How Did the Global Financial Crisis Misalign East Asian Currencies?

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Background and Motivation

- The global financial crisis in 2007–2008 had inflicted harm not only on the economies of the United States but also Europe. The related economic slump in the United States and Europe indirectly gave adverse effects on the world economy, which includes East Asian economy.

- Exchange rates of East Asian currencies were indirectly affected by the global financial crisis via changes in capital flows (currency carry trades).

- East Asian currencies made asymmetric response to the global financial crisis,

  - Depreciation of the Japanese yen and appreciation of the Korean won before the global financial crisis,

  - Appreciation of the Japanese yen and depreciation of the Korean won during and after the global financial crisis.

Objectives and Methodologies

- Objectives

  This paper uses the PPP-based AMU Deviation Indicator adjusted by the Balassa–Samuelson effect to investigate:

  - how East Asian currencies had misaligned before and after the global financial crisis.

- Methodologies (β-convergence and σ-convergence)

  - β-convergence focuses on speed of convergence, and a larger coefficient represents a relative higher speed of convergence among the variables.

  - σ-convergence focuses on cross-sectional dispersion, and it will occur if the variance (or standard deviation) across a group of variables declines over time.

Contents

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

- Possibility of the PPPs divergence

  - Law of one price

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

  - Tradable goods' prices tend to be lower

- Balassa–Samuelson effect

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

- Benchmark rate of the PPP-based AMU D.I. is calculated by the exchange rate in 2001 and each country's CPI.

  - Balassa–Samuelson effect

  - Benchmark rate's overvaluation or undervaluation

- It is necessary to take into account the Balassa–Samuelson effect to set time-varying benchmark rate based on PPP calculated in terms of CPI.

A Simple 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
  - Within-border $\Rightarrow$ labor mobility
  - Cross-border $\Rightarrow$ labor immobility

- Nominal wage rates
  - Nominal wage rates (W) of the domestic economy
    * The tradable good sectors = the non-tradable good sectors
  - Nominal wage rates (W^*) of the foreign economy
    * The tradable good sectors = the non-tradable good sectors
- Prices of tradable goods and non-tradable goods for the domestic economy

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

- Prices of tradable goods and non-tradable goods for the foreign economy

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

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

$$P = P_T^{\omega_T} \cdot P_N^{\omega_N} \qquad (1)$$

$$P^* = P_T^{*\omega_T^*} \cdot P_N^{*\omega_N^*} \qquad (2)$$

- Under the law of one price for tradable goods

$$P_T = S^{LOP} P_T^* \qquad (3)$$

- The PPP expressed by general price levels

$$S^{PPP} = \frac{P}{P^*} = \frac{P_T^{\omega_T} \cdot P_N^{\omega_N}}{P_T^{*\omega_T^*} \cdot P_N^{*\omega_N^*}} \qquad (4)$$

Therefore, the PPP can be expressed by the exchange rate following the law of one price and the productivities of tradable good sectors and non-tradable good sectors both the home and foreign economies.

$$logS^{PPP}$$
$$= logS^{LOP} + \omega_N \cdot (log\alpha_T - log\alpha_N) - \omega_N^* \cdot (log\alpha_T^* - log\alpha_N^*) \ (5)$$

- Productivity of the tradable good sectors (α_T) and productivity of the non-tradable good sectors (α_N) in the domestic economy

$$\alpha_T = \frac{\sum Y_T}{\sum L_T} \, , \, \alpha_N = \frac{\sum Y_N}{\sum L_N}$$

- Productivity of the tradable good sectors (α_T^*) and productivity of the non-tradable good sectors (α_N^*) in the foreign economy

$$\alpha_T^* = \frac{\sum Y_T^*}{\sum L_T^*} \, , \, \alpha_N^* = \frac{\sum Y_N^*}{\sum L_N^*}$$

- The rate of change is defined as the percent change from the previous year.

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

  - Taking into account the Balassa–Samuelson effect in using PPP calculated in terms of CPI

$$DI^{PPP\ Adjusted\ by\ BS}$$
$$\approx \log(S)^{Actual}$$
$$- \{\log(S)^{PPP} - \omega_N \cdot (log\alpha_T - log\alpha_N) + \omega_N^* \cdot (log\alpha_T^* - log\alpha_N^*)\ \}$$

$$DI^{PPP\ Adjusted\ by\ BS}$$
$$\approx logS^{Actual} - logS^{PPP} +$$
$$\omega_N \cdot (log\alpha_T - log\alpha_N) - \omega_N^* \cdot (log\alpha_T^* - log\alpha_N^*)$$

$$DI^{PPP\ Adjusted\ by\ BS}$$
$$\approx DI^{PPP} + \omega_N \cdot (log\alpha_T - log\alpha_N) - \omega_N^* \cdot (log\alpha_T^* - log\alpha_N^*)$$

Data

- Countries: ASEAN6+3 (Japan, China, Korea, Singapore, Indonesia, Thailand, Malaysia, Vietnam, the Philippines)

- 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

PPP-based AMU Deviation Indicators Adjusted by the Balassa–Samuelson Effect
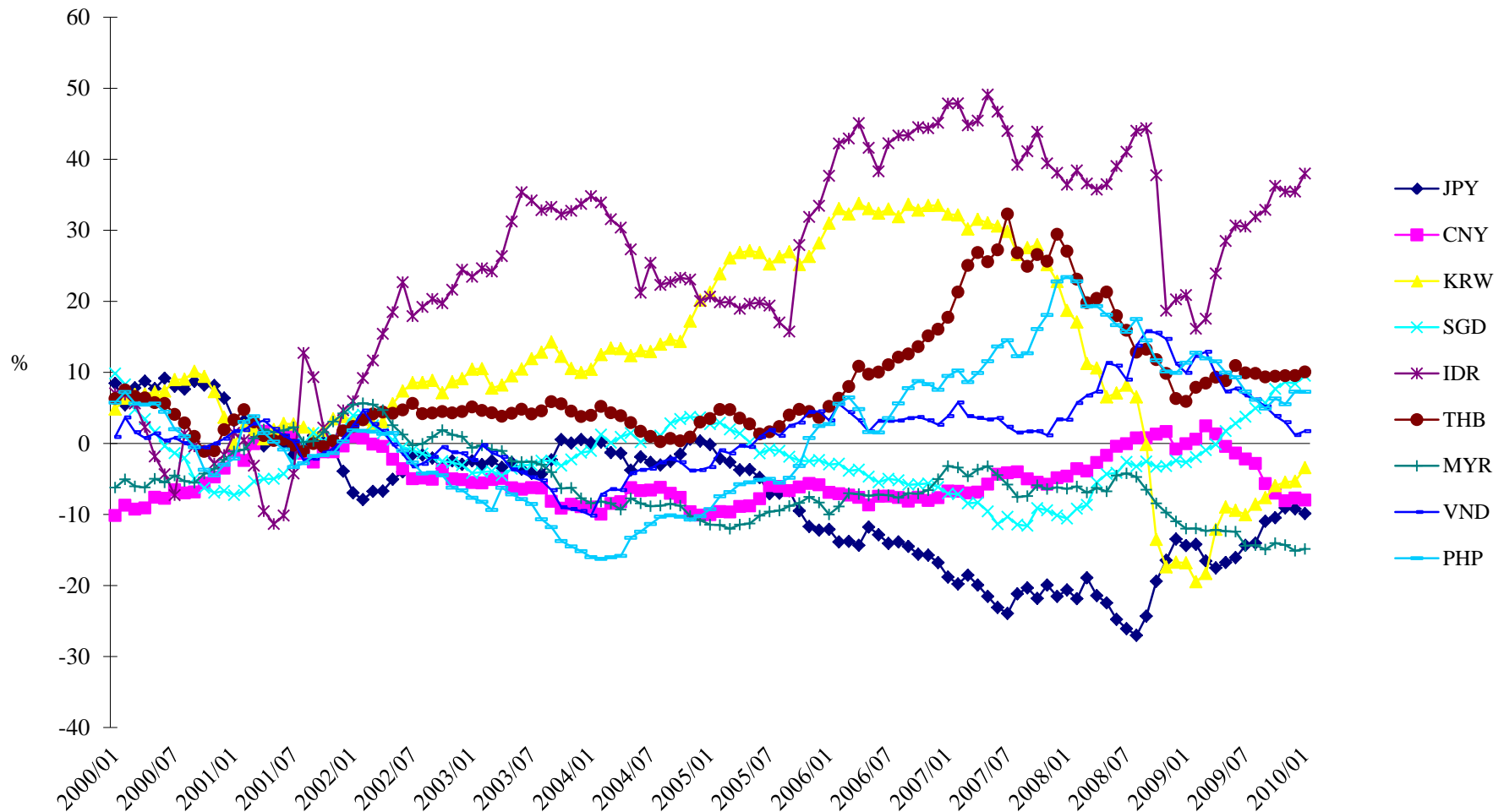
Source: RIETI Discussion Paper Series 12-E-078.

β and σ Convergences of East Asian Currencies

- β-convergence
  - Test with common unit root process (panel):

$$\triangle DI_{i,t} = \mu_i + \beta_i DI_{i,t-p} + \sum_{j=1}^{p-1} \gamma_{i,j} \triangle DI_{i,t-j} + \varepsilon_{i,t}$$

  - β can be directly used to measure the speed of convergence.
  - A negative β indicates that divergence spreads in countries with relatively large tend to converge to their average level more rapidly than those countries with relatively small.
  - Unit root test
    * Levin, Lin and Chu (LLC, 2002)

$$H_0 : \beta_i = \beta = 0 \quad \text{vs.} \quad H_1 : \beta < 0$$

    * Im, Pesaran and Shin (IPS, 2003)

$$H_0 : \beta_i = 0 \quad \text{vs.} \quad H_1 : \beta_i < 0$$

- σ-convergence
  - Test with common unit root process (time series):
    $$\triangle\sigma^2_{DI,t} = \mu + \varphi\sigma^2_{DI,t-p} + \sum_{j=1}^{p-1}\gamma_j\triangle\sigma^2_{DI,t-j} + \varepsilon_t$$
  - A negative φ indicates that cross-sectional dispersion of the variables tends to decrease.
  - A negative φ also suggests that a sequent variance follows a stationary process and the degrees of integration among the variables increase over time.
  - Unit root test
    * Augmented Dickey–Fuller (ADF, 1979)
      $$H_0 : \varphi = 0 \quad \text{vs.} \quad H_1 : \varphi < 0$$
    * Phillips–Perron (PP, 1988)
      $$H_0 : \varphi = 0 \quad \text{vs.} \quad H_1 : \varphi < 0$$

- Data and sample periods
  - AMU Deviation Indicator adjusted by the Balassa–Samuelson effect
    * PPP (CPI) and Productivities
  - Sample periods (from January of 2000 to January of 2010)
  => RMB reform in July 2005, BNP Paribas shock in August 2007, and Lehman Brothers bankrupt in September 2008
    * January of 2000 to June of 2004
    * January of 2000 to June of 2005
    * January of 2000 to July of 2007
    * January of 2000 to August of 2008
    * January of 2000 to January of 2010
    * June of 2004 to January of 2010
    * June of 2005 to January of 2010
   * July of 2007 to January of 2010

Empirical Results (unit root tests)

502 Combinations	2000.1~ 2004.6	2000.1~ 2005.6	2000.1~ 2007.7	2000.1~ 2008.8	2000.1~ 2010.1	2004.6~ 2010.1	2005.6~ 2010.1	2007.7~ 2010.1
β-convergence	154	129	0	0	0	33	18	110
σ-convergence	69	72	7	16	19	9	28	109
β-convergence & σ-convergence	32	32	0	0	0	1	0	23

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Empirical Results (unit root tests)

- A small number of combinations of East Asian currencies that converged during the sub-sample periods, especially from the beginning of 2000 to the middle of 2005 and from the end of 2007 to the beginning of 2010.

- Since late 2005, the combinations that were accepted in the early sample periods have also been rejected, few number of combinations are accepted for convergence.

- The exchange rates of East Asian currencies were asymmetrically affected by the global financial crisis.

=> From the results of empirical analysis, it is clear that East Asian currencies do not converge with each other in most of the sample periods. Especially since late 2005, the combinations that were accepted in the early sample periods have also been rejected. The main reason for this can be explained by exchange rate fluctuations caused by capital flows.

Capital Flow(Other Investments) and AMU, Japan
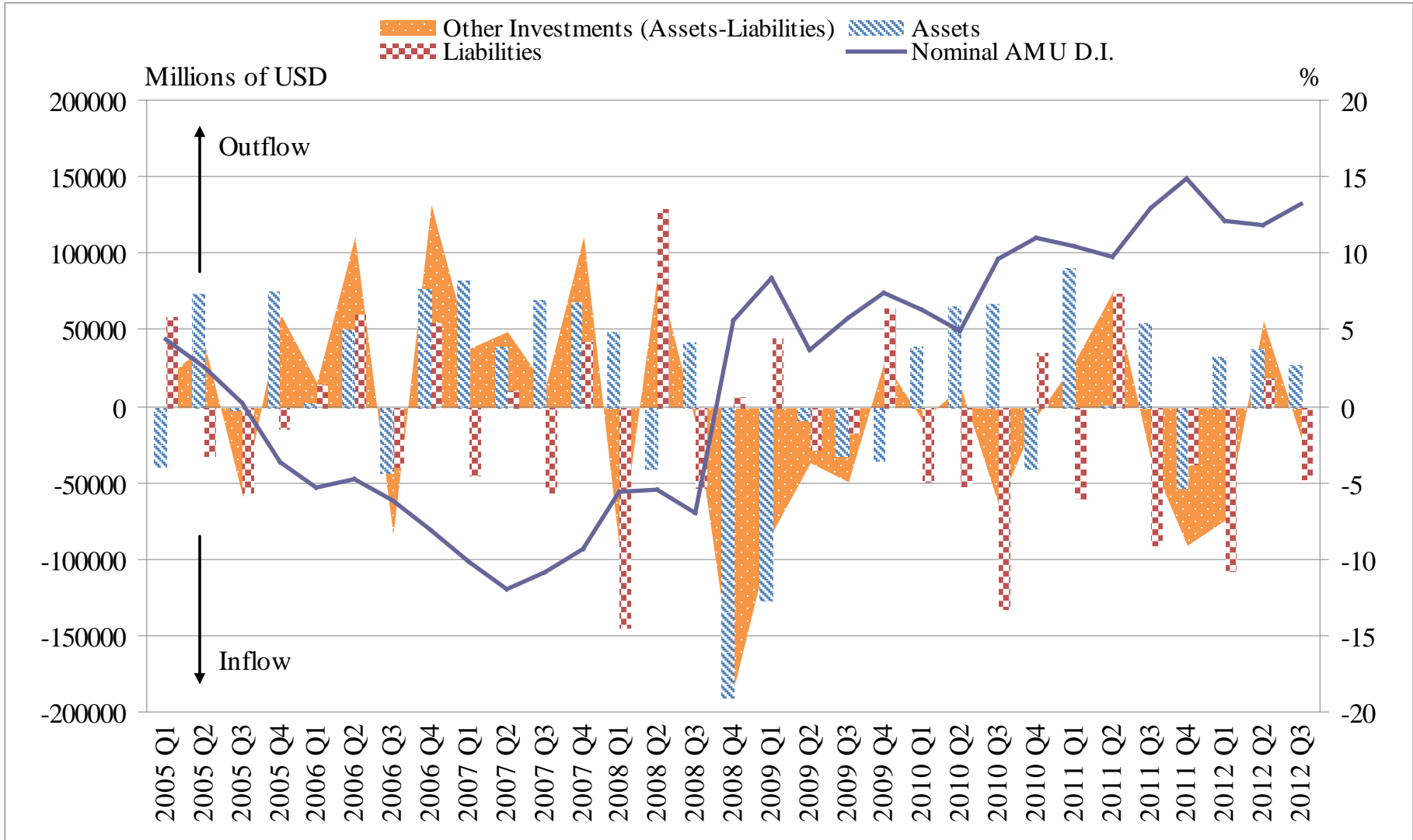
Source: International Financial Statistics (IMF).

Capital Flow(Other Investments) and AMU, Korea
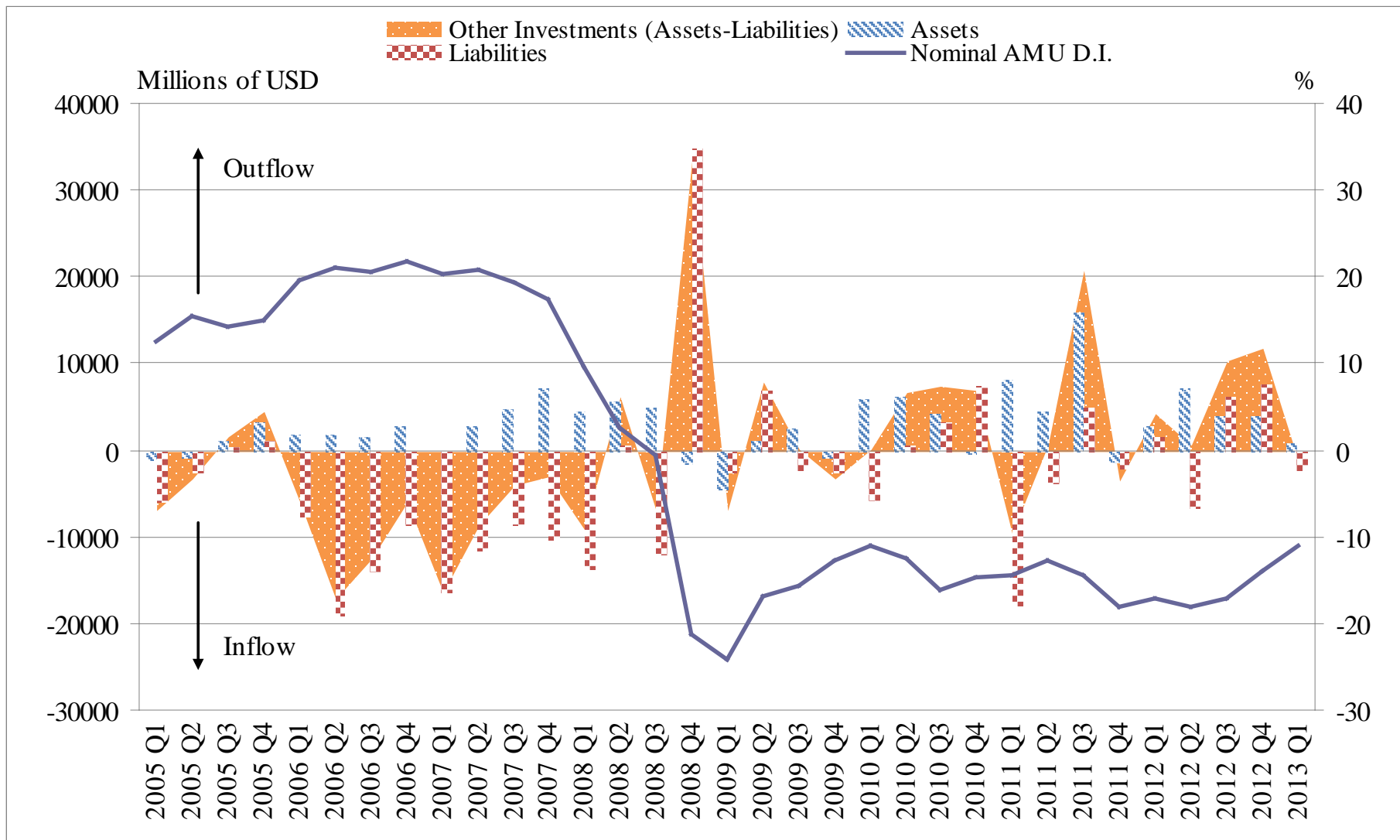
Source: International Financial Statistics (IMF).

- In the case of Japan, the category of "Other Investments" tended to be positive before the third quarter of 2008, and then turned into a negative level. It indicates that capital outflows happened in Japan before the global financial crisis, after that capital inflows occurred. Due to the capital flows, the Japanese yen was in a trend of depreciation before the bankruptcy of Lehman Brothers, and then turned into appreciation.

- In the case of Korea, the category of "Other Investments" was negative till the third quarter of 2008, and became positive since around the end of 2008. It means that capital inflows happened in Korea before the global financial crisis, after that capital outflows occurred. Active capital flows made the Korean won tend to be overvaluation since around 2006 and fall into undervaluation after the bankruptcy of Lehman Brothers.

- By comparing "Other Investments" of Japan with that of Korea, It is clear that the two countries' "Other Investments" were shifting in opposite direction, especially from the beginning of 2006 to the third quarter of 2008. One of the main reasons for this can be considered as yen carry trade.

Conclusion

We used the methodologies of β-convergence and σ-convergence along with the AMU Deviation Indicators adjusted by the Balassa–Samuelson effect to obtain the following empirical results:

- Most of East Asian currencies were seriously affected by the global financial crisis in 2007–2008.

- Exchange rate misalignments occurred among East Asian currencies.

- Yen carry trade also had a strong impact on the stationarity of East Asian currencies.

We obtain policy implications from the empirical results:

- It is necessary to conduct a surveillance process over intra-regional exchange rate in East Asian area.

- The monetary authorities of East Asian countries should use the PPP-based AMU Deviation Indicator adjusted by the Balassa–Samuelson effect to monitor the intra-regional exchange rates.

- It is important to carry out policy coordination for facilitating the adjustment of intra-regional exchange rate misalignments.