://www.rieti.go.jp/users/amu/en/index.html of RIETI)
  - consists of ASEAN+3 currencies, calculating the weight of each currency by using trade volume and GDP measured at PPP
  - appropriate in monitoring misalignment and volatility of the relative value of Asian currencies within the region and against the major currencies outside the region.

Objectives

- Calculate Asian Monetary Unit (AMU), a weighted average of the East Asian currencies.
- Calculate a deviation indicator (AMU Deviation Indicator) from benchmark rate for the estimated AMU.
- Investigate relationships between the AMU Deviation Indicators and the effective exchange rates for each East Asian currency.

Contents

Methodology to calculate the AMU

- Member countries

  ASEAN10 + Japan, China and Korea

- Period

  from January 1999 to June 2005

- To follow the methodology to calculate the ECU （see Tanaka and Jin, 2003）

The basket weights of AMU

- The basket weights based on
  - the countries' respective shares of GDP measured at PPP
  - the trade volumes (the sum of exports and imports) in the total of sampled countries for the relevant country.
- We use the average of both data for the last three years (2001-2003).

Data

- Trade data are from *Direction of Trade Statistics*, IMF.
- GDP measured at PPP are from *World Development Report*, World Bank.
- Exchange rates are from Datastream.

AMU in terms of US$-euro

- We should use a basket currency composed by the US dollar and the euro (US$-euro) as a numeraire currency to estimate AMU.
- We apply trade shares with the US and the euro area (EU12) for total of the sampled East Asian countries as basket weights of US$-euro.

  (US dollar : euro = 65% : 35%)

To choose the benchmark period for AMU

- The benchmark period is defined as the following:
  - the total trade balance of member countries
  - the total trade balance of the member countries (excluding Japan) with Japan
  - the total trade balance of member countries with the rest of world

  should be relatively close to zero.
- The benchmark exchange rate for each currency is defined in terms of the AMU during 2000-2001.

Trade Account(net) of ASEAN10 + 3(Japan, Korea & China)

million of US$

	with Japan*	within ASEAN+3	with World
1990	-23,437	-1,738	35,513
1991	-33,084	-4,710	58,318
1992	-41,172	-871	87,331
1993	-54,184	-4,985	88,324
1994	-65,089	9,511	1,969,336
1995	-73,856	14,610	2,378,160
1996	-59,880	12,231	2,437,858
1997	-54,531	26,440	236,500
1998	-29,802	12,102	215,241
1999	-32,065	4,781	4,819
2000	-37,239	-6,593	-6,562
2001	-23,997	1,934	1,953
2002	-40,027	12,265	12,289
2003	-55,724	27,701	27,727

Notes: All figures are calculated by authors. Trade data are from DOTS, IMF and GDP data are from IFS, IMF.

* The figure of trade account with Japan is the total amount of current account (net) with 12 East Asian countries.

Table 2. AMU weights of East Asian Currencies (benchmark year=2000/2001)

	Trade volume* %	GDP measured at PPP** ,%	Arithmetic shares % (a)	Benchmark exchange rate*** (b)	AMU weights (a)/(b)
Brunei	0.41	0.41	0.41	0.5912	0.0069
Cambodia	0.19	0.21	0.20	0.0003	7.4235
China	21.65	47.93	34.79	0.1256	2.7711
Indonesia	4.67	5.56	5.12	0.0001	452.7871
Japan	27.31	28.30	27.80	0.0091	30.5681
Korea	12.86	6.65	9.76	0.0009	113.1459
Lao PDR	0.09	0.08	0.08	0.0001	5.8500
Malaysia	8.85	1.83	5.34	0.2735	0.1953
Myanmar	0.38	0.38	0.38	0.1598	0.0239
Philippines	3.12	2.74	2.93	0.0220	1.3347
Singapore	11.90	0.81	6.36	0.5912	0.1075
Thailand	6.60	3.56	5.08	0.0246	2.0630
Vietnam	1.96	1.53	1.74	0.0001	243.0432

* : The trade volume is calculated as an average of total export and import volumes in 2001, 2002 and 2003 from the Direction of Trade Statistics, IMF.

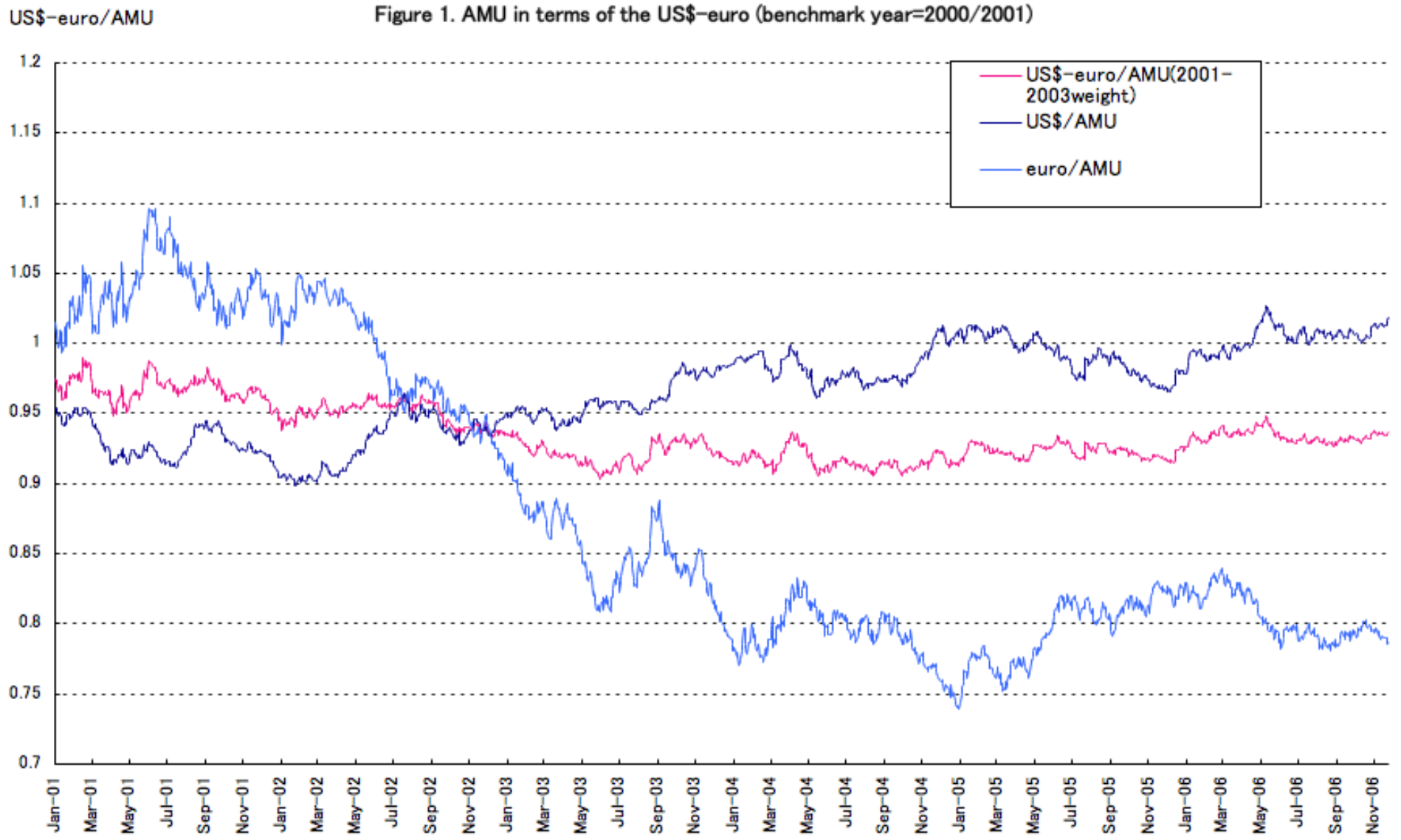
**: GDP measured at PPP is the average of GDP measured at PPP in 2001, 2002 and 2003 from the World Development Report, World Bank. For Brunei and Myanmar, we use same share of trade volume since there are no GDP data for Brunei and Myanmar.

***: Benchmark exchange rate ($-euro/Currency) is the average of daily exchange rate in terms of $-euro in 2000 and 2001.

Weights of AMU based on GDP measured at PPP and Trade Volume

- We calculate an AMU with the weights based on "GDP measured at PPP" and "Trade volume" according to the following formula.

$$
\begin{aligned}
US\$/euro_{AMU} = {} & 0.0069\, US\$/euro_{BN\$} + 7.4235\, US\$/euro_{CBR} + 2.7711\, US\$/euro_{CNY} \\
& + 452.7871\, US\$/euro_{IDR} + 30.5681\, US\$/euro_{JPY} + 113.1459\, US\$/euro_{KRW} \\
& + 5.9500\, US\$/euro_{LOK} + 0.1953\, US\$/euro_{MLR} + 0.0239\, US\$/euro_{MYK} \\
& + 1.3347\, US\$/euro_{PLP} + 0.1075\, US\$/euro_{SP\$} + 2.0630\, US\$/euro_{TLB} \\
& + 243.0432\, US\$/euro_{VTD}
\end{aligned}
$$


US$-euro/AMU
Figure 1. AMU in terms of the US$-euro (benchmark year=2000/2001)
US$-euro/AMU(2001-2003weight)
US$/AMU
euro/AMU
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
Jan-01
Mar-01
May-01
Jul-01
Sep-01
Nov-01
Jan-02
Mar-02
May-02
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Sep-02
Nov-02
Jan-03
Mar-03
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Jan-04
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Sep-04
Nov-04
Jan-05
Mar-05
May-05
Jul-05
Sep-05
Nov-05
Jan-06
Mar-06
May-06
Jul-06
Sep-06
Nov-06

How to calculate the Nominal Deviation Indicator

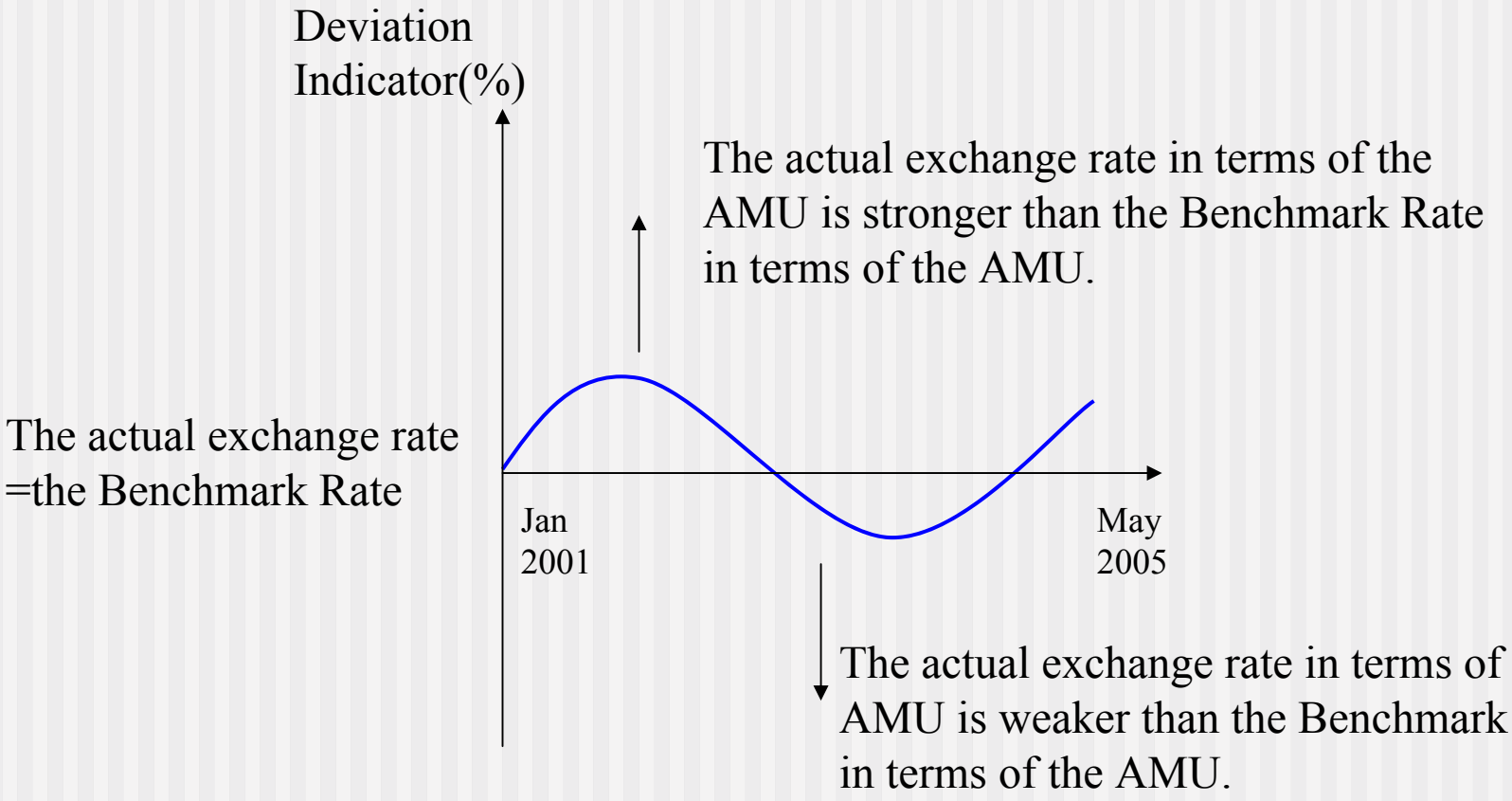
- Using the estimated AMU, we calculate the Nominal Deviation Indicator as follows:

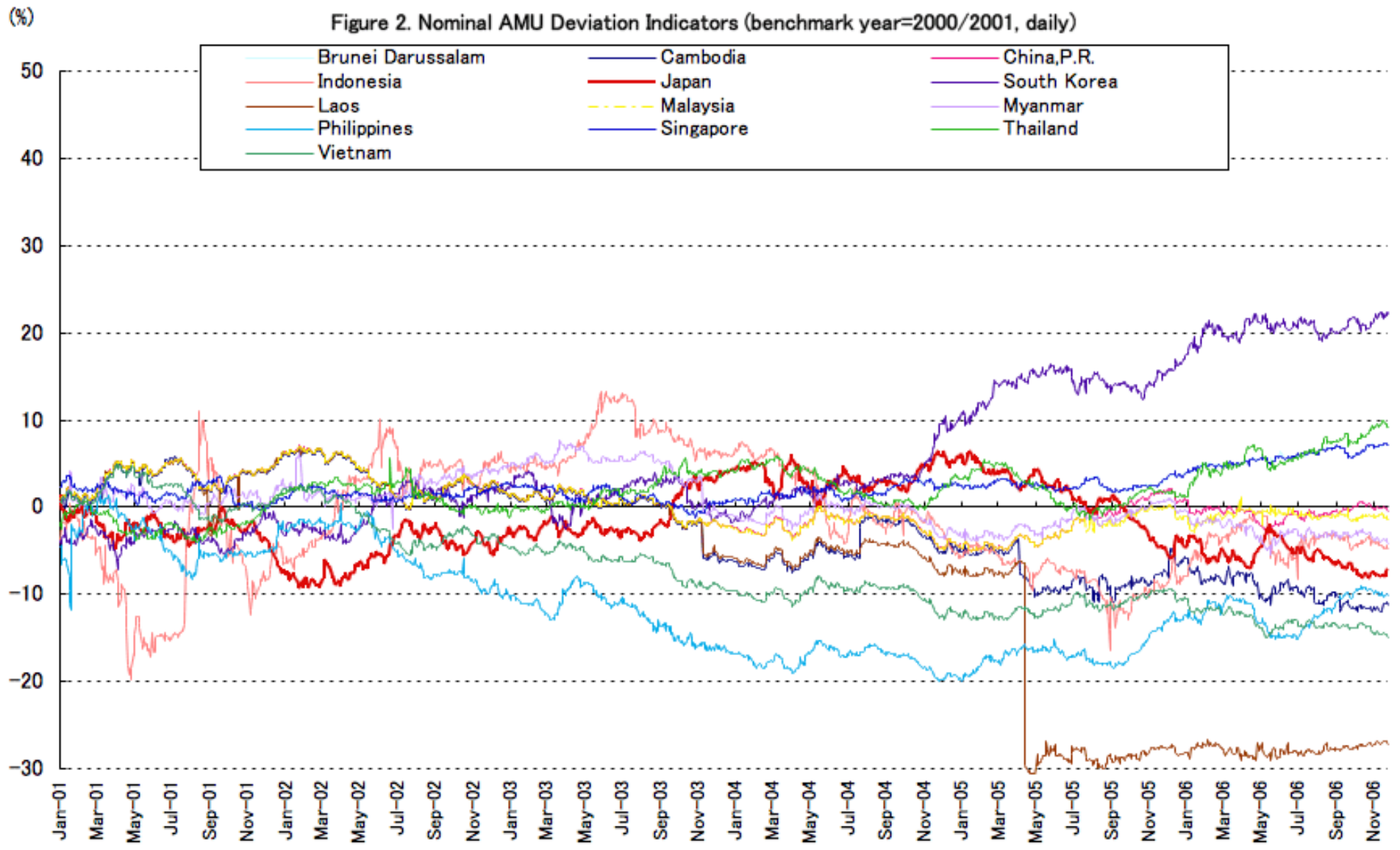
  benchmark rate : each currency's exchange rate in terms of AMU at the benchmark period

  actual exchange rate : exchange rate of each currency in terms of AMU which fluctuates as the each currency actually move

$$\text{Nominal Deviation Indicator (\%)} = \frac{\text{actual exchange rate of } \text{AMU}/\text{a currency} - \text{benchmark exchange rate of } \text{AMU}/\text{a currency}}{\text{benchmark exchange rate of } \text{AMU}/\text{a currency}} \times 100 \quad (1)$$

AMU Deviation Indicator from the Benchmark Rate(%)




(%)
Figure 2. Nominal AMU Deviation Indicators (benchmark year=2000/2001, daily)
Brunei Darussalam
Cambodia
China,P.R.
Indonesia
Japan
South Korea
Laos
Malaysia
Myanmar
Philippines
Singapore
Thailand
Vietnam
50
40
30
20
10
0
−10
−20
−30
Jan−01
Mar−01
May−01
Jul−01
Sep−01
Nov−01
Jan−02
Mar−02
May−02
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Nov−02
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Mar−06
May−06
Jul−06
Sep−06
Nov−06

Nominal and Real Deviation Indicators

- We should take into account inflation rate differentials if we consider real effect of exchange rates on trade, FDI and real economic activities (real GDP).
- We calculate also deviation indicators in real terms by taking into account inflation rate differentials.

How to calculate Real Deviation Indicator

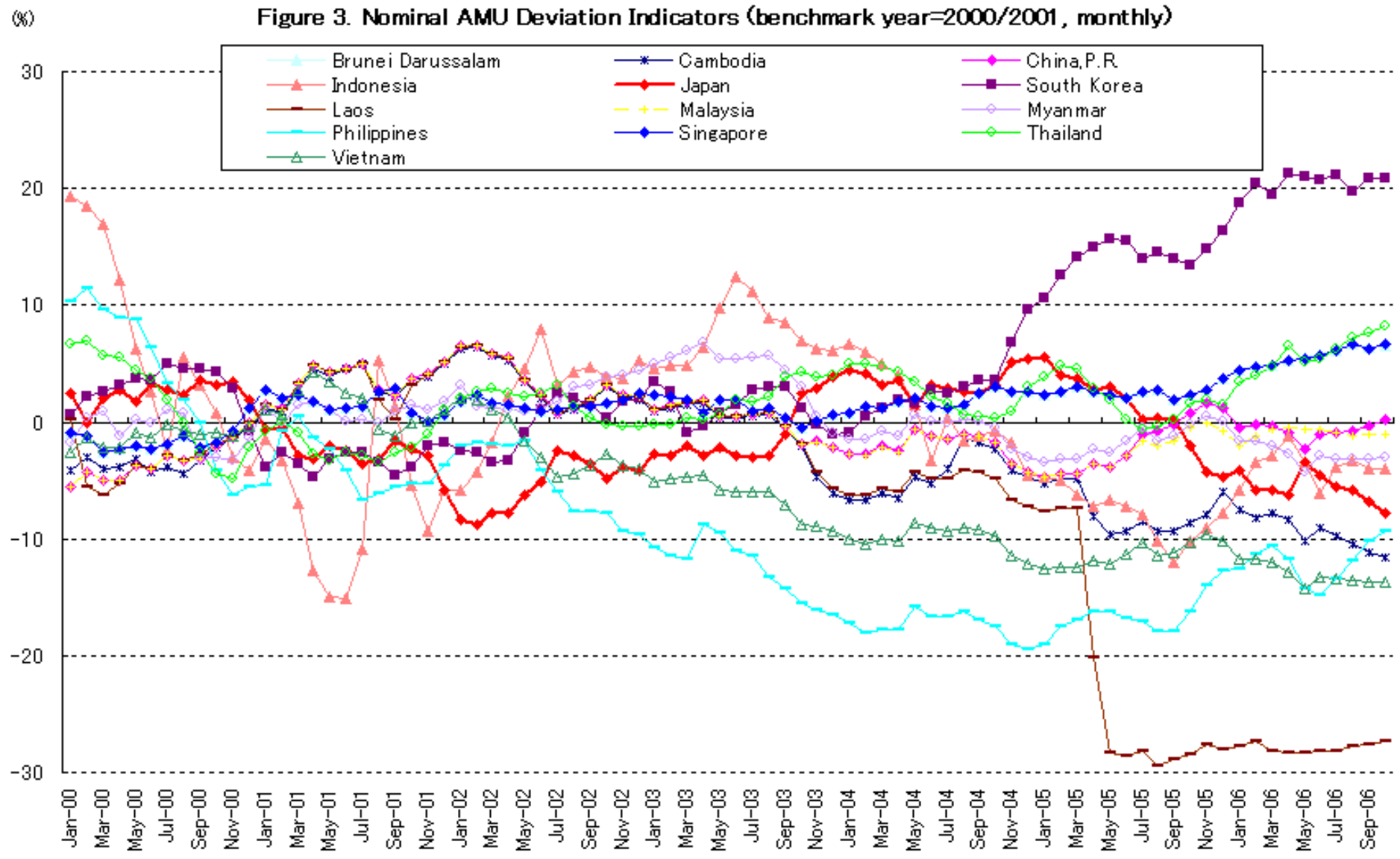
- We can calculate a Real AMU Deviation Indicator as follows:

$$\text{Rate of Change in Real AMU Deviation Indicator}_i = \text{Rate of Change in Nominal AMU Deviation Indicator}_i - \left(\dot{P}_{AMU} - \dot{P}_i\right)$$

$\dot{P}_{AMU}$: inflation rate in the AMU area

$\dot{P}_i$: inflation rate in country i.

- We use CPI data to calculate the inflation rates.
- CPI of AMU: weighted CPI of member countries


(%)
Figure 3. Nominal AMU Deviation Indicators (benchmark year=2000/2001, monthly)
Brunei Darussalam
Cambodia
China,P.R.
Indonesia
Japan
South Korea
Laos
Malaysia
Myanmar
Philippines
Singapore
Thailand
Vietnam
30
20
10
0
-10
-20
-30
Jan-00
Mar-00
May-00
Jul-00
Sep-00
Nov-00
Jan-01
Mar-01
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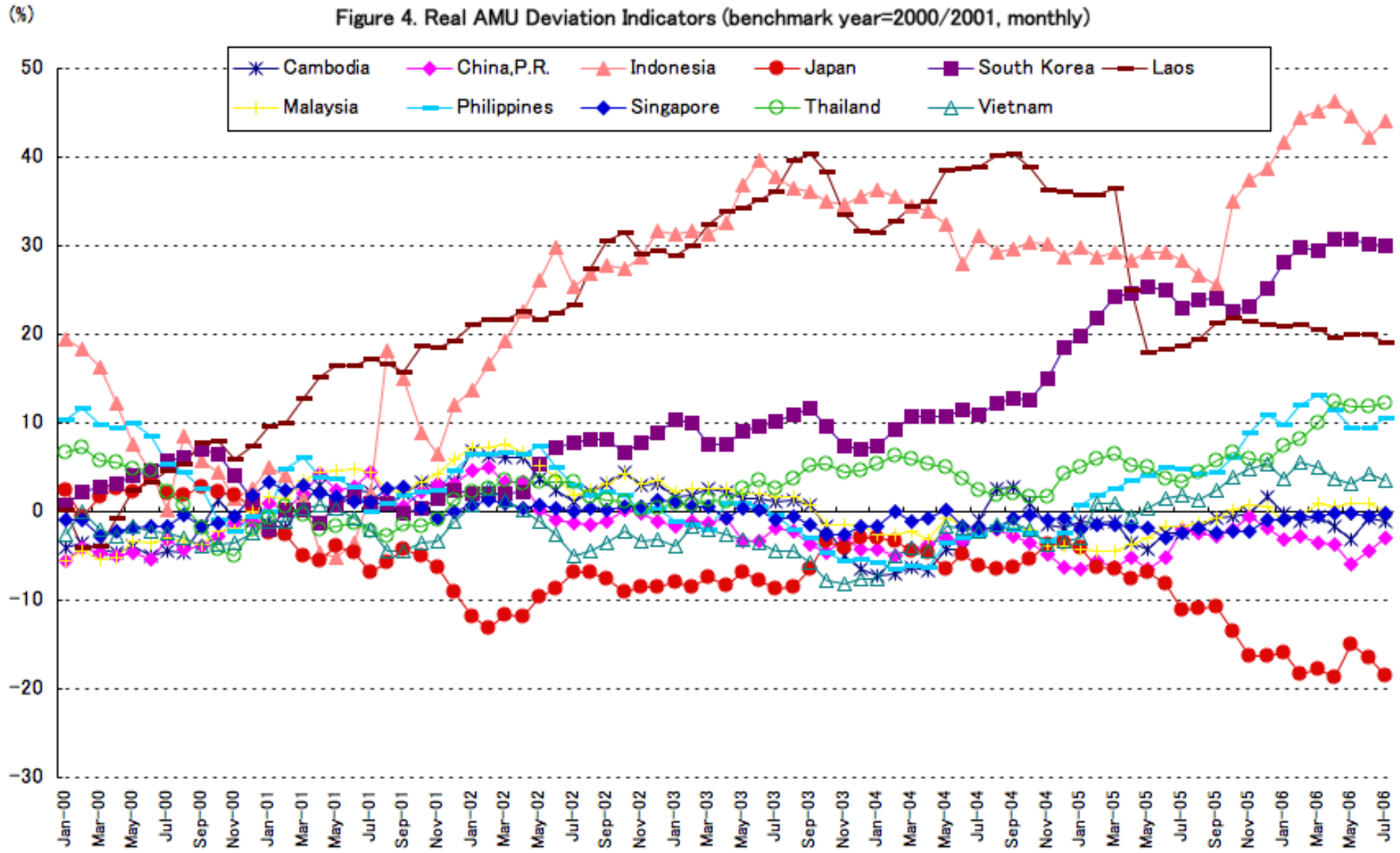
Sep-06


(%)
Figure 4. Real AMU Deviation Indicators (benchmark year=2000/2001, monthly)
Cambodia
China,P.R.
Indonesia
Japan
South Korea
Laos
Malaysia
Philippines
Singapore
Thailand
Vietnam
50
40
30
20
10
0
-10
-20
-30
Jan-00
Mar-00
May-00
Jul-00
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Jan-06
Mar-06
May-06
Jul-06

Merits and Demerits of Nominal and Real indicators

- The nominal deviation indicator can be watched in real time while the real deviation indicator are available only in monthly basis.
- Considering effects of exchange rate on real economic activity, we should watch the deviation indicators in real term.
- Considering effects of exchange rate on monetary aspects, the nominal deviation indicators are enough to be concerned.
- We could use both nominal and real deviation indicators as an indicator for the surveillance.

Relationship of EER with AMU and AMU DI

- Does the combination of the AMU and a Nominal AMU Deviation Indicator of one currency correspond to its nominal effective exchange rate?

- We investigate how the movements of the AMU and the AMU Deviation Indicators reflect in the movements of effective exchange rates.

Effective Exchange Rates

- Two types of effective exchange rate
  - an effective exchange rate in terms of currencies of the rest of world ("ROW")
  - an effective exchange rate in terms of currencies of the rest of sampled East Asian countries ("ROEA")

Regression

- The EERs are regressed on both the AMU and the AMU Deviation Indicator for each currency.

$$\Delta\left(\log EER_{ROW}\right) = \beta_0 + \beta_1 \cdot \Delta\left(\log AMU\right) + \beta_2 \cdot \Delta\left(AMUDI\right)$$

$$\Delta\left(\log EER_{ROEA}\right) = \beta_0 + \beta_1 \cdot \Delta\left(\log AMU\right) + \beta_2 \cdot \Delta\left(AMUDI\right)$$

- Sample period: from January 1999 to December 2004
- Number of observation: 71 after adjusting endpoints.

Table 3. Relationship of effective exchange rate(ROW) with AMU and AMU Deviation Indicator

Effective Exchange Rate	constant		AMU		AMU Deviation Indicator		AR(1)		Adjusted R-squared	F-statistic
Japanese yen (ROW)	0.0090 (0.0039)	**	1.2850 (0.4913)	**	0.0111 (0.0032)	***	−0.2876 (0.1183)	**	0.2593	9.0532 (0.0000)
Chinese yuan (ROW)	−0.0001 (0.0087)		1.7181 (1.2119)		0.0248 (0.0127)	*	−0.2093 (0.1305)		0.0432	2.0388 (0.1169)
Korean won (ROW)	0.0067 (0.0038)	*	1.3331 (0.5343)	**	0.0043 (0.0037)		−0.5163 (0.1147)	***	0.3291	11.3014 (0.0000)
Singapore $ (ROW)	0.0023 (0.0045)		0.5968 (0.6483)		0.0083 (0.0093)		−0.4077 (0.1121)	***	0.1492	5.0327 (0.0033)
Thailand baht (ROW)	0.0045 (0.0064)		0.8166 (0.7662)		0.0131 (0.0055)	**	−0.2869 (0.1210)	**	0.0991	3.5289 (0.0195)
Indonesian rupiah (ROW)	−0.0046 (0.0036)		−0.9345 (0.4634)	**	0.0122 (0.0010)	***	−0.4549 (0.1114)	***	0.6436	42.5325 (0.0000)
Malaysian ringgit (ROW)	0.0036 (0.0044)		0.6066 (0.6469)		0.0111 (0.0067)	*	−0.3773 (0.1128)	***	0.1201	4.1406 (0.0095)
Philippine peso (ROW)	0.0018 (0.0096)		0.6987 (1.1258)		0.0083 (0.0070)		−0.4554 (0.1150)	***	0.1645	5.5306 (0.0019)
Brunei $ (ROW)	−0.0014 (0.0271)		2.0011 (3.8377)		0.0435 (0.0534)		−0.3637 (0.1161)	***	0.1055	3.7120 (0.0157)
Canbodian riel (ROW)	−0.0140 (0.0318)		4.4152 (3.4575)		0.0512 (0.0303)	*	−		0.0188	1.6738 (0.1952)
Laos (ROW)	−0.0415 (0.0298)		2.5081 (3.4958)		0.0013 (0.0046)		−0.3069 (0.1186)	**	0.0650	2.6000 (0.0595)
Myanmar kyat (ROW)	0.0021 (0.0179)		−0.0165 (2.5999)		−0.0139 (0.0240)		−0.2908 (0.1163)	**	0.0559	2.3634 (0.0791)
Vietnamese dong (ROW)	0.0015 (0.0129)		4.9215 (1.7378)	***	0.0424 (0.0186)	**	−0.3701 (0.1188)	***	0.1433	4.7373 (0.0048)

1. Sample period is from Jan 1999 to Dec 2004. All data are monthly and the number of Observation is 71after adjusting endpoints.

2. Effective exchange rate (ROW) is calculated by using the trade data against the rest of the world. On the other hand, effective exchange rate (ROEA) is calculated by using the trade data against the Sampled East Asian countries.

3. AMU and AMU Deviation Indicator (nominal) are the montly average of daily calculated AMU and AMU Deviation Indicators, respectively.

4. Estimated method is OLS and . If the residual has serial correlation, the term of AR(1) is added. Standard errors are in parenthesis. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 4. Relationship of effective exchange rate(ROEA) with AMU and AMU Deviation Indicator

Effective Exchange Rate	constant	AMU		AMU Deviation Indicator		AR(1)		Adjusted R-squared	F-statistic
Japanese yen (ROEA)	−0.0029 (0.0052)	0.1832 (0.6348)		0.0133 (0.0042)	***	−0.2009 (0.1216)		0.1213	4.1754 (0.0091)
Chinese yuan (ROEA)	−0.0031 (0.0037)	0.8595 (0.4138)	**	0.0300 (0.0055)	***	−0.3026 (0.1199)	**	0.3142	11.5382 (0.0000)
Korean won (ROEA)	−0.0055 (0.0045)	0.4191 (0.6076)		0.0002 (0.0042)		−0.4479 (0.1108)	***	0.1667	5.6036 (0.0017)
Singapore $ (ROEA)	−0.0049 (0.0047)	−0.4682 (0.6759)		0.0099 (0.0096)		−0.4143 (0.1102)	***	0.1710	5.7454 (0.0015)
Thailand baht (ROEA)	−0.0033 (0.0064)	−0.1576 (0.8000)		0.0117 (0.0056)	**	−0.4212 (0.1120)	***	0.1610	5.4145 (0.0022)
Indonesian rupiah (ROEA)	0.0051 (0.0049)	1.0082 (0.6147)	*	0.0109 (0.0013)	***	−0.4368 (0.1180)	***	0.4599	20.5917 (0.0000)
Malaysian ringgit (ROEA)	−0.0017 (0.0070)	−0.4931 (0.9879)		0.0198 (0.0104)	*	−0.2304 (0.1152)	***	0.0872	3.1962 (0.0290)
Philippine pesp (ROEA)	−0.0108 (0.0104)	−0.7995 (1.1428)		0.0067 (0.0073)		−0.2430 (0.1197)	**	0.0339	1.8088 (0.1541)
Brunei $ (ROEA)	−0.0041 (0.0186)	−0.5915 (2.6416)		0.0579 (0.0378)		−0.4171 (0.1129)	***	0.1838	6.1811 (0.0009)
Cambodian riel (ROEA)	−0.0200 (0.0337)	5.6355 (3.6646)		0.0611 (0.0321)	*	−		0.0335	2.2127 (0.1172)
Laos (ROEA)	−0.0542 (0.0367)	2.2781 (3.6824)		−0.0028 (0.0049)		−		−0.0175	0.3986 (0.6728)
Myanmar kyat (ROEA)	0.0000 (0.0148)	1.0423 (2.2908)		0.0111 (0.0214)		−0.5274 (0.0985)	***	0.2639	9.2468 (0.0000)
Vietnamese dong (ROEA)	−0.0048 (0.0109)	1.0079 (1.5091)		0.0134 (0.0161)		−0.4809 (0.1114)	***	0.1916	6.2940 (0.0008)

1. Sample period is from Jan 1999 to Dec 2004. All data are monthly and the number of Observation is 71after adjusting endpoints.

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3. AMU and AMU Deviation Indicator (nominal) are the montly average of daily calculated AMU and AMU Deviation Indicators, respectively.

4. Estimated method is OLS and . If the residual has serial correlation, the term of AR(1) is added. Standard errors are in parenthesis. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Results:

- For the Japanese yen and the Chinese yuan, most of the coefficients are significant and positive. These results are due to the higher weights of both currencies in AMU.
- The coefficients on AMU DI are positive and significant for the seven East Asian currencies.
- These results indicate that the AMU DIs have positive relationship with their EER for some of the East Asian currencies.

Conclusion

- The strong relationships are found between the AMU or the AMU DI and the EER for some East Asian currencies.
- Accordingly, we should monitor both the AMU and the AMU DI in order to stabilize EER in terms of trader partners' currencies.
- Although we cannot find strong relationship between them for some currencies.

Further research on AMU and Deviation Indicator

- The effects of our measurements (the AMU and the AMU Real Deviation Indicators) on economic variables in East Asian countries.
  - Trade accounts within East Asian countries
  - Trade accounts with US and euro Area
  - GDP and others economic variables in the East Asian countries