The AMU Deviation Indicators Based on the Purchasing Power Parity and Adjusted by the Balassa-Samuelson Effect

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Contents

1. Introduction

2. Asian Monetary Unit and AMU Deviation Indicators

3. PPP-based AMU Deviation Indicator

4. PPP-based AMU Deviation Indicator Adjusted by the Balassa-Samuelson Effect

5. Conclusion

1. Introduction

Background of this paper

- After East Asia experienced the Asian Currency Crisis in 1997, the regional monetary cooperation has been enhanced.
  - Chiang Mai Initiative (CMI)
  - Economic Review and Policy Dialogue (ERPD)
- To prevent a currency crisis in the future and enhance surveillance within ASEAN+3
  - Incorporate intra-regional exchange rates into the surveillance process
  - Establish a surveillance system to monitor fluctuations and misalignments of each ASEAN+3 currency

Objectives of this paper

- Reconsider the benchmark rate of AMU Deviation Indicator (D.I.)
  - A constant benchmark $\Rightarrow$ a time-varying benchmark
- AMU D.I. based on PPP and adjusted by the Balassa-Samuelson effect
  - Time-varying benchmark based on PPP
    * PPPs calculated by CPIs
    * CPIs include the prices of non-tradable goods
    * Balassa-Samuelson effect
    * Time-varying benchmark based on PPP adjusted by Balassa-Samuelson effect

2. AMU and AMU Deviation Indicators

Asian Monetary Unit

- Asian Monetary Unit
  - A currency basket unit
  - Idea from European Currency Unit (ECU)
  - East Asian (ASEAN+3) currencies
- Official exchange rate of AMU
  - Important trading partners
  - The US dollar and the euro

- The weight on each country
    - GDP in terms of PPP
    - Trade volumes
- The benchmark period
    - Trade balance relatively close to zero
        * Comparison of total trade balance of ASEAN+3
        * Comparison of total trade balance of ASEAN+2 (China and Korea)   against Japan
        * Comparison of total trade balance of ASEAN+3 against the rest of world

AMU Deviation Indicators

- The Nominal AMU Deviation Indicator

The Nominal AMU Deviation Indicator (%)

$$= \frac{\left(\dfrac{\text{AMU}}{\text{N.C.}}\right)^{\text{Actual}} - \left(\dfrac{\text{AMU}}{\text{N.C.}}\right)^{\text{Benchmark}}}{\left(\dfrac{\text{AMU}}{\text{N.C.}}\right)^{\text{Benchmark}}} \times 100$$

- The Real AMU Deviation Indicator

The Real AMU Deviation Indicator (%)

$=$ the Rate of Change in Nominal AMU Deviation Indicator of 'Country i'

$$-\left(\dot{P}_{\text{AMU}} - \dot{P}_{i}\right)$$

- The Nominal AMU Deviation Indicator

  - Monitoring the fluctuation of foreign exchange rate in real time

- The Real AMU Deviation Indicator

  - Focusing on the exchange rate effects on real economic variables

- The AMU Deviation Indicators (Nominal + Real)

  - Complementary measures for surveillance of exchange rates and macroeconomic variables of concern

3. PPP-based AMU Deviation Indicator

- Realized problems

  - A constant benchmark rate

  - Higher growth rate of productivity

  - Remarkable economic growth

  - Structural change of foreign exchange regimes

- PPP-based AMU Deviation Indicator

  - An index where the benchmark rate is based on PPP

  - The benchmark rate is time-varying by reflecting exchange rate fundamentals

- Benchmark year of the PPP-based AMU D.I.

  - Trade accounts of AMU area near to zero $\Rightarrow$ 2001

$$S_t^{PPP,i} = S_{2001}^i \times \frac{P_t^{AMU} / P_{2001}^{AMU}}{P_t^i / P_{2001}^i}$$

- The PPP-based AMU D.I.

  - Idea from the original AMU D.I. (Ogawa and Shimizu[2005])

  $$PPP-based\ AMU\ Deviation\ Indicator\ (\%)$$

  $$= \frac{\left(\dfrac{AMU}{N.C.}\right)^{Actual} - \left(\dfrac{AMU}{N.C.}\right)^{PPP}}{\left(\dfrac{AMU}{N.C.}\right)^{PPP}} \times 100$$
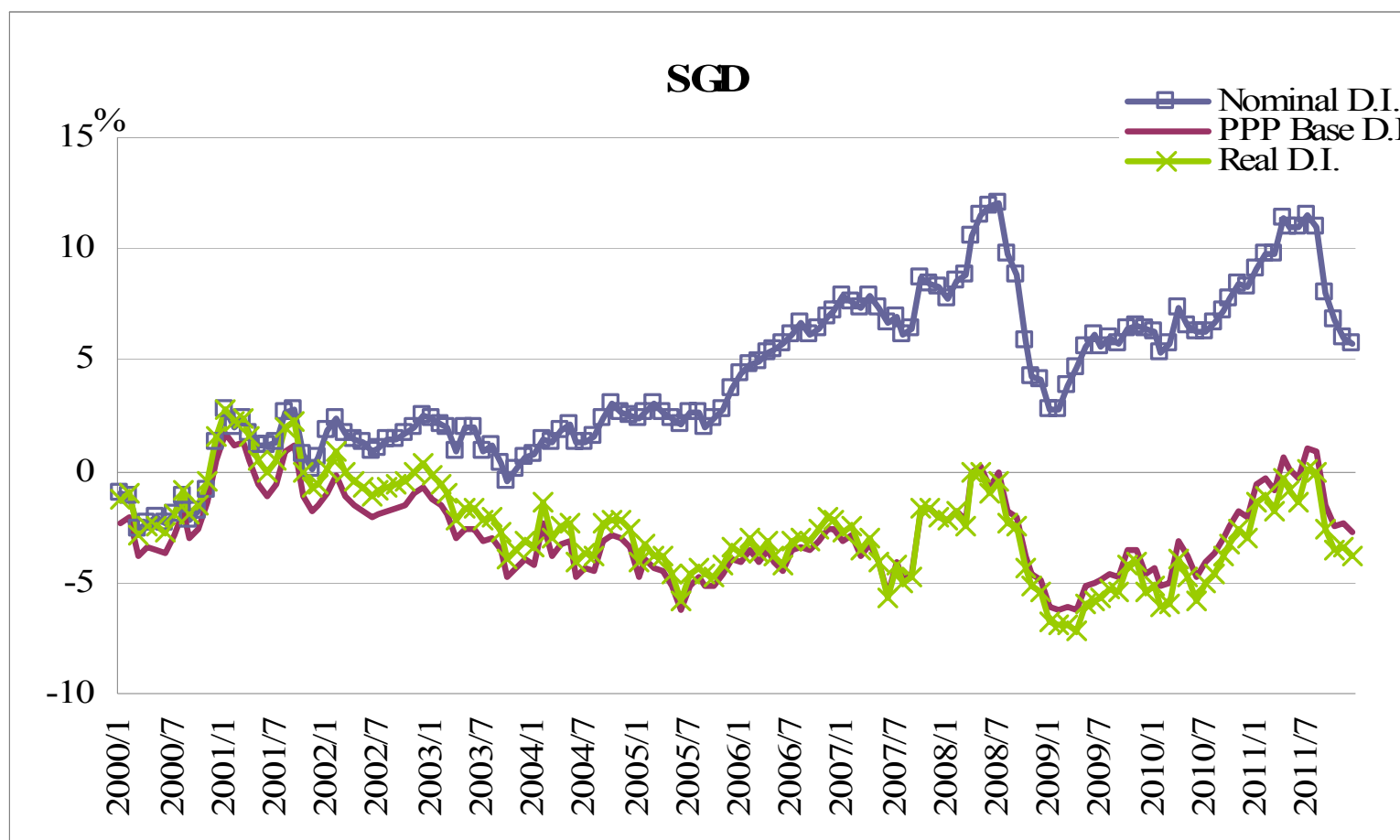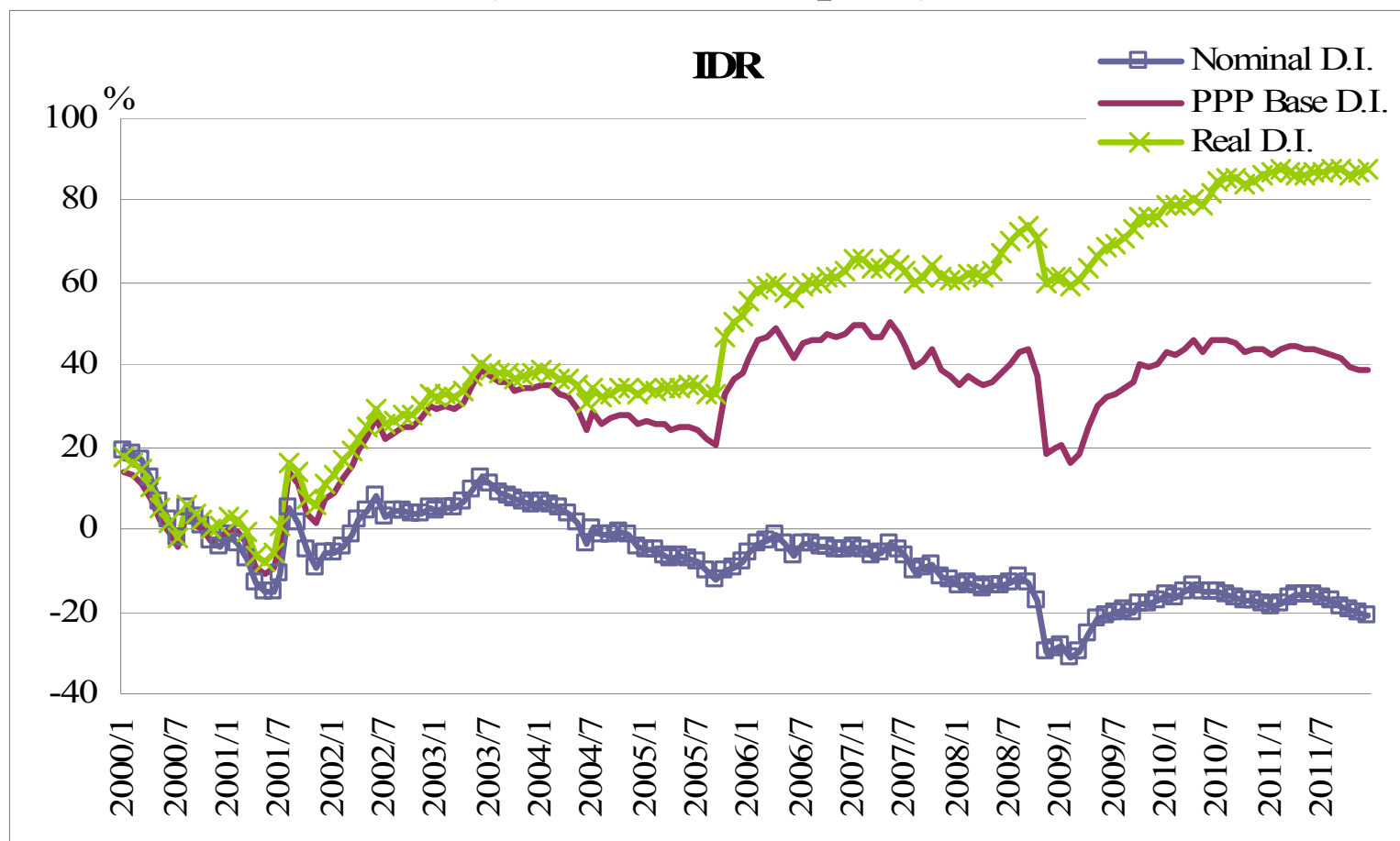
The PPP-based AMU Deviation Indicators
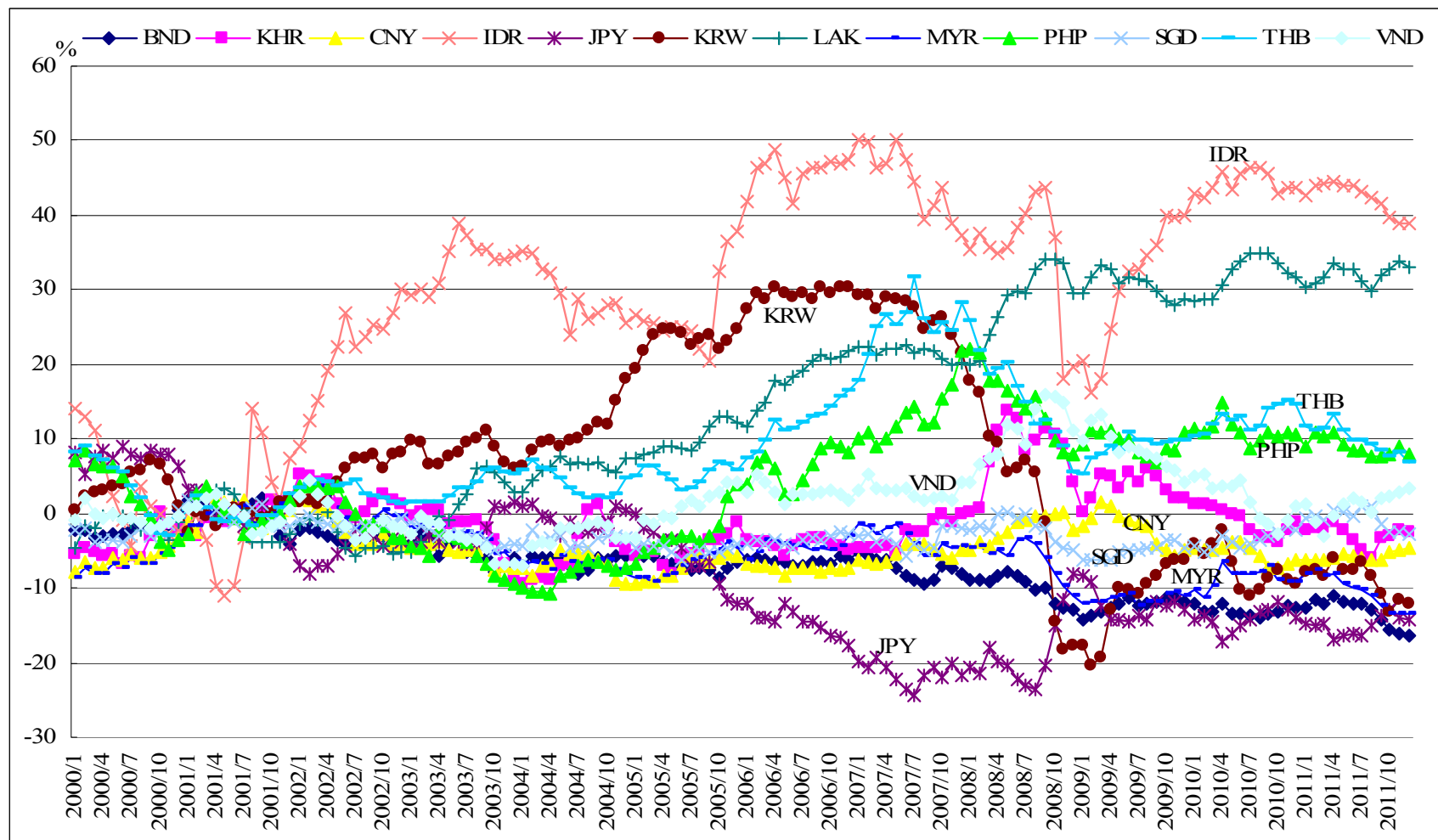
Source: RIETI (Research Institute of Economy, Trade and Industry) online database.
International Financial Statistics (IMF).

The Nominal AMU Deviation Indicator, the Real AMU Deviation Indicator and the PPP-based AMU Deviation Indicator (Japanese yen)
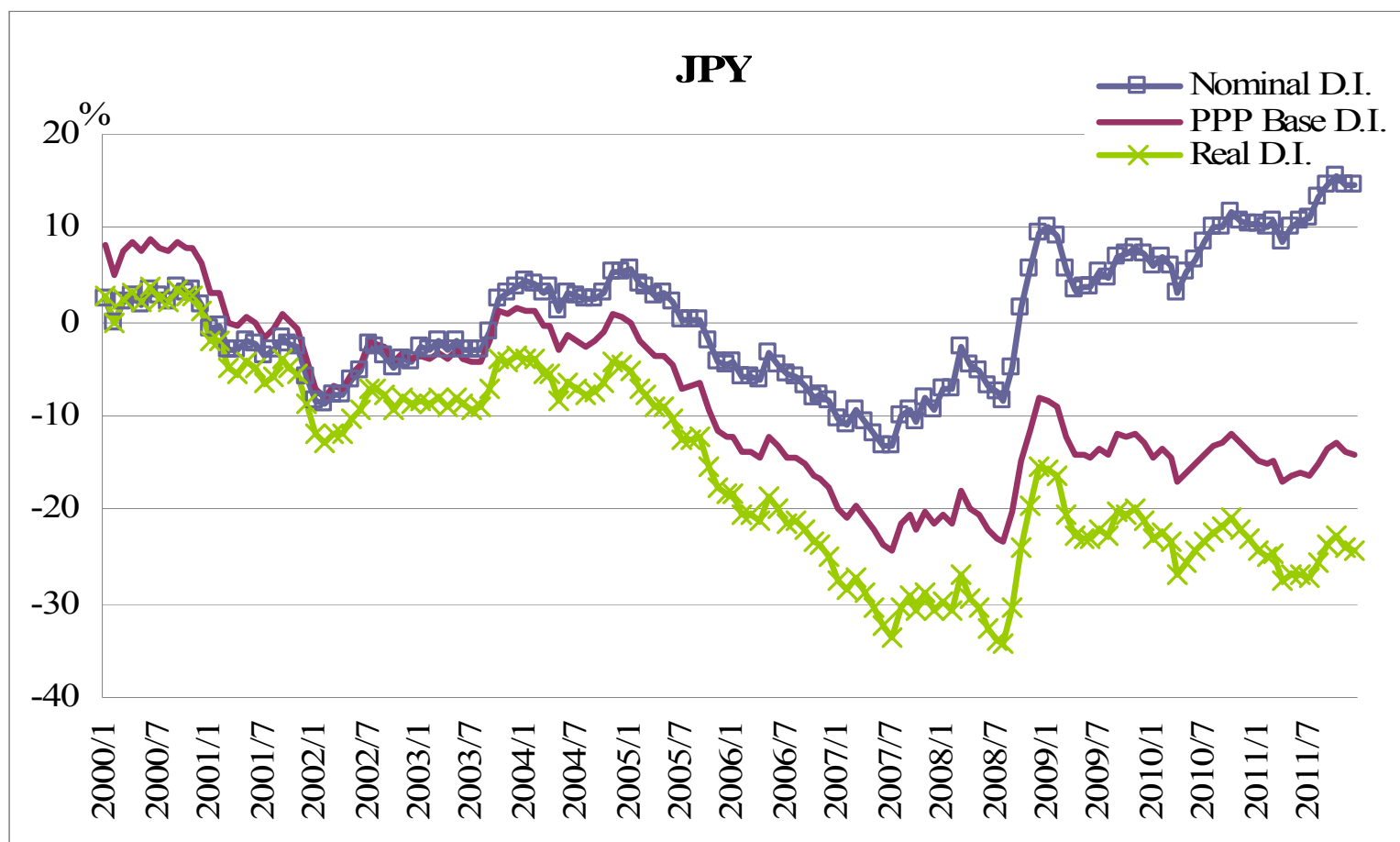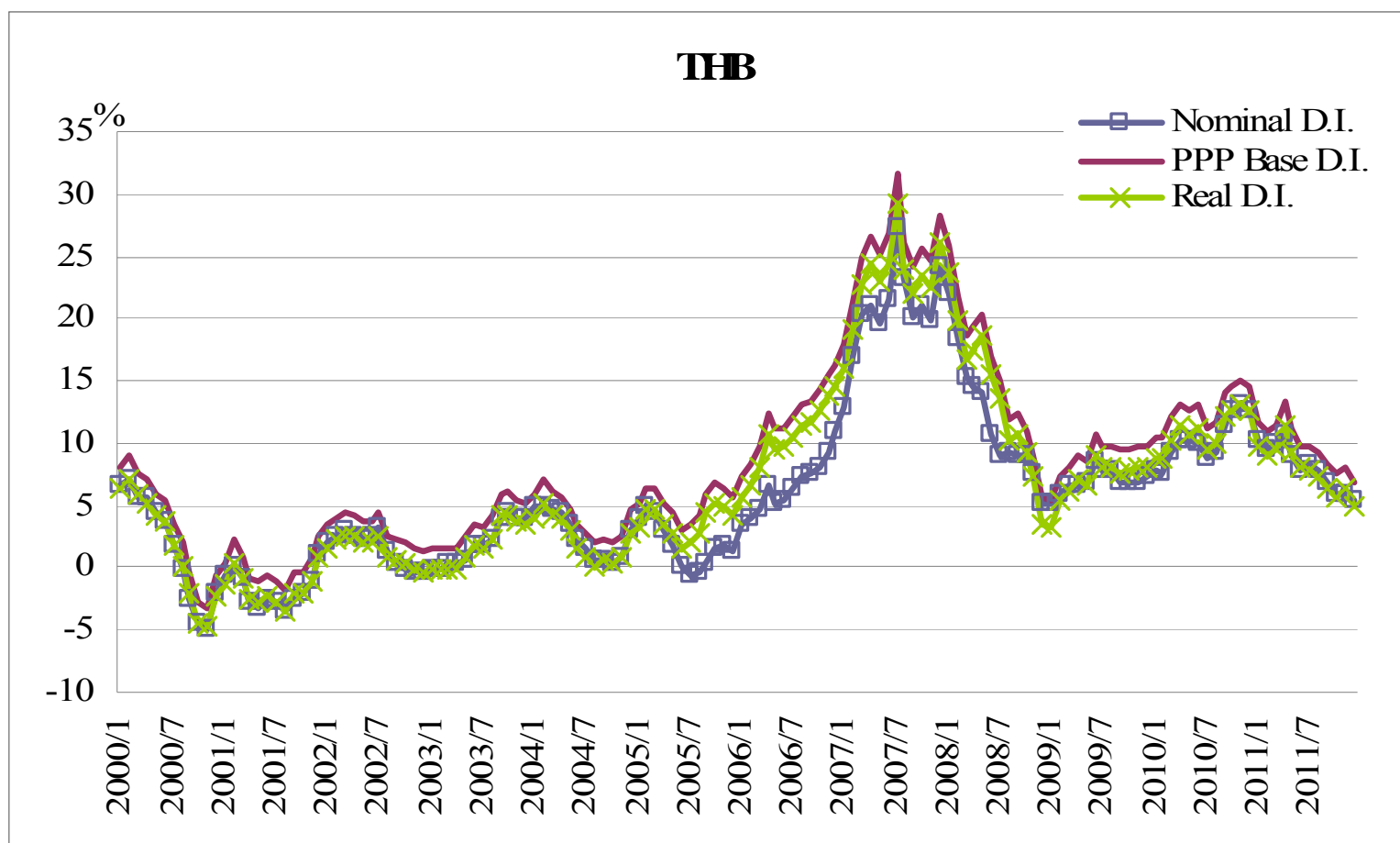

Source: RIETI (Research Institute of Economy, Trade and Industry) online database.
International Financial Statistics (IMF).

The Nominal AMU Deviation Indicator, the Real AMU Deviation Indicator and the PPP-based AMU Deviation Indicator (Chinese yuan)
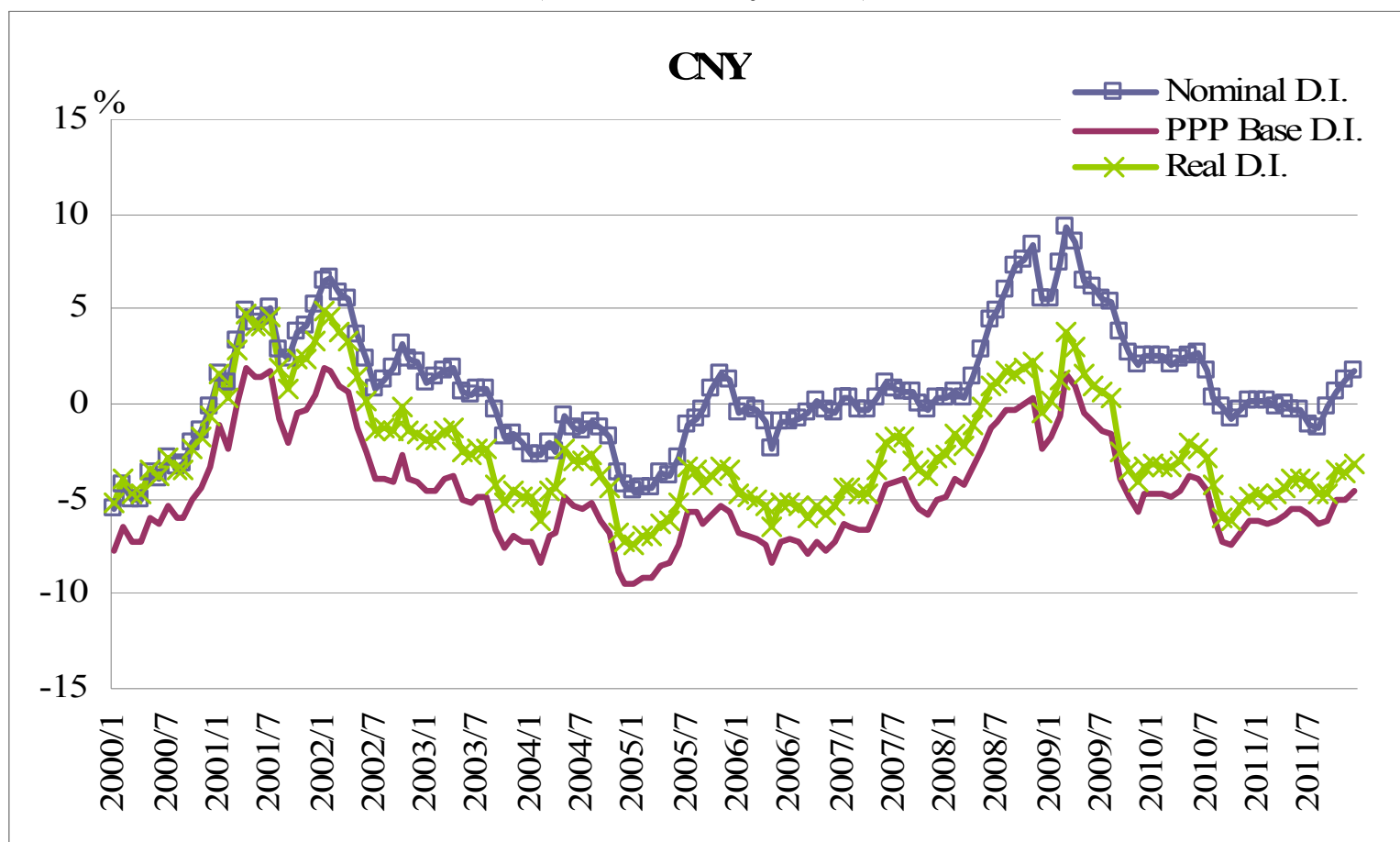
Source: RIETI (Research Institute of Economy, Trade and Industry) online database.
International Financial Statistics (IMF).

The Nominal AMU Deviation Indicator, the Real AMU Deviation Indicator and the PPP-based AMU Deviation Indicator (Korean won)
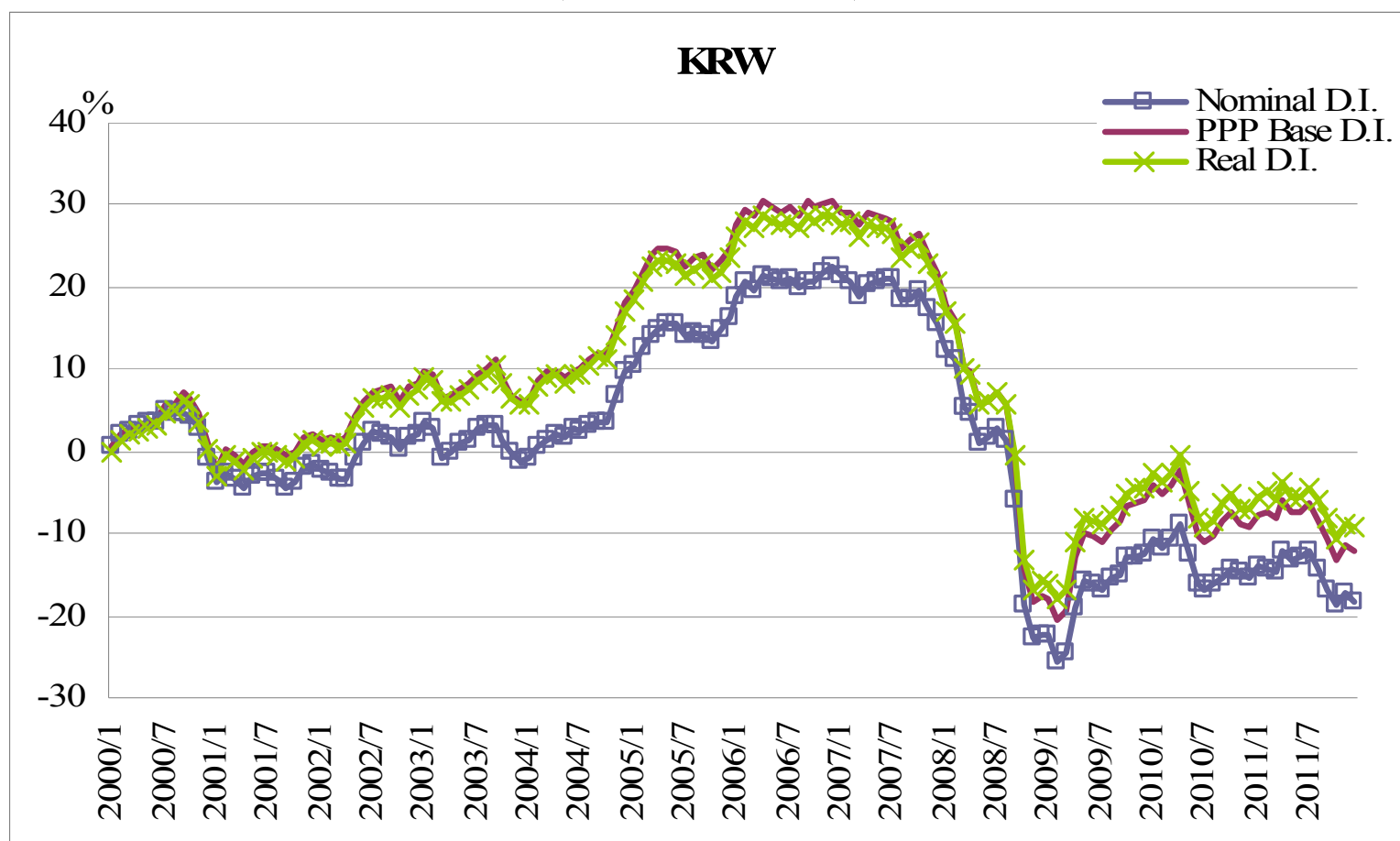
Source: RIETI (Research Institute of Economy, Trade and Industry) online database.
International Financial Statistics (IMF).

The Nominal AMU Deviation Indicator, the Real AMU Deviation Indicator and the PPP-based AMU Deviation Indicator (Singapore dollar)

Source: RIETI (Research Institute of Economy, Trade and Industry) online database.
International Financial Statistics (IMF).

The Nominal AMU Deviation Indicator, the Real AMU Deviation Indicator and the PPP-based AMU Deviation Indicator (Indonesian rupiah)

Source: RIETI (Research Institute of Economy, Trade and Industry) online database.
International Financial Statistics (IMF).

The Nominal AMU Deviation Indicator, the Real AMU Deviation Indicator and the PPP-based AMU Deviation Indicator (Thai baht)

Source: RIETI (Research Institute of Economy, Trade and Industry) online database.
International Financial Statistics (IMF).

Summary of section 3

- The higher inflation rates are, the PPP-based AMU Deviation Indicators will be more overvalued, and vice versa.

  - Inflationary countries $\Rightarrow$ Indonesia and Laos

  - Deflationary country $\Rightarrow$ Japan

- The diverging spreads tend to be broadening in high inflationary countries.

  - The PPP-based AMU D.I. vs. the original Nominal AMU D.I.

- A similar trend of fluctuation for the lower inflationary countries

  - The PPP-based AMU D.I. vs. the original Real AMU D.I.

4. PPP-based AMU Deviation Indicator Adjusted by the Balassa-Samuelson Effect

Realized problems

- The PPPs calculated by CPIs

  - CPIs include the prices of non-tradable goods

- Some possibilities about the PPP divergences

  - Law of one price

- In general, productivity (T) $>$ productivity (N)

  - Tradable goods' prices tend to be lower

  - Balassa-Samuelson effect

Model

- A simple model to explain the Balassa-Samuelson effect

  - Based on Ogawa and Sakane[2006]

- Assumptions

  - Two countries (home and foreign)

  - Tradable good sector (T) with a share ω_T and non-tradable good sector (N) with a share ω_N ($\omega_T+\omega_N=1$)

  - Home country $\Rightarrow$ a small open economy

  - Labor mobility $\Rightarrow$ within-border

  - Labor immobility $\Rightarrow$ cross-border

- Nominal wage rates
  - The nominal wage rates (W) of a domestic economy
    * The tradable good sectors = the non-tradable good sectors
  - The nominal wage rates (W*) of a foreign economy
    * The tradable good sectors = the non-tradable good sectors
- The prices of tradable goods and non-tradable goods for a home country

$$P_T = \frac{W}{\alpha_T} \quad , \quad P_N = \frac{W}{\alpha_N}$$

- The prices of tradable goods and non-tradable goods for a foreign country

$$P_T^* = \frac{W^*}{\alpha_T^*} \quad , \quad P_N^* = \frac{W^*}{\alpha_N^*}$$

- General price level (weighted average of the tradable goods' price level and the non-tradable goods' price level)

$$P = P_T^{\omega_T} \cdot P_N^{\omega_N}$$

$$P^* = P_T^{*\,\omega_T^*} \cdot P_N^{*\,\omega_N^*}$$

- Law of one price for tradable goods

$$P_T = S^{LOP} P_T^*$$

- The PPP expressed by general price levels

$$S^{PPP} = \frac{P}{P^*} = \frac{P_T^{\omega_T} \cdot P_N^{\omega_N}}{P_T^{*\,\omega_T^*} \cdot P_N^{*\,\omega_N^*}}$$
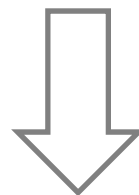
$$\log S^{PPP} = \log S^{LOP} + \omega_N \cdot \left(\log \alpha_T - \log \alpha_N \right) - \omega_N^* \cdot \left(\log \alpha_T^* - \log \alpha_N^* \right)$$

- The PPP can be expressed by each variable's rate of change

$$\dot{S}^{\text{PPP}} = \dot{S}^{\text{LOP}} + \boxed{\omega_{\text{N}}\left(\dot{\alpha}_{\text{T}} - \dot{\alpha}_{\text{N}}\right) - \omega_{\text{N}}^*\left(\dot{\alpha}_{\text{T}}^* - \dot{\alpha}_{\text{N}}^*\right)}$$

If $\quad\omega_{\text{N}}\left(\dot{\alpha}_{\text{T}} - \dot{\alpha}_{\text{N}}\right) - \omega_{\text{N}}^*\left(\dot{\alpha}_{\text{T}}^* - \dot{\alpha}_{\text{N}}^*\right) > 0$

→ The PPP becomes undervalued when compared with an exchange rate based on the law of one price

If $\quad\omega_{\text{N}}\left(\dot{\alpha}_{\text{T}} - \dot{\alpha}_{\text{N}}\right) - \omega_{\text{N}}^*\left(\dot{\alpha}_{\text{T}}^* - \dot{\alpha}_{\text{N}}^*\right) < 0$

→ The PPP becomes overvalued when compared with an exchange rate based on the law of one price

Data

- Industrial origins
  - The tradable good sectors: agriculture, livestock, forestry, fishery, mining, quarrying and manufacturing.
  - The non-tradable good sectors: construction, utilities, wholesale, retail trade, hotels, restaurants, transport, storage, communications, financial services, business services, real estate services, community services, social services, personal services and other service industries.
- Statistical department of each country
- Statistical yearbook of each country
- OECD Structural Analysis Statistics

Contribution of Tradable and Non-tradable Variables (Japan)
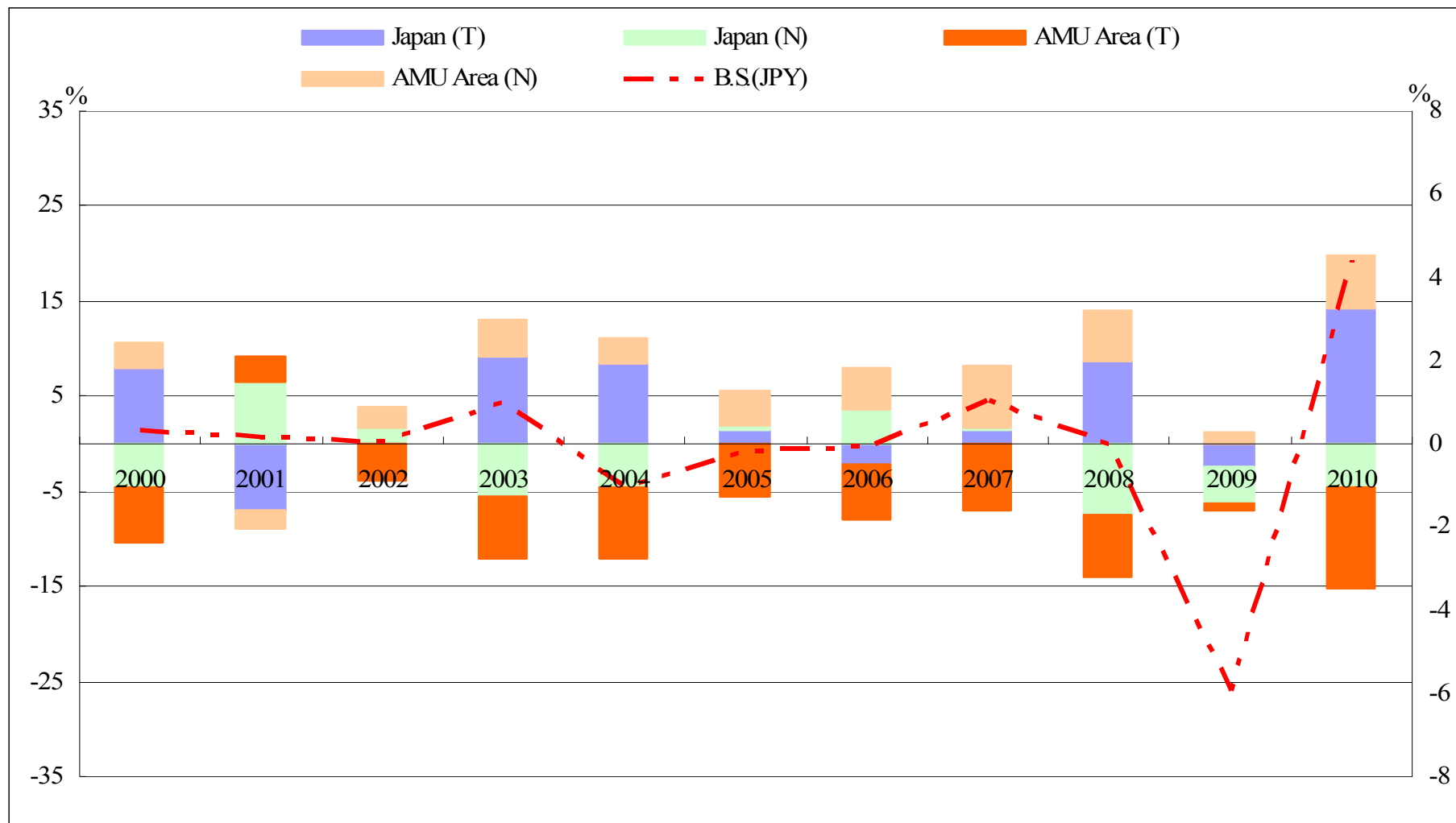
Source: Japan Statistical Yearbook, OECD Structural Analysis Statistics,
Cabinet Office, Government of Japan, Ministry of Internal Affairs and Communications.

Contribution of Tradable and Non-tradable Variables (China)
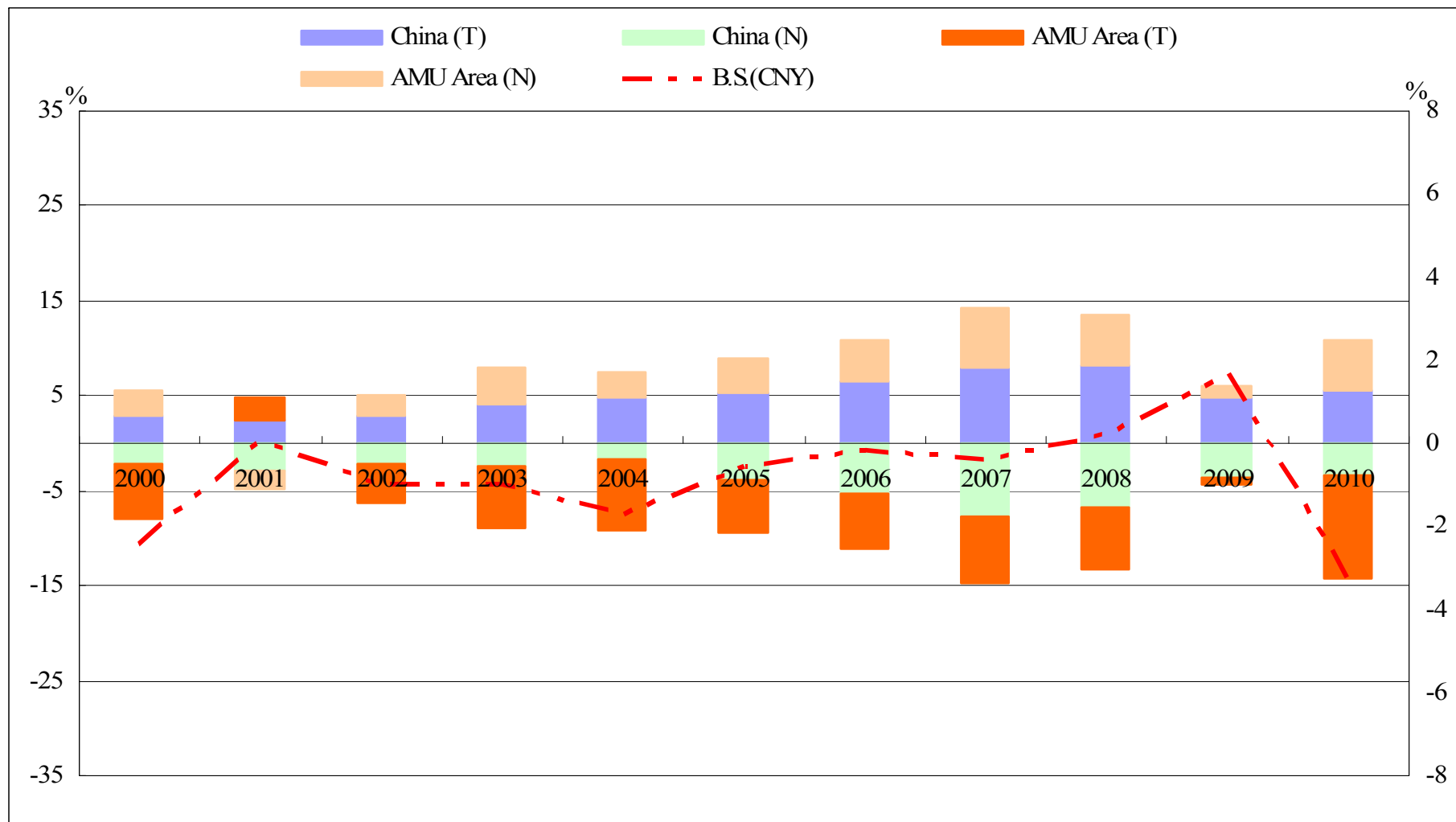
Source: China Statistical Yearbook,
        National Bureau of Statistics of China.

Contribution of Tradable and Non-tradable Variables (Korea)
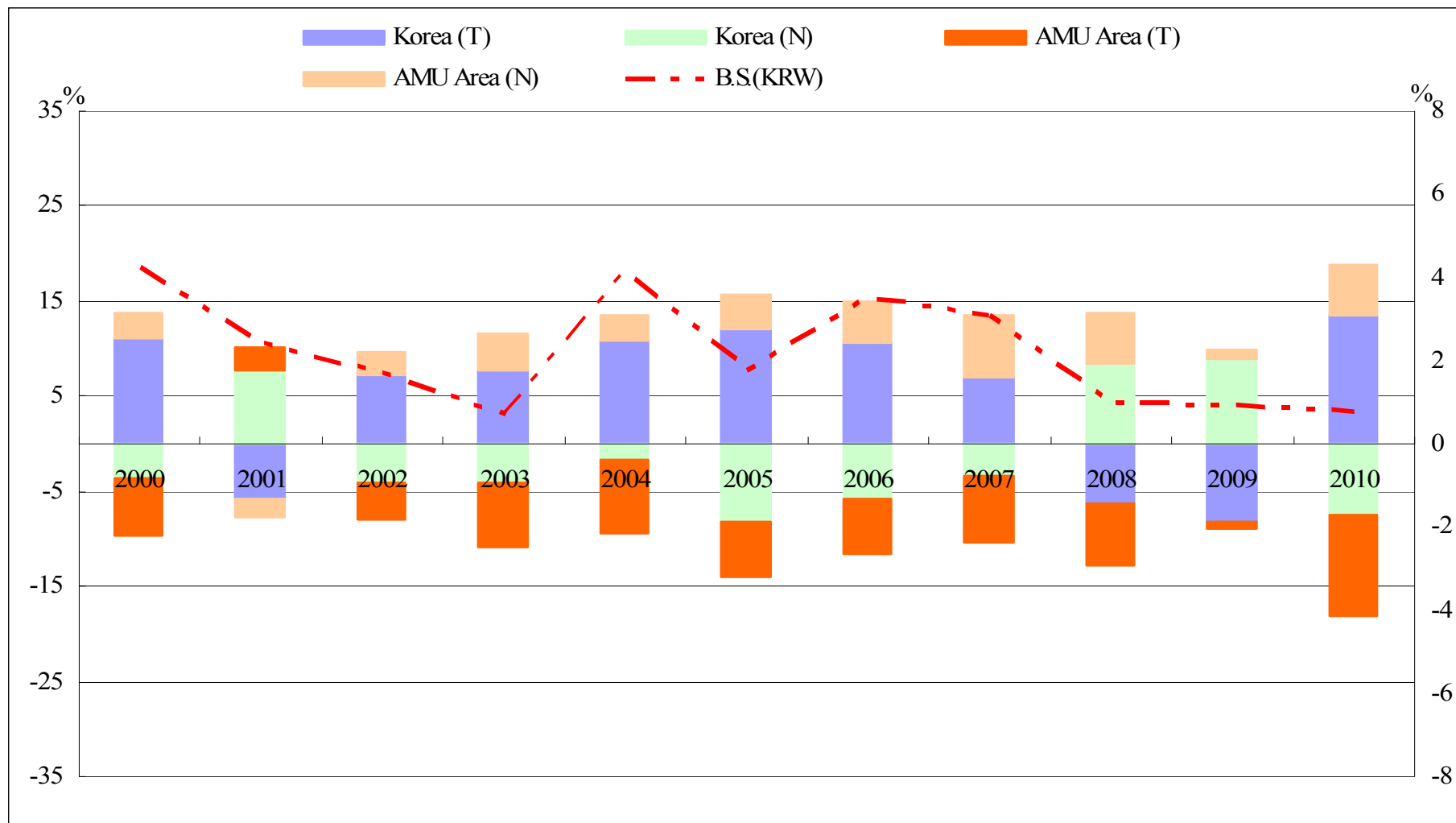
Source: Korea Statistical Yearbook, OECD Structural Analysis Statistics,
   Statistics Korea.

Contribution of Tradable and Non-tradable Variables (Singapore)
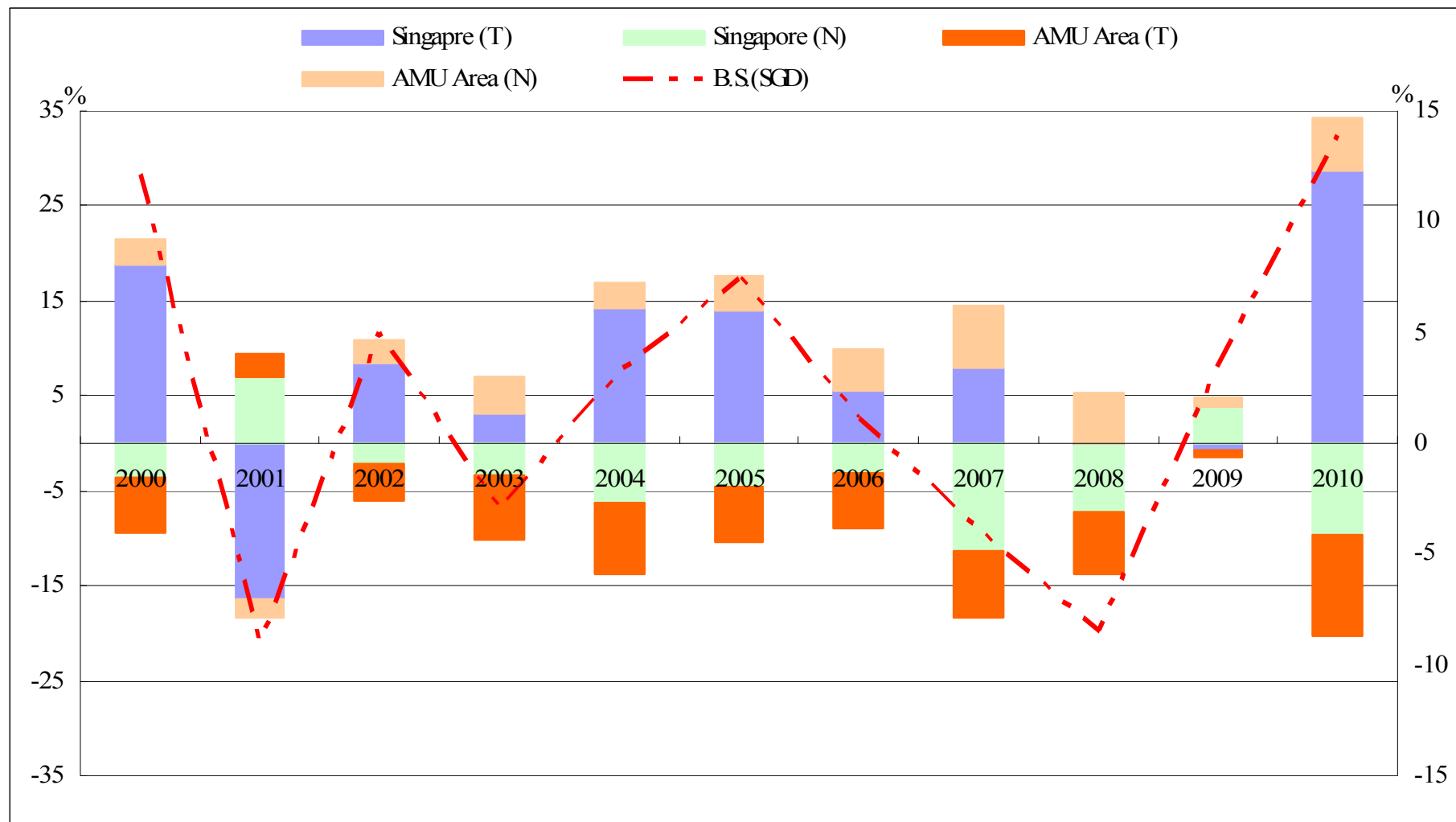
Source: Yearbook of Statistics Singapore, Department of Statistics Singapore,
   Ministry of Manpower.

Contribution of Tradable and Non-tradable Variables (Indonesia)
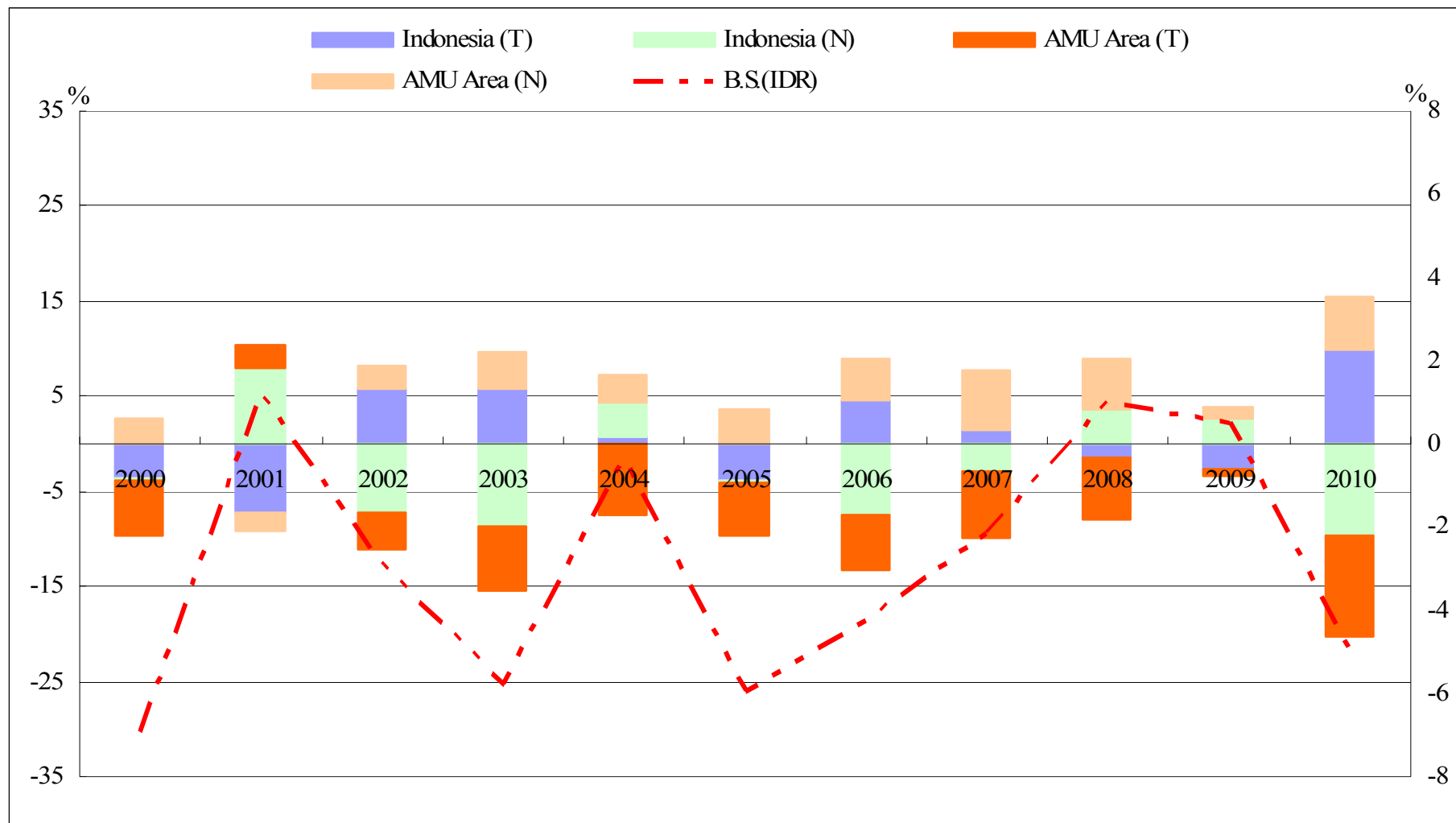
Source: Statistical Yearbook of Indonesia,
  Statistics Indonesia.

Contribution of Tradable and Non-tradable Variables (Thailand)
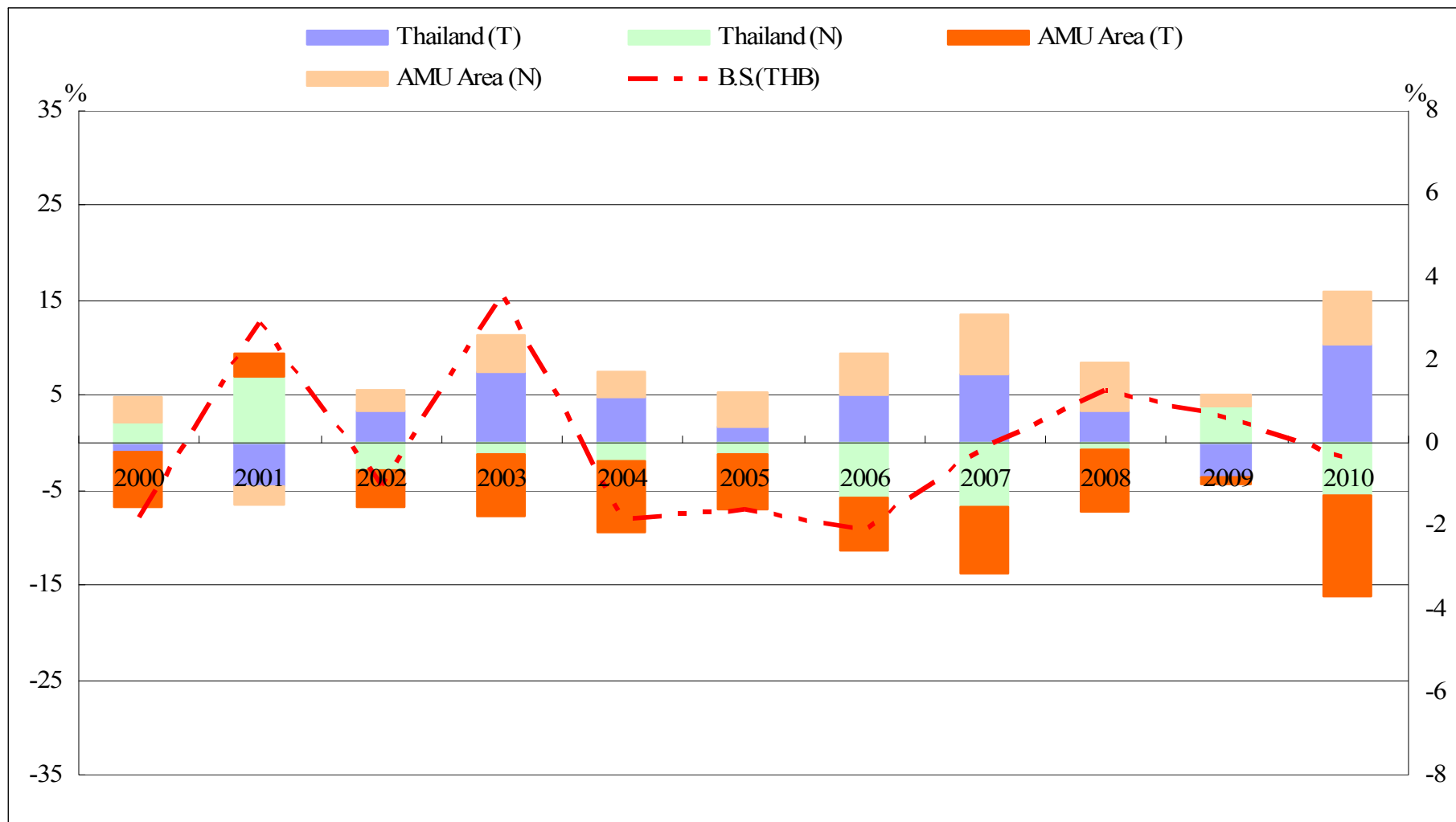
Source: Thailand Statistical Yearbook, National Statistical Office,
Office the National Economic and Social Development Board.

PPP-based AMU D.I. adjusted by Balassa-Samuelson effect

- The benchmark rate of the PPP-based AMU Deviation Indicator is calculated by the exchange rate in 2001 and countries' CPIs.

  - Balassa-Samuelson effect

  - Benchmark rate's overvaluation or undervaluation

- It is necessary to eliminate the Balassa-Samuelson effect from the benchmark.

- The exchange rate as it follows the law of one price will be the benchmark rate.

- PPP-based AMU D.I. and the Balassa-Samuelson effect

$$DI^{\text{PPP Adjusted by BS}} = \frac{S^{\text{Actual}} - S^{\text{LOP}}}{S^{\text{LOP}}}$$
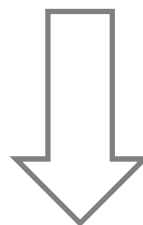
$$DI^{\text{PPP Adjusted by BS}} \approx \log S^{\text{Actual}} - \boxed{\log S^{\text{LOP}}}$$

Because of

$$\log S^{\text{LOP}} = \log S^{\text{PPP}} - \omega_N \cdot \left(\log \alpha_T - \log \alpha_N \right) + \omega_N^* \cdot \left(\log \alpha_T^* - \log \alpha_N^* \right)$$

$$\text{DI}^{\text{PPP Adjusted by BS}} \approx$$

$$\log\text{S}^{\text{Actual}} - \log\text{S}^{\text{PPP}} + \omega_{\text{N}} \cdot \left(\log\alpha_{\text{T}} - \log\alpha_{\text{N}}\right) - \omega_{\text{N}}^{*} \cdot \left(\log\alpha_{\text{T}}^{*} - \log\alpha_{\text{N}}^{*}\right)$$

$$\Delta\text{DI}^{\text{PPP Adjusted by BS}} \approx \dot{\text{S}}^{\text{Actual}} - \dot{\text{S}}^{\text{PPP}} + \omega_{\text{N}}\left(\dot{\alpha}_{\text{T}} - \dot{\alpha}_{\text{N}}\right) - \omega_{\text{N}}^{*}\left(\dot{\alpha}_{\text{T}}^{*} - \dot{\alpha}_{\text{N}}^{*}\right)$$

$$\text{PPP}-\text{based} \ \text{AMU} \ \text{D.I.} \ (\%) = \frac{\left(\dfrac{\text{AMU}}{\text{N.C.}}\right)^{\text{Actual}} - \left(\dfrac{\text{AMU}}{\text{N.C.}}\right)^{\text{PPP}}}{\left(\dfrac{\text{AMU}}{\text{N.C.}}\right)^{\text{PPP}}} \times 100$$
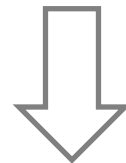
$$\text{DI}^{\text{PPP}} \approx \log\text{S}^{\text{Actual}} - \log\text{S}^{\text{PPP}}$$
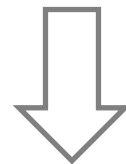
$$\Delta\,\text{DI}^{\text{PPP}} \approx \dot{\text{S}}^{\text{Actual}} - \dot{\text{S}}^{\text{PPP}}$$

- PPP-based AMU D.I. adjusted by the Balassa-Samuelson effect

$$\Delta DI^{PPP \ Adjusted \ by \ BS} \approx \boxed{\dot{S}^{Actual} - \dot{S}^{PPP}} + \omega_N(\dot{\alpha}_T - \dot{\alpha}_N) - \omega_N^*(\dot{\alpha}_T^* - \dot{\alpha}_N^*)$$

$$\Downarrow$$
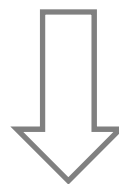
$$\Delta DI^{PPP \ Adjusted \ by \ BS} \approx \Delta DI^{PPP} + \omega_N(\dot{\alpha}_T - \dot{\alpha}_N) - \omega_N^*(\dot{\alpha}_T^* - \dot{\alpha}_N^*)$$

PPP-based AMU Deviation Indicators Adjusted by Balassa-Samuelson Effect
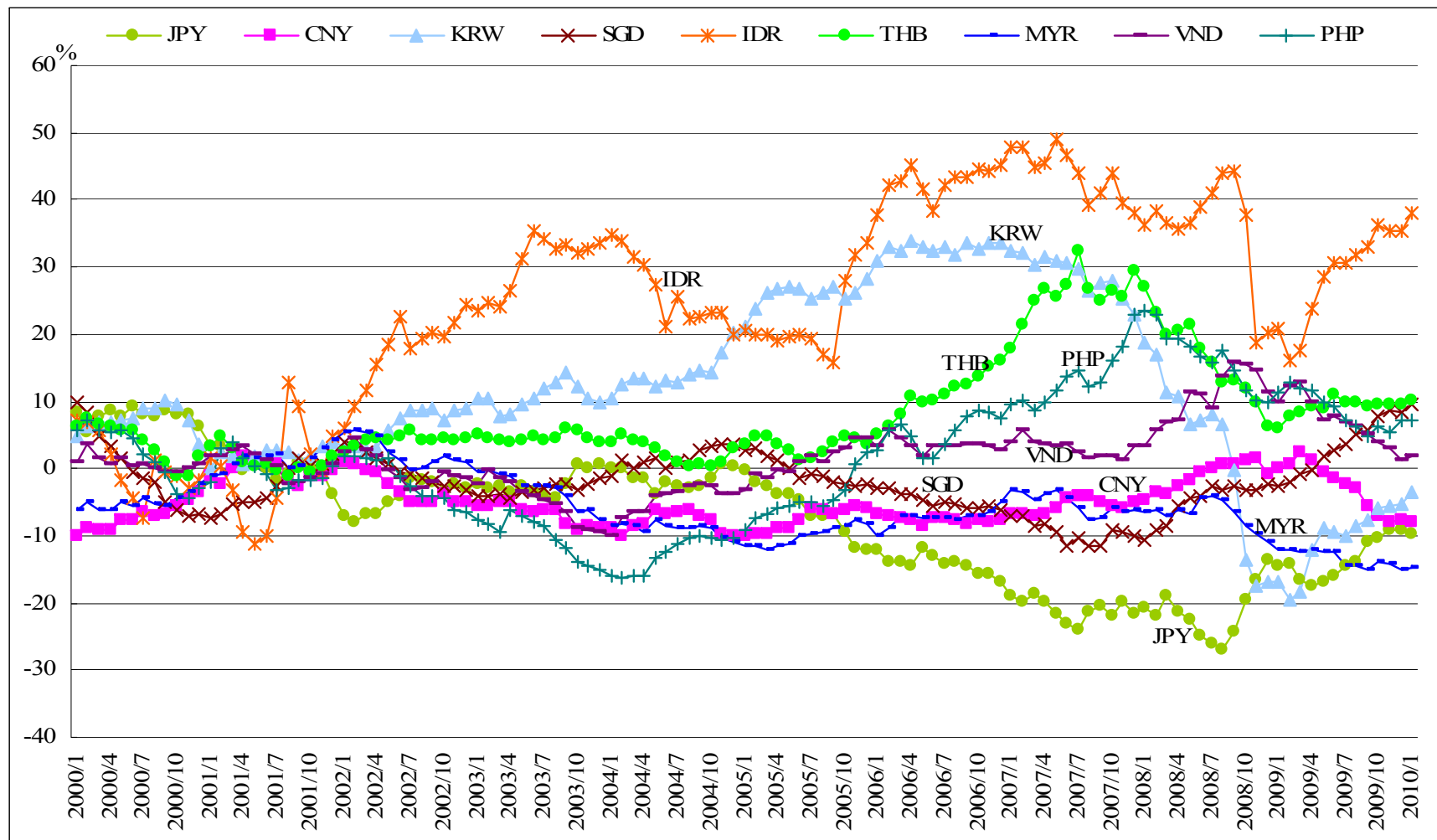
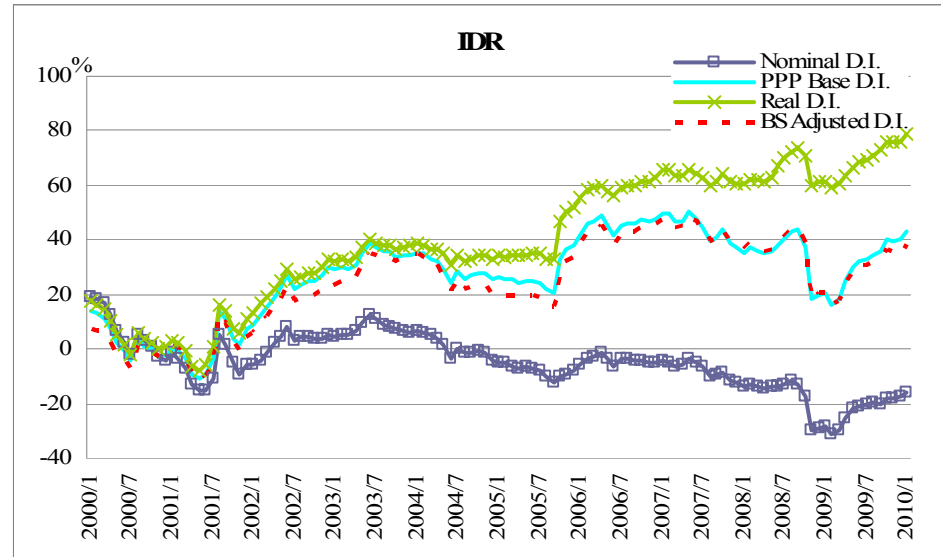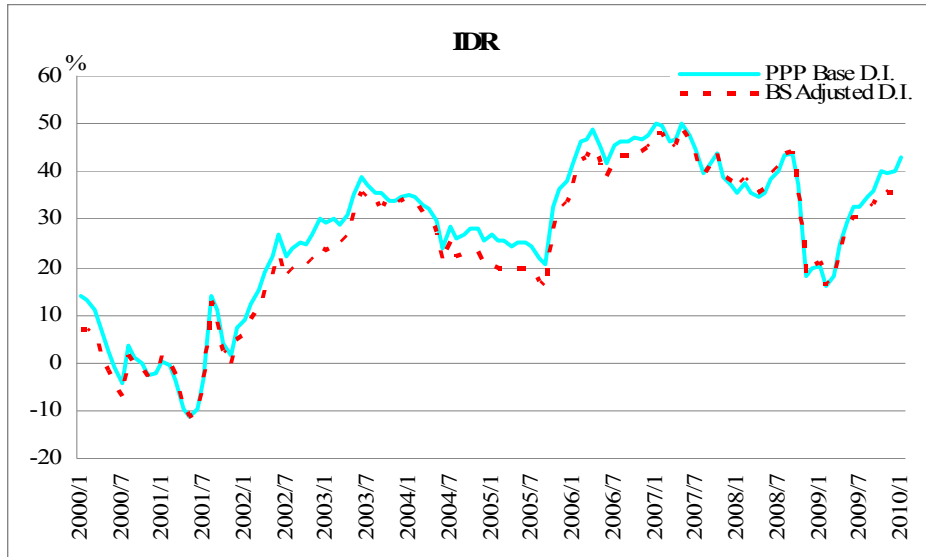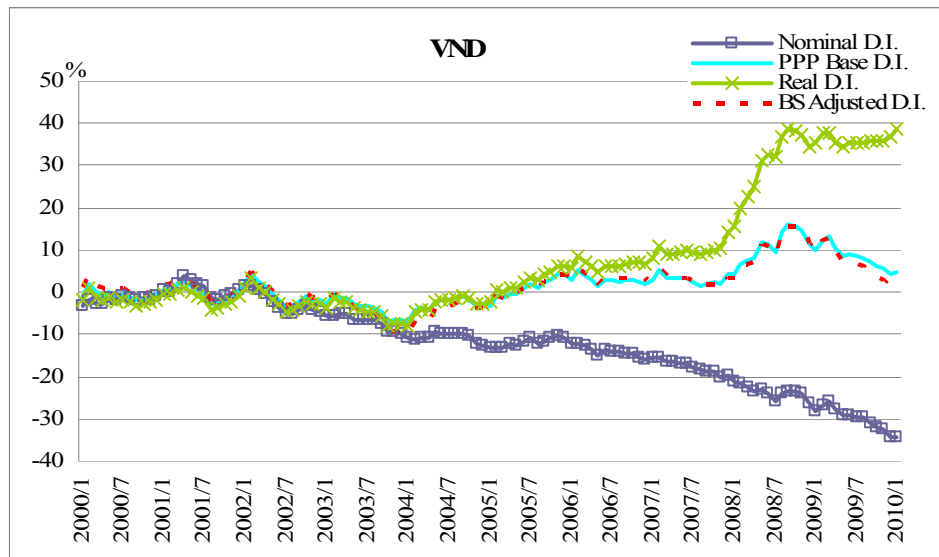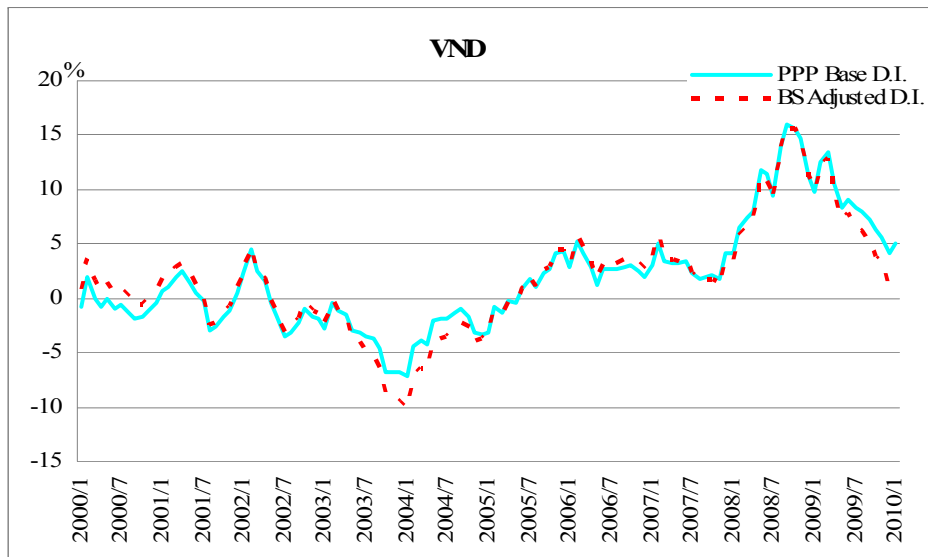Source: RIETI (Research Institute of Economy, Trade and Industry) online database, International Financial Statistics (IMF), Table 4-1-1 to 4-1-9.
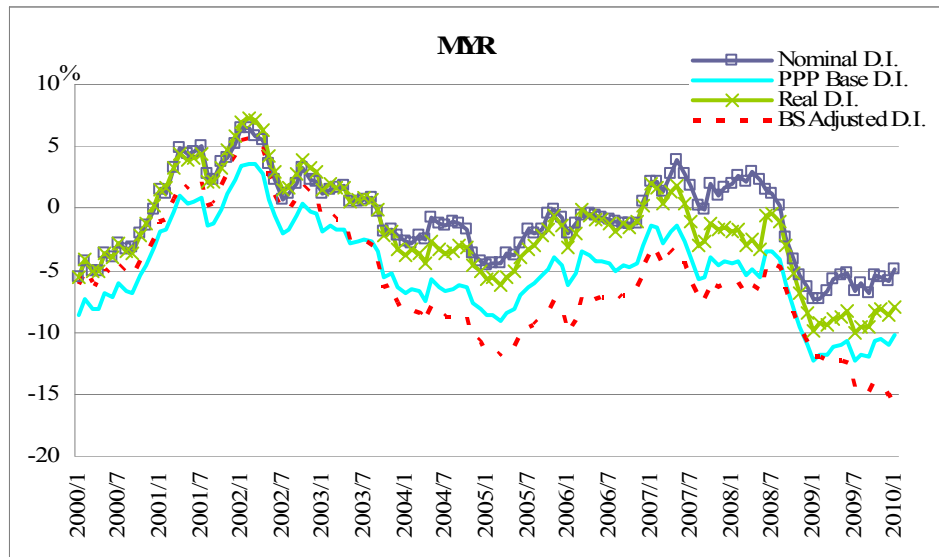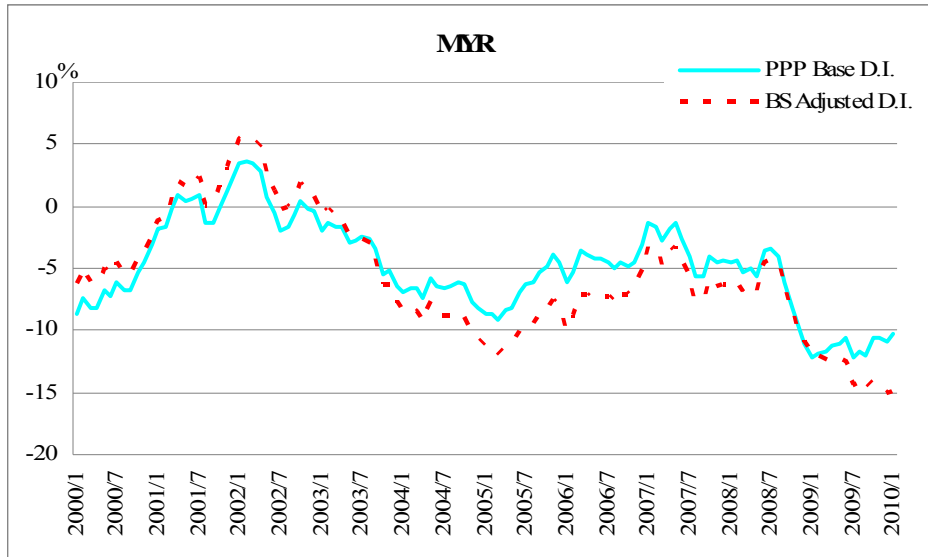
The AMU Deviation Indicators of ASEAN6+3
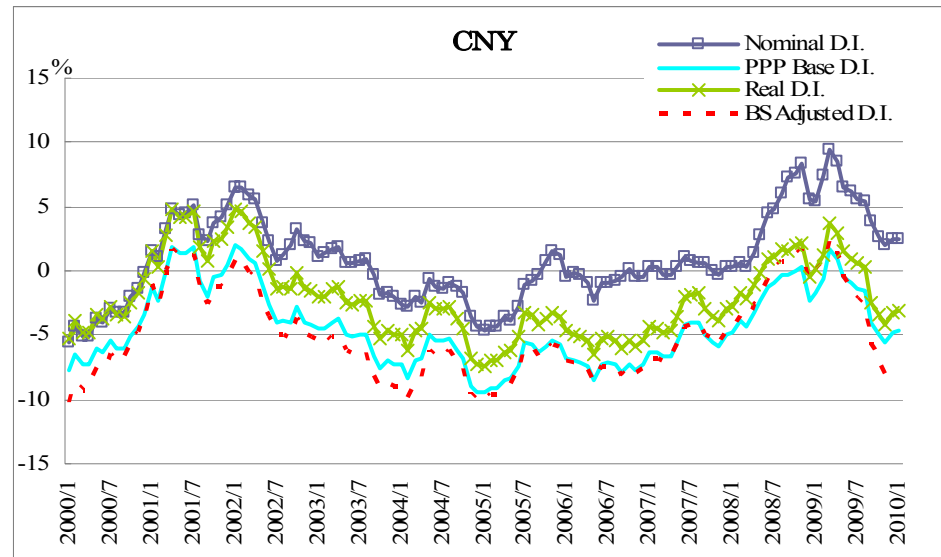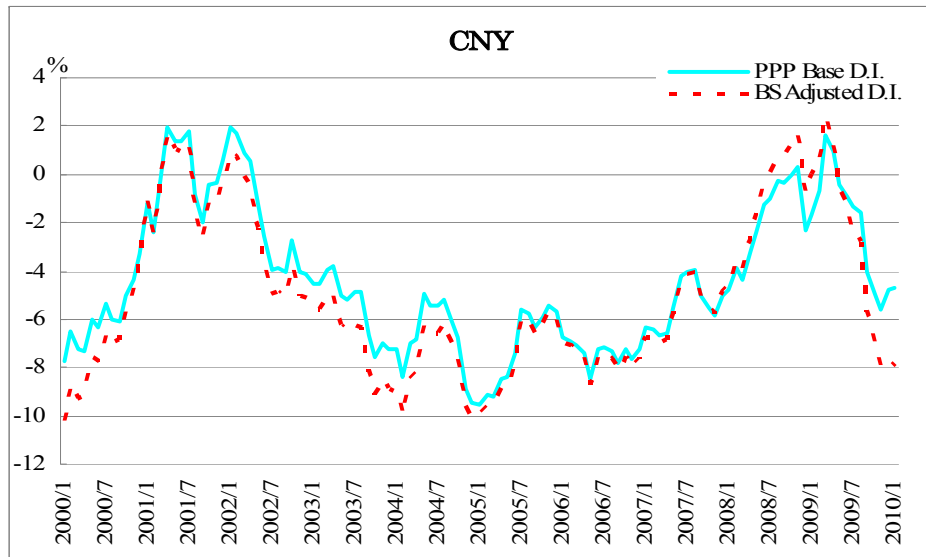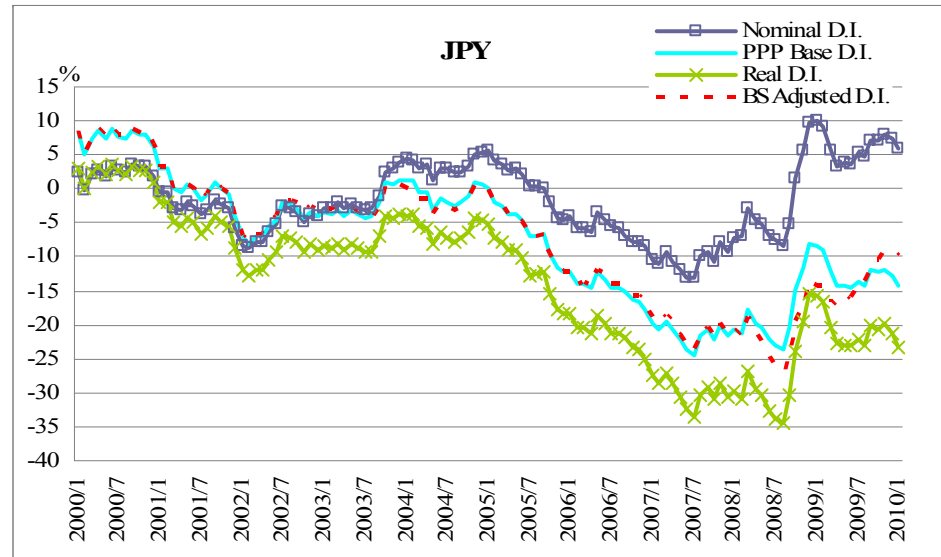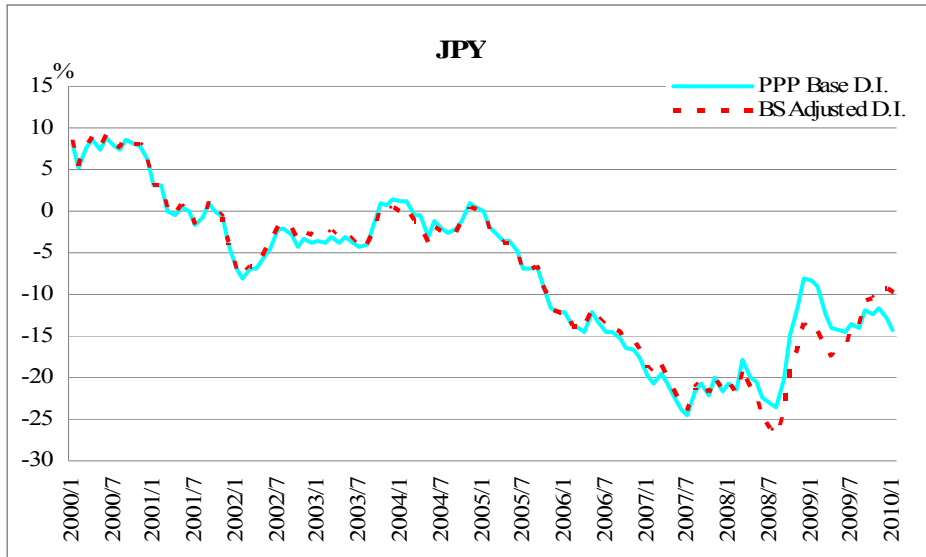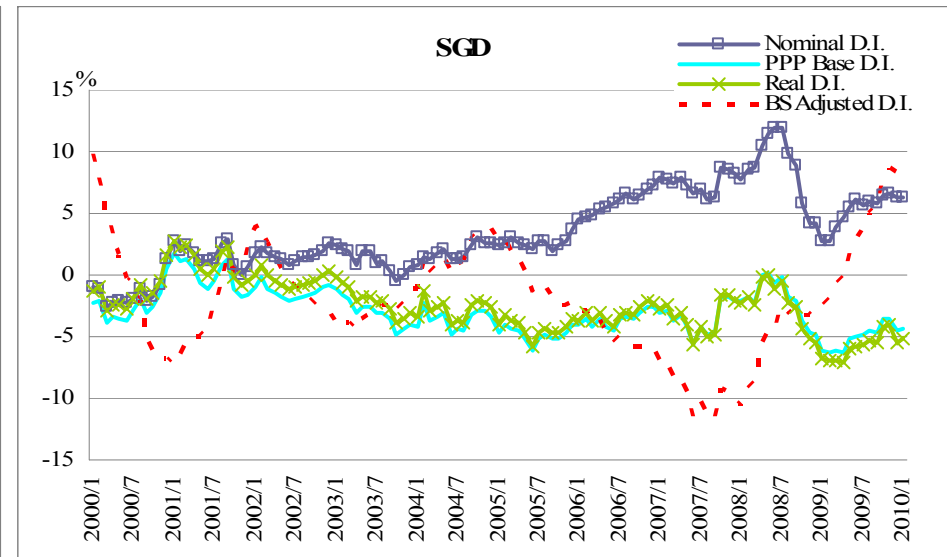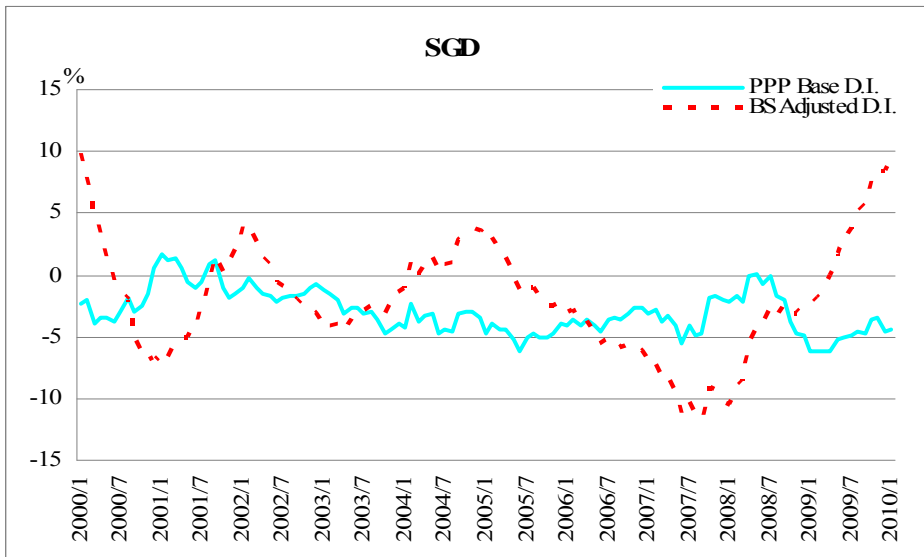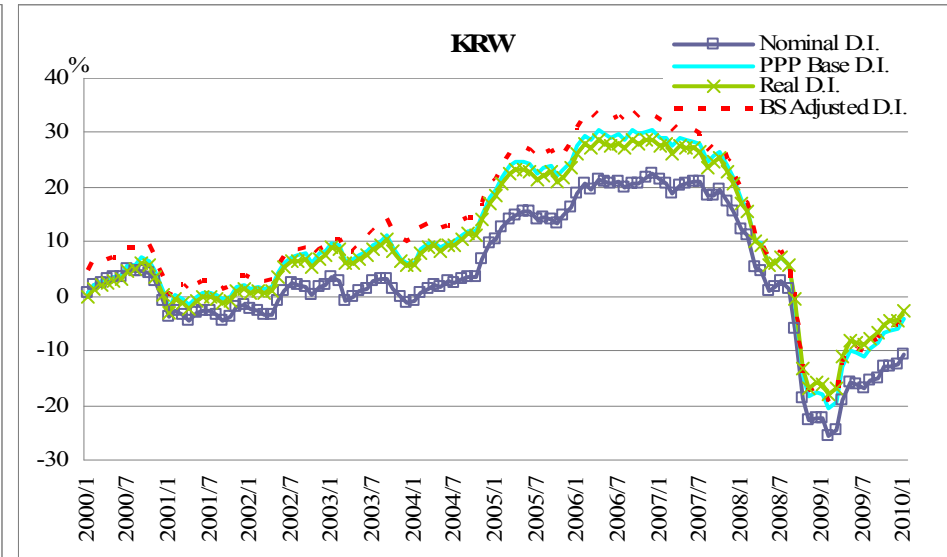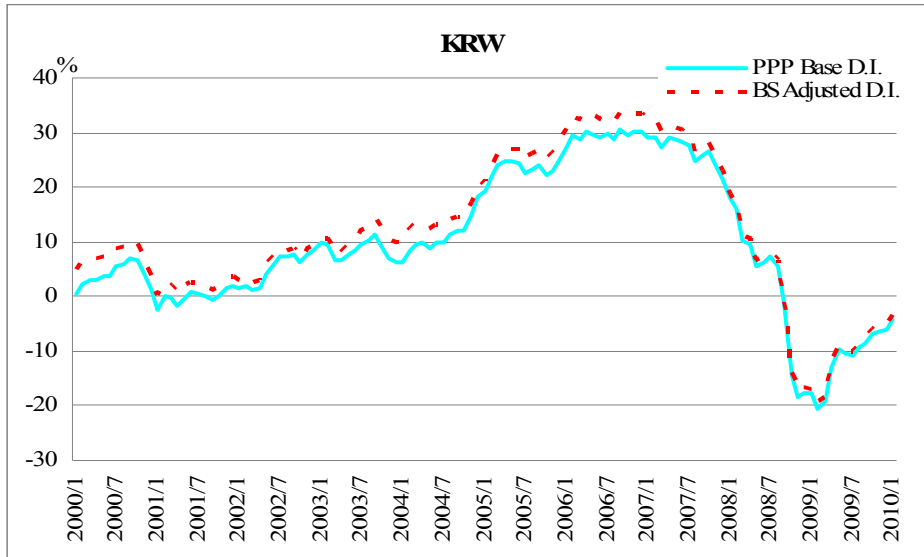
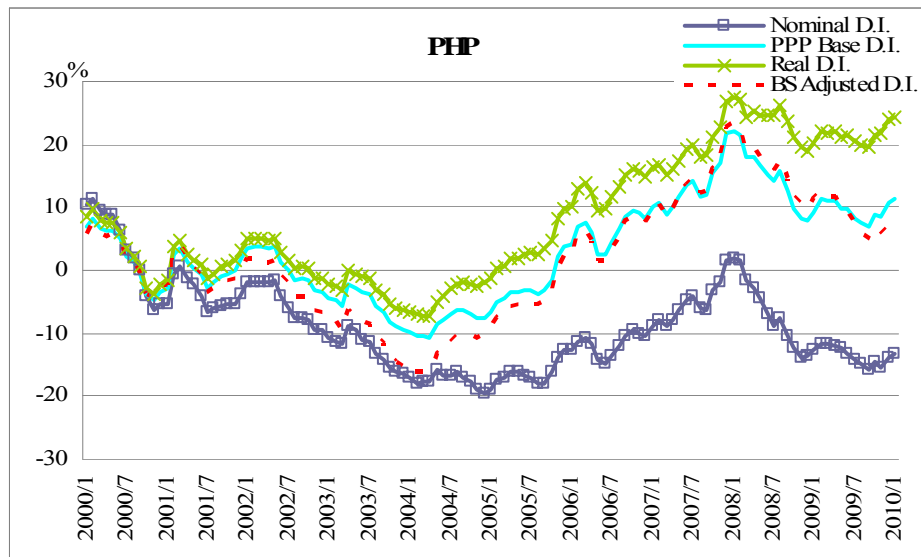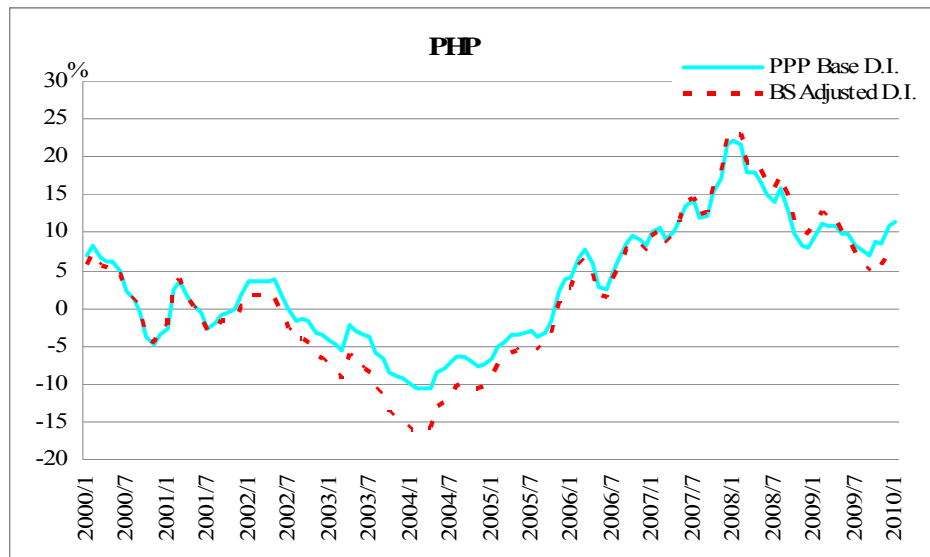# The AMU Deviation Indicators of ASEAN6+3

The AMU Deviation Indicators of ASEAN6+3
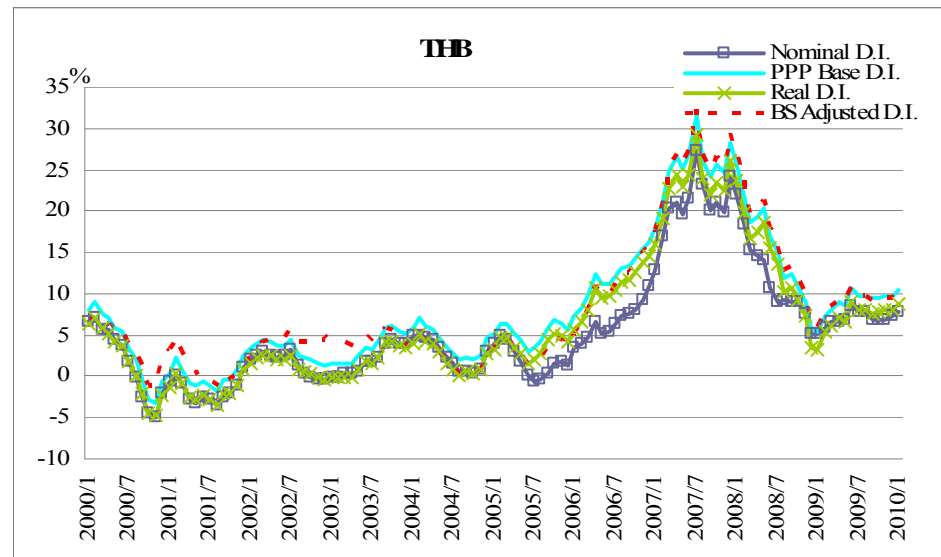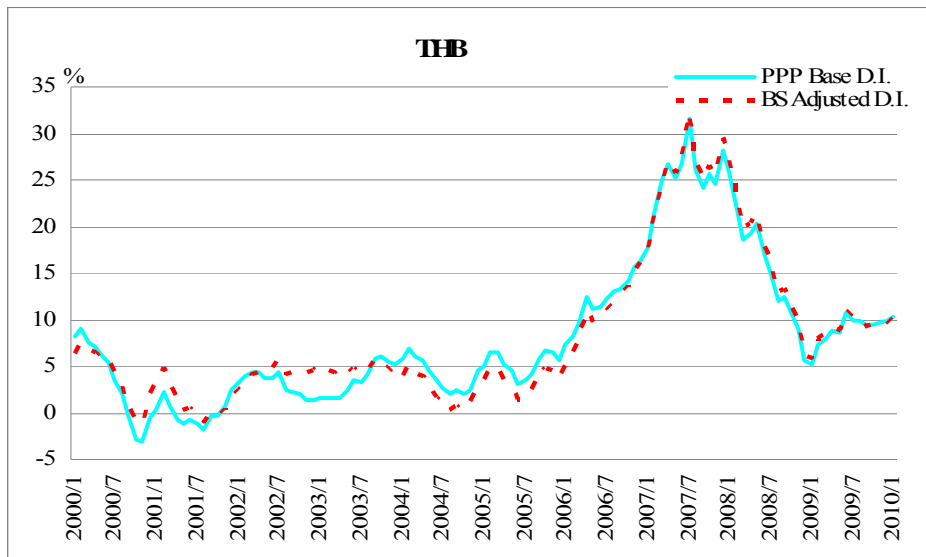
The AMU Deviation Indicators of ASEAN6+3

The AMU Deviation Indicators of ASEAN6+3

Source: RIETI (Research Institute of Economy, Trade and Industry) online database, International Financial Statistics (IMF),
Table 4-1-1 to 4-1-9.

Summary of section 4

- PPP-based AMU Deviation Indicators adjusted by the Balassa-Samuelson effect have a tendency to be

  - undervalued in Japan, China and Malaysia

  - overvalued in Korea, Indonesia, Thailand, Vietnam and the Philippines

  - near to balance in Singapore

- Asymmetric diversity on foreign exchange rates within the AMU area is still an important issue in the process of monetary cooperation.

5. Conclusion

The AMU Deviation Indicators based on the Purchasing Power Parity and adjusted by the Balassa-Samuelson effect:

- Time-varying benchmarks
- Similar trend of fluctuations with the Real AMU D.I.
- Different movements with the Nominal AMU D.I.
- Asymmetric diversity on foreign exchange rates within the AMU area
- Evaluating the exchange rate level from the viewpoint of real economy
- Subsidiary indices to support the original AMU Deviation Indicators

Thank you !