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Abstract

This paper attempts to estimate the quarterly equilibrium exchange rates (EER) of nine Asian currencies (Japan, China, Korea, Hong Kong, Singapore, Thailand, Indonesia, Malaysia, and Philippines) with the Behavioral Equilibrium Exchange Rates (BEER) from 2006 to 2014. The BEER was compared with the Fundamental Equilibrium Exchange Rates (FEER) published biannually by the Peterson Institute for International Economics. While four Asian currencies tend to be undervalued in the Peterson's FEER approach, the assessment of Asian currencies changed over time in this paper's BEER approach, which captures the Crowther's theory about the development of balance of payments over the long term. Results imply that the BEER approach is imperative for the assessment of Asian currencies, while the equilibrium level of BEER is sometimes sensible for the change of a sample period. Lessons from the results indicate that the EER of countries that shift to a more matured stage, such as Japan and emerging Asia, needs to be frequently assessed by a multi-method so that policy makers can implement appropriate coordination of exchange rate policies for the integration of Asian economies.

Keywords: Equilibrium exchange rates, Asian currencies, External balance assessment

JEL classification: F31; F36

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1. Introduction

When the direction of major central bank's monetary policy is different, how can we assess the appropriate level of exchange rate and coordinate a foreign exchange policy? During a global recession, a country often has an incentive to take a beggar-thy-neighbor policy, so called currency wars. How do Japan and other Asian countries assess their currency values not only to promote regional economic recovery but to rationalize their exchange rate policies?

In the European sovereign crises of 2011, Japanese yen was purchased aggressively as a safe asset[1] and finally reached the historical high value, 75.54 yen per dollar and continued to be around 80 yen per dollar. In May 2011, Peterson Institute for International Economics, which semi-annually publishes equilibrium exchange rates of 34 countries including 11 Asian countries, announced that the equilibrium exchange rate (EER) of Japanese yen against the U.S. dollar was 76 yen (Cline and Williamson 2011). Thus, just after the East Japan Earthquake and the meltdown of nuclear power plants, the highest value of the Japanese yen would be appropriately valued according to the their method of the Fundamental Equilibrium Exchange Rate (FEER). In fact, all the other Asian currencies were overvalued against U.S. dollar. However, Japan and Asian countries did not explicitly have their EERs designed for Asian countries to refute the level of EERs.

In January 2015, the Swiss National Bank (SNB) abolished its exchange rate cap against Euro, meaning that the SNB stopped intervening by purchasing Swiss franc against Euro. As a result, Swiss franc was appreciated against US dollar by 30% within 10 minutes (Figure 1). At the same time Japanese yen and Singapore dollar were appreciated by 1% as investors needed to sell Euro and buy some safe currencies instead of Swiss franc that was limited liquidity and capacity in terms of volume. If the Japanese yen and Singaporean dollar were undervalued, this was the adjustment process of misalignment. If not, authorities could have implemented exchange rate adjustment policies to avoid significant deviation from EER. These two episodes shed light on an

[1] See IMF(2012) for the detailed reason for the lack of safe assets globally.

importance for equilibrium exchange rates for Asian countries with various estimation methods.

Monetary authorities usually do not announce the target of exchange rate levels as it might lead to speculative activities toward the target, increasing exchange rate volatility. In the Communiqué of G-20 Finance Ministers and Central Bank Governors held on February 2013 stated,

> "…our commitments to move more rapidly toward more market-determined exchange rate systems and exchange rate flexibility **to reflect underlying fundamentals, and avoid persistent exchange rate misalignments** … excess volatility of financial flows and **disorderly movements in exchange rates** have adverse implications for economic and financial stability…We will not target our exchange rates for competitive purposes…"

Even if monetary authorities do not explicitly express the specific level of exchange rates, the EERs published by Asian institution are still useful for policy coordination. Following the Crowther's theory about the development stages of current accounts over the long-term, these Asian countries tend to have trade and current account surplus. Since most of East and Southeast Asian countries are export-oriented countries and involved in highly integrated supply-chain, Asian countries including Japan need EERs designed for themselves as policy instruments.

This paper, therefore, tries to estimate the quarterly Behavioral Equilibrium Exchange Rates (BEER) of nine Asian currencies (Japan, China, Korea, Hong Kong, Singapore, Thailand, Indonesia, Malaysia, and Philippines) with a Pooled Dynamic Ordinary Least Square proposed by Pedroni (2000), which tests a cointegrated panel, and Kao and Chiang (2000), which shows estimation and inference of a cointegrated panel. Then, the BEERs are compared with Peterson Institute's Fundamental Equilibrium Exchange rates (FEER). This paper does not directly answer the questions raised in the beginning of this chapter. However, it helps policy makers to find appropriate solutions in order to promote trade and economic integration of the Asian countries.

2. Review of Equilibrium Exchange Rate Approaches

The equilibrium of Real Effective Exchange Rate (REER) is a key concept in international finance. The persistent and further deviation of REER from the equilibrium level, so called the REER misalignment, could have prevented the economy from promoting trade activity and economic growth. Many strands of theoretical and empirical literature suggest that REER misalignment identifies a country's economic vulnerability. The persistence of REER overvaluation, particularly, could trigger the crisis (Williamson 1983 and 1994, Edwards 1989 and 2000, Stein et al. 1995). The sustained real over-valuation reflects unsustainable macroeconomic conditions within the countries, making them vulnerable to speculative attack and currency crisis. On the other hand, persistent real undervaluation could result in economic boom, which provides pressure on domestic prices and leads to misallocation of resources between tradable and non-tradable sectors.

Isard (2007) provides the good summary of EER assessment methodologies: the Purchasing Power Parity (PPP) Approach, PPP adjusted for the Balassa-Samuelson Effects, and the Macroeconomic Balance Framework. The PPP theory postulates that the exchange rate change between two currencies over any period of time is determined by the change in the two countries' relative price levels. However, due to imperfect competition, sticky domestic wage, market segmentation, the PPP theory is often invalid empirically (Frankel 1981, Kasa 1992, Faruqee 1995, and Corsetti and Dedola 2002). The Balassa-Samuelson is another reason for the invalidity of the PPP theory, that is, the observation that consumer price levels in richer countries are systematically higher than in poorer ones and an economic model predicting the above, based on the assumption that productivity varies more by country in the traded goods' sectors than in other sectors (the Balassa–Samuelson hypothesis). This paper focuses on the comparison of the following two approaches for assessing whether a country's exchange rate is consistent with economic fundamentals, considering a country's economic structure and the level of development rather than "one fits all" approach.

One approach is the Fundamental Equilibrium Exchange Rate (FEER), which is called as the Macroeconomic Balance Framework by IMF. In this approach, the real exchange rate that is consistent with macroeconomic balance, which is identified as the rate that brings the current account into equality with the underlying or sustainable capital account, where the determinants of both the current and capital account have been set at their full employment values. Because this approach aims at calculating exchange rates for a particular set of economic conditions, it abstracts from short-run cyclical conditions and temporary factors and focuses on "economic fundamentals," which are identified as those conditions or variables that are likely to persist over the medium term (Clark and MacDonald, 1998).

These conditions are not necessarily those projected to occur in the future, but rather are desirable outcomes that may never be realized. In fact, Williamson (1994) has characterized the FEER as the equilibrium exchange rate that would be consistent with "ideal economic conditions." Thus, this approach has the normative aspect. This aspect by itself is not a problem. However, we must carefully consider for whom or which country the FEER is consistent with ideal economic conditions.

For example, Crowther (1957) shows how the trade balance, income balance, current account, and net financial asset of a country have been changing in the transition of the development stage (Table 1). The Asia emerging economies are mostly categorized in either Stage III (large trade surplus) or Stage IV (trade surplus); Japan is somewhere between Stage IV and Stage V (trade deficit). The United States and the United Kingdom belongs to Stage VI (trade deficit and income surplus). If the ideal world of the FEER condition is Stage V (trade deficit and large income surplus) or Stage VI, the currency of a country that has a trade surplus is never over-valued regardless of other economic conditions.

The other approach is the analysis of a reduced form model of the behavior of the real effective exchange rate, consequently called the Behavioral Equilibrium Exchange Rate (BEER), proposed by Clark and MacDonald (1998). The BEER is consistent with the Balassa–Samuelson hypothesis and other fundamentals, based on uncovered interest rate parity. In the short-run, economic fundamentals cannot easily capture the exchange rate movement due to various noises such as capital flows etc. (Meese and Rogoff, 1983). In the medium-run, the exchange rate reaches the equilibrium reflected by the fundamentals as the short-term noises are canceled out.

The BEER approach produces a measure of misalignment that is different from the FEER, as it relates to the deviation between the actual exchange rate and the value given by the estimated equilibrium relationship such as error-correction models or cointegrated models. Thus, large one-side deviation (only undervalued or overvalued) from BEERs during the whole sample period is not usually observed. In fact, the BEER approach also requires judging whether the economic fundamentals that determine exchange rate behavior are themselves at sustainable or equilibrium levels, i.e., the choice of explanatory variables explaining BEER is arbitrary. Moreover, as the BEER assumes medium-run adjustment, the BEER is potentially more sensible to a historical mean and a sample period than the FEER is.

Many strands of empirical literature provide different methodologies, and estimation results of EERs. However, they mostly focus on only one or a couple of currencies. As the examples of Asian currencies, Kinkyo (2013), Goldstein (2004)

[FEER], Frankel (2005) [FEER], Wang (2004) [BEER], and Cheng and Orden (2005) [BEER] estimated EERs for China. All of the following EERs are estimated as BEER. Hong Kong's EERs is estimated by Zhang (2002), Cheng and Orden (2005), and Leung and Ng (2007). Moreover, Kinkyo (2008), Lim (2000), MacDonald (2004), and Sahminan (2005) estimated the EERs of Korea, Thailand, Singapore, and Indonesia, respectively. For multi-country estimates, Jongwanich (2009) examines the EERs of eight Asian countries (China, Hong Kong, India, Indonesia, Korea, Malaysia, Singapore, and Thailand).

In the policy use of EERs, a few multilateral organizations such as the G-20, the International Monetary Fund (IMF) and the European Union have designed surveillance approaches to detect excessive imbalances in countries' external positions. The IMF took the initiative when it analyzed current account balances and real exchange rates under the Consultative Group on Exchange Rate Issues (CGER). The methodology of CGER exchange rate assessments consists of three approaches: Macroeconomic Balance Approach, External Sustainability Approach, and Equilibrium Real Exchange Rate Approach. The first two approaches correspond to FEER; the last one is equivalent to BEER. In 2012, the IMF started to publish a new analysis as annual external sector reports with a view to assessing the external position of countries from a multilateral perspective (IMF, 2012). In the new analysis, the CGER analysis was modified as the External Balance Assessment (EBA). The new method incorporates the analysis of the determinants of the current account balance and the real exchange rate, using two different panel regression models that include structural and cyclical factors and other policy variables, which is similar to BEER. Furthermore, the EBA covers a normative approach that evaluates to what extent deviations between the current and desirable policies, according to the IMF's criteria to formulate recommendations on appropriate policies. This approach can be regarded as FEER. The IMF reports the equilibrium exchange rate deviation with multi-methods. However, in the IMF's assessment, the details of EER estimation are not necessarily disclosed. The assessment may allow the wide range of the EER deviation. For example, the EER deviation of Japanese yen was between undervalued by 20 percent and overvalued by 10 percent (Table 2). To the best of my knowledge, no institution regularly published equilibrium exchange rates that focus on Asian currencies.

3. Data and Methodology

The data for this study are taken from various sources (See Appendix for the details). The coverage of countries for the estimation of the Behavioral EERs consists of nine Asian countries (Japan, China, Korea, Hong Kong, Singapore, Thailand, Indonesia, Malaysia, and Philippines). Data for four major trade countries (United States, United Kingdom, Canada, and Australia), and Euro area, the variables of which are calculated from Germany, France, and Italy, is also used to construct variable. The sample period is from the fourth quarter of 2005 until the second quarter of 2014, 35 periods.

3.1. Panel Unit Root Tests

Individual unit root tests have limited power. The power of a test is the probability of rejecting the null hypothesis when it is false and the null hypothesis is unit root. If there are too many unit roots in a series of explanatory variables, Levin-Lin-Chu (LLC) test suggests the following hypotheses

H_0: each time series contains a unit root

H_1: each time series is stationary

First, we run augmented Dickey-Fuller (ADF) for each cross-section on the equation:

$$\Delta y_{it} = \rho_i y_{i,t-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \qquad (3.1)$$

where the lag order ρ is permitted to vary across individuals.

In the second step, we run two auxiliary regressions:

$$\Delta y_{it} \text{ on } \Delta y_{i,t-1} \text{ and } d_{mt} \text{ for residual } \hat{e}_{i,t}$$

$$y_{i,t-1} \text{ on } \Delta y_{it-L} \text{ and } d_{mt} \text{ for residual } \hat{v}_{i,t-1}$$

The third step involves standardization of the residuals by performing

$$\tilde{e}_{it} = \hat{e}_{i,t} / \hat{\sigma}_{\varepsilon_i} \qquad (3.2)$$

$$\hat{v}_{i,t-1} = \hat{v}_{it} / \hat{\sigma}_{\varepsilon_i} \qquad (3.3)$$

where *i* denotes the standard error from each ADF.

Finally, we run the pooled OLS regression

$$\tilde{e}_{it} = \rho \hat{v}_{i,t-1} + \tilde{\varepsilon}_{it} \qquad (3.4)$$

The null hypothesis is $\rho = 0$; the standard deviation of *t*-statistics is adjusted, following Levin et al. (2002). According to the authors, the statistic performs well when the cross-sectional dimension *N* lies between 10 and 250 and when time dimension *T* lies between 5 and 250. If *T* is very small, the test has low power. The disadvantage of the test statistics is reliance on the assumption of cross-sectional independence. Moreover, the null hypothesis that all cross-sections have a unit root is restrictive. Thus, it does not allow the intermediate case, where some variables are subject to a unit root and others are not. If *T* is very large, Levin et al. (2002) suggest an individual unit root time-series test. If *N* is very large or *T* is very small, general panel data procedures can be applied.

3.2. Panel Co-integration Test

The cointegration tests proposed by Pedroni (1999) is a standard in panel data econometrics. Alternatively, tests proposed by Kao (1999) and McCoskey and Kao (1998) could also be employed. However, the tests proposed by Pedroni allow for heterogeneous variances across the countries in the panel and some form of dependence across the countries at each point of time. Pedroni (1999) proposes seven residual-based tests based on the null hypothesis of no cointegration. First, showing the group-by-group estimation of the proposed long-run relationship:

$$y_{it} = \alpha_i + \gamma_i t + \theta_t + \beta_1 x_{1it} + \cdots + \beta_K x_{Kit} + \varepsilon_{it} \quad (3.5)$$

where K is the number of regressors and β_k are the elasticities. The deterministic elements (α_i and γ_i) are defined as above, and θ_t are common time effects. This formulation permits some heterogeneity in the panel data because fixed effects, individual-specific deterministic trends, and different error variances can be applied for estimation (Maeso-Fernandez et al., 2006). Some of the Pedroni tests (group tests) also allow for heterogeneous slope coefficients, as the elasticity is estimated by averaging the individual β_k instead of pooling the long-run information. There is no requirement for exogeneity of the regressors as the dynamics are jointly determined for both y_i and all x_{ki}.

The Pedroni's seven tests follow asymptotically a standard normal distribution after a normalization process. The heterogeneity of the cross-section units is adjusted for the group-specific long-run variance of cointegration residuals. Four of the tests are based on pooling along the within-dimension of the panel and three are based on averaging along the between-dimension. Based on Monte Carlo experiments for a case with one dependent variable (Pedroni (1999)), the tests have distorted size and low power for sample sizes if T is below 100. Overall, Pedroni (1999) suggests that the panel-ρ statistic appears to be the most reliable when T is large enough; for small T, the parametric group-t statistic and panel-t statistic appear to have the highest power, followed by the panel-ρ statistic.

4. Models and Results

4.1. Dynamic Ordinary Least Square

We start from the static regression of equation (3.5). In a country-by-country set-up, this corresponds to the Engle-Granger procedure, which generates a consistent estimator of the long-run parameters. However, in the panel data, the long-run parameters are biased. In Monte Carlo experiments, Kao et al. (1999) show that correcting the coefficients for this bias does not improve over the uncorrected OLS. This leads to using alternative methods, such as the Dynamic Ordinary Least Square (DOLS).

The calculation of the DOLS estimator starts in equation (3.5). In order to obtain an unbiased estimator of the long-run parameters, DOLS involves a parametric adjustment to the errors of the static regression. The correction is achieved by assuming that there is a relationship between the residuals from the static regression and first differences of the leads, lags and contemporaneous values of the regressors in first differences:

$$\varepsilon_{it} = \sum_{j=-q}^{q} c_{ij} \Delta x_{it-j} + \varepsilon_{it}^{*} \qquad (3.6)$$

$$y_{it} = \alpha_i + \gamma_i t + \theta_t + \beta_1 x_{1it} + \cdots + \beta_K x_{Kit} + \sum_{j=-q}^{q} c_{ij} \Delta x_{it-j} + \varepsilon_{it}^{*} \qquad (3.7)$$

A simple OLS regression provides super-consistent estimates of the long-run parameters. The t-statistic is based on the long-run variance of the residuals instead of the contemporaneous variance, which is commonly used in OLS regressions. In the panel setting, the mean-group DOLS long-run coefficients are obtained by averaging the group estimates over N

4.2. Models and Results of Panel Cointegration Tests

The analysis is implemented by a quarterly balanced panel data set for nine Asian countries. Real Effective Exchange Rates (Q) is the logarithm of BIS "Effective Exchange Rate Indices," broad indices. Terms of trade (TOT) is the ratio of a country's Export Price Index divided by Import Price Index to the trade volume weighted indexes of foreign countries, which consists of nine Asian countries (Japan, China, Korea, Hong Kong, Singapore, Thailand, Indonesia, Malaysia, and Philippines) and other five major countries and area (United States, Euro zone [Germany, France, and Italy], United Kingdom, Canada, and Australia). Relative price of tradable goods and non-tradable goods (TNT) is the ratio of a country's Consumer Price Index (CPI) divided by Producer Price Index (PPI) or Wholesale Price Index (WPI) to the trade volume weighted indexes of the above foreign countries. Real Interest Rates (R), expressed as percentage, are defined as 10-year (or longest maturity available) government bond yield divided by CPI minus the trade volume weighted rates of 10-year (or longest maturity available) government bond yield divided by CPI of the above foreign countries. All the TOT, TNT, and R are the logarithm. Net Foreign Asset (NFA) is defined as Net International Investment Position divided by Nominal GDP. Government Debt (λ) is calculated as Gross General Government Debt divided by Nominal GDP. Net Total Asset (NTA) is defined as Net Foreign Asset minus Gross General Government Debt.

Table 3 summarizes the results of the LLC unit root test with no time trend. For all the variables except *TNT* follows a stationary process. For *TNT*, the LLC test fails to reject the null hypothesis of non-stationarity. After taking the first difference, this variable is clearly non-stationary.

For assessing the current value of an exchange rate for BEER is the use of an estimated reduced-form equation that explains the behavior of the real exchange rate over the sample period. Clark and MacDonald (1998) indicate that the general approach of BEER is expressed as:

$$\mathrm{BEER} = f\,(\overset{+/-}{TOT_t},\ \overset{+}{TNT_t},\ \overset{+}{R_t},\ \overset{+}{NFA_t},\ \overset{-}{\lambda_t})$$

The expected sign of each variable is the above. Income effects and substitution effects of terms of trade determine the relationship between *TOT* and *Q*. For example, the improvement of *TOT* possibly raises real income and demand for a good, resulting in an increase in the relative price of non-tradable goods and REER (Harberger 1950, Laursen and Metzler 1950). However, this income effect may be wiped out by substitution effects (Edwards 1989, Cashin and McDemott 1998). Thus, the sign of *TOT* cannot be pre-determined. *TNT* captures the Balassa-Samuelson Effects. In the medium to long run, larger net foreign asset allows appreciation of REER as *NFA* provides capital inflow, which covers trade deficit. λ reflects a risk premium. Thus, greater λ leads to depreciation of REER. Moreover, in uncovered parity condition, higher *R* (an increase in real interest rate of own country or a decrease in interest rate of foreign countries) results in the appreciation of REER.

If foreign investors consider that government debt is collateralized by net foreign asset, BEER (Q) could be expressed as:

$$\text{BEER} = f\,(\overset{+/-}{TOT_t},\ \overset{+}{TNT_t},\ \overset{+}{R_t},\ \overset{+}{NTA_t})$$

In this case, we assume that an increase in NFA_t, and a decrease in λ_t have the same impact on REER. Finally, the following four BEER models are tested:

$$Q = f\,(\overset{+/-}{TOT_t},\ \overset{+}{TNT_t},\ \overset{+}{R_t}) \text{ —— (Eq. A)}$$

$$Q = f\,(\overset{+/-}{TOT_t},\ \overset{+}{TNT_t},\ \overset{+}{R_t},\ \overset{+}{NFA_t}) \text{ —— (Eq. B)}$$

$$Q = f\,(\overset{+/-}{TOT_t},\ \overset{+}{TNT_t},\ \overset{+}{R_t},\ \overset{+}{NFA_t},\ \overset{-}{\lambda_t}) \text{ —— (Eq. C)}$$

$$Q = f\,(\overset{+/-}{TOT_t},\ \overset{+}{TNT_t},\ \overset{+}{R_t},\ \overset{+}{NTA_t}) \text{ —— (Eq. D)}$$

These equations are applied to equation (3.7) and tested by Panel Cointegration Test of Pedroni (1999). Table 4 shows that the result of Panel Cointegration Test. Overall, all the test statistics are significant at 5% level except the Panel *t*-stats (parametric) of Eq. B, which is still significant at 10% level.

Table 5 shows the results of four models of Pooled Dynamic Ordinary Least Square (DOLS). Eq. A is a base model. All the three variables (*TOT*, ⊿*TNT*, and *R*) are significance at 5% level and the sign conditions are satisfied. In Eq. B, the Net Foreign Asset is added. Despite the fact that *NFA* is significant at 1% level, the sign of the coefficient of *NFA* is negative, which does not satisfy the sign condition.

In Eq. C, the Government Debt is added as a risk premium factor. Now the coefficients of *NFA* and λ satisfy the sign conditions. At the same time, terms of trade turns into negative, implying that the substitution effects of *TOT* exceed its income effects if the government debt is included. In Eq. D, the Net Total Asset (*NTA*) is added instead of *NFA* and λ as the absolute value of the coefficient of *NFA* and λ are at the similar level in Eq. C. In Eq. D, as *NFA* could be regarded as the collaterals of government debt by investors, an increase in *NFA* might improve a risk appetite, and thus reduce the risk premium of EERs.

The result of Eq. D is significant. All the four variables (*TOT*, Δ*TNT*, *R* and *NTA*) are significance at 5% level and the sign conditions are satisfied. The level of coefficients is close to the Eq. A and Eq. B. Therefore, both Eq. C and Eq. D can be chosen for the BEER estimation. Then, we need to determine which model is the best for nine Asian countries. In order to assess the models, the heterogeneity of Asian countries has to be considered.

The panel analysis involves the strong assumption that the impacts of a change in explanatory variables on equilibrium exchange rates are identical. Table 6, Table 7, Table 8, and Table 9 shows the individual country's results for Eq. A, Eq. B, Eq. C, and Eq. D, respectively, before they are pooled. Comparing the fitness of the sign conditions of individual counties in Eq. C and Eq. D, Eq. C has a slightly better performance than Eq. D. Moreover, during a crisis period, the EER's movements in the models of Eq. A, Eq. B., and Eq. D are quite spikey (e.g., the EER movements of Singapore, Indonesia, Thailand, and Philippines) due to the large coefficient of Δ*TNT* (first difference), based on the panel result of Pooled DOLS. Therefore, the Eq. C is chosen for the comparison to Peterson Institute's FEER.

4.3. The comparison of BEER and FEER

In this section, the BEERs estimated by Eq. C are compared with the FEERs published by Peterson Institute for International Economics. The FEER data is collected from a series of reports of Peterson Institute for International Economics[2]. In the reports, the FEER is provided as a REER basis as well as a U.S. dollar basis. First, the comparison of the FEER consistent with U.S. dollar and the FEER in a REER basis is provided.

The FEER in a REER basis is determined by how much the REER should be changed to reach the target level of the current account balance (Cline, 2008). The target level of the current account seems to be zero or as it is determined by a normative way. According to the definition of FEER, the current account balance is equal to the negative value of the capital account balance. Thus, if a country makes portfolio investment overseas, its EER is depreciated, meaning that the value of the country's currency tends to be overvalued.

Figure 2 provides the comparison of the FEER consistent U.S. dollar rate and REER for Asian countries as of September-October 2014 (Cline, 2014b). It appears that the FEER consistent dollar basis has a tendency to be more undervalued than the FEER in a REER basis, reflecting the bilateral trade balance between the U.S. and Asian countries. For example, Indonesian rupiah against the FEER consistent U.S. dollar is 4.3 percent point more undervalued than the FEER of REER basis as Indonesia has a trade surplus against the United States. In fact, all the currencies of nine Asian countries against the FEER consistent dollar basis are undervalued due to a bilateral trade surplus.

If a country has a trade deficit, its currency is usually assessed as being overvalued in a FEER approach. In fact, the REER-based FEERs of Japan, China, and Indonesia are overvalued as they had a trade deficit to the world. If the BEER estimated

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[2] Data are cited from Cline and Williamson (2008, 2009, 2010a, 2010b, 2011, 2012a, 2012b) and Cline (2013a, 2013b 2014a). Thus, the FEER data is in general estimated on the real time basis.

in a REER basis is we compared with the FEER as a policy instrument, which basis of the FEER should be used, REER or dollar? In a normal case, the FEER in a REER basis has to be compared with this paper's BEER. However, if we assume the difference of a country's equilibrium exchange rates between REERs and dollar rates is explained by the difference of trade balance between its current balance and its bilateral trade balance with the United States, the FEER consistent dollar rate could be chosen. This is because the share of the U.S. dollar trade contracts dominates for Asian countries. The comparison of the BEER and the FEER dollar rate is meaningful as a policy discussion.

In the following discussion, this paper's BEER (Model C) in a REER basis and Peterson Institute's FEER in a REER basis unless otherwise noted.

The BEER shows that the Japanese yen had been overvalued by about 10 point until the fourth quarter of 2012 (Figure 3[3], Model C). After the adjustment process of overvaluation due to (anticipated) implementation of monetary easing, yen is undervalued by 7.7 percent point in the second quarter of 2014. In contrast, in the FEER of REER a basis is undervalued by just 1.1 percent point (Figure 3, left-bottom); in FEER constant dollar rate, Japanese yen has been undervalued (Figure 3, right-bottom) even if the yen's value was at the peak level, 80 yen per dollar.

In case of Korean won, the BEER was turned into undervalued during the Global Financial Crisis in 2008Q3 and had been undervalued until 2013. In the second quarter of 2014, it becomes overvalued (Figure 4). In contrast, the FEER expresses that Korean won had been slightly undervalued although in FEER constant dollar rate, Korean won has been undervalued.

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[3] First differences of the leads, lags and contemporaneous values of the regressors in first differences are not included in the BEERs in Figures.

In case of Chinase Renminbi (CNY), the BEER indicates that it is undervalued until the early 2011. After then, it has been overvalued. In contrast, CNY has been undervalued throughout the sample period in a REER basis as well as the FEER consistent dollar rate (Figure 5).

Figure 6, Figure 7, and Figure 8 show the BEER and the FEER of Hong Kong, Singapore, Indonesia; Figure 9, Figure 10, and Figure 11 show the BEER and the FEER of Thailand, Philippines, and Malaysia. In all the above case, the BEER indicates that their currencies are overvalued or undervalued, depending on economic fundamentals and risk premium. In case of FEER in a REER basis, however, the currency values of Hong Kong, Singapore, and Malaysia have been undervalued throughout the sample period. Moreover, the FEER constant dollar rate always indicates their currencies are undervalued, reflecting their trade balance surplus with the United State.

5. Conclusion

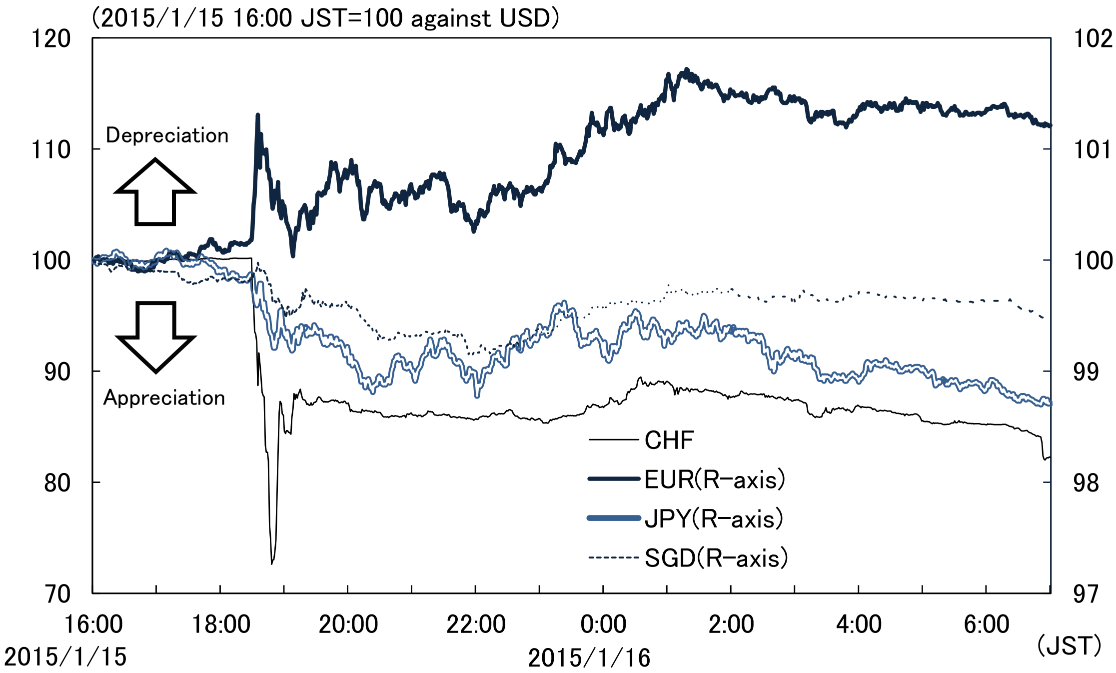
This paper estimates the quarterly Behavioral Equilibrium Exchange Rates (BEER) of nine Asian currencies with a Pooled Dynamic Ordinary Least Square. The BEERs are compared with Peterson Institute's Fundamental Equilibrium Exchange rates (FEER). This paper's results imply that the FEER, which focus on the current account balance in a normative way, does not necessarily fit Asian countries if a country's development stage in terms of Crowther (1957)'s definition is in transition.

This does not mean the BEER is a better assessment approach than the FEER. As the target satisfies the full employment or the ideal economic conditions, the FEER does work better for a country that has never (or rarely) experienced a good economic performance or for a country in the matured stage such as the United States, Australia, and the United Kingdom. The BEER cannot indicate the equilibrium exchange rate the level of which a country has never experienced as it is restricted by a historical mean. Therefore, if monetary authorities and policy makers assess their country's equilibrium exchange rate, they need to choose an approach that fits their purpose and compare results estimated by multi-method.

Moreover, there is a limitation for the results of this paper due to the heterogeneity of Asian countries. Although the sign of individual coefficient is overall the same as the sign of panel coefficients in all the models, we have to be careful the difference of Asian economies. The panel analysis assumes all the countries are homogenous. Some might argue this assumption would be too strong. A reason why this paper chooses the panel analysis is that a simple Ordinary Least Square method may generate biased estimators. However, vector error-correction model or any time series techniques cannot be applicable for an individual country as long quarterly time series-data for the emerging Asia is not available yet. Still, the panel results are useful because they indicate the overall impacts of terms of trade, net foreign asset, and government debt on equilibrium exchange rates in Asia.

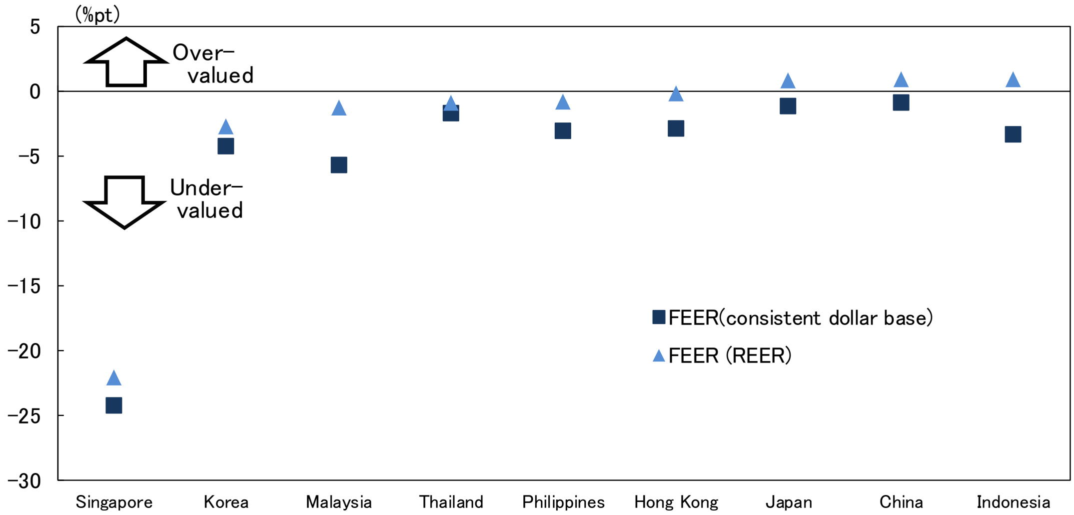
Lessons from the results indicate that the equilibrium exchange rate of countries that have been shifting to more matured stage, such as Japan and the emerging Asia, need to be assessed with higher frequency by multi-method so that policy makers can have the real-time and appropriate coordination of exchange rate adjustment. Thus, Japan and other Asian countries need equilibrium exchange rates that focus on the Asian economic conditions.

Figure 1. Swiss Shock on Asia—Adjustment or Misalignment?



Source: Bloomberg

Figure 2. FEER consistent Dollar Rate and REER
of Peterson Institute for International Economics

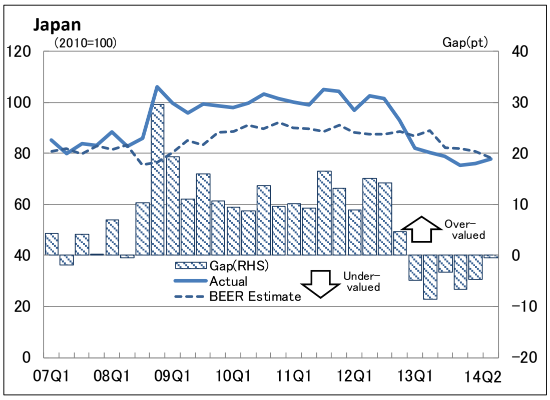


Note: FEER means the Funtamental Equilibrium Exchange Rate. REER imeans Real Exchange Rate.
Source: Cline (2014b)

Figure 3. Comparison of BEER and FEER (Japan)

Panel Estimated BEER

<Model A (REER)>



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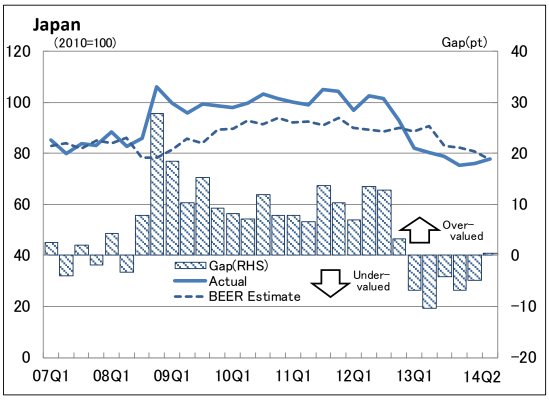

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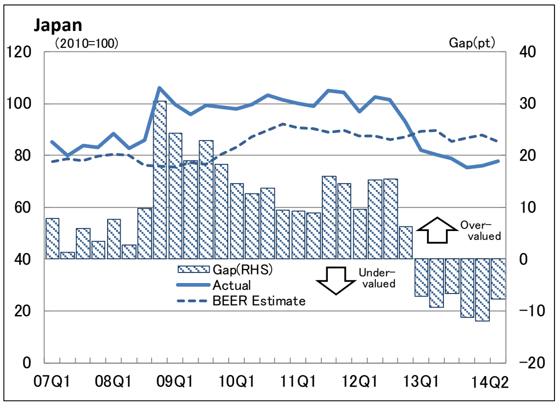
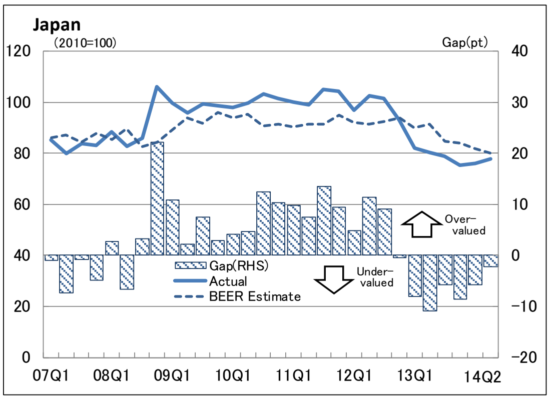
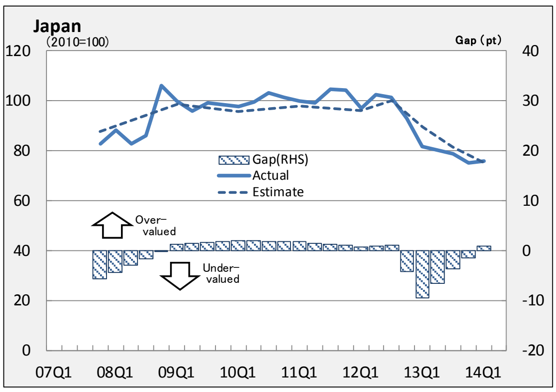


<Model D (REER)>

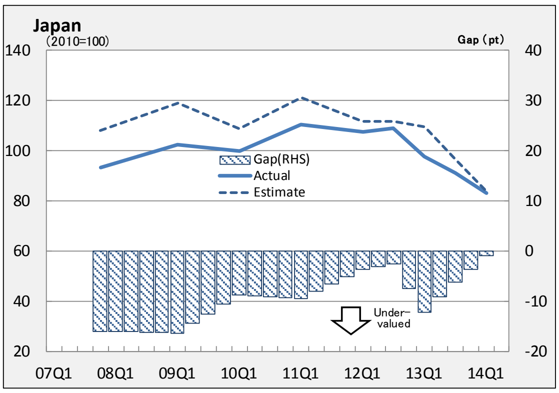


Peterson Institute’s FEER

<REER>



<FEER consistent dollar rate>

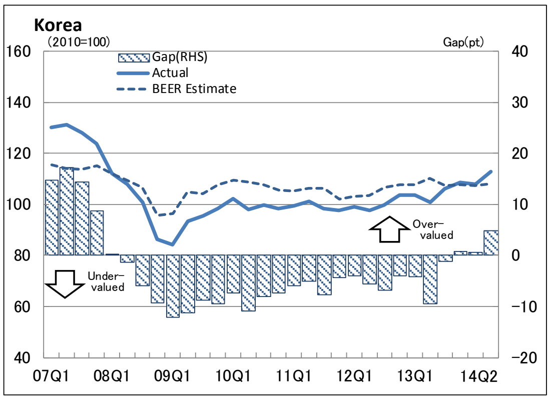


Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS’s REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author’s estimation

Figure 4. Comparison of BEER and FEER (Korea)

Panel Estimated BEER (REER)

<Model A (REER)>



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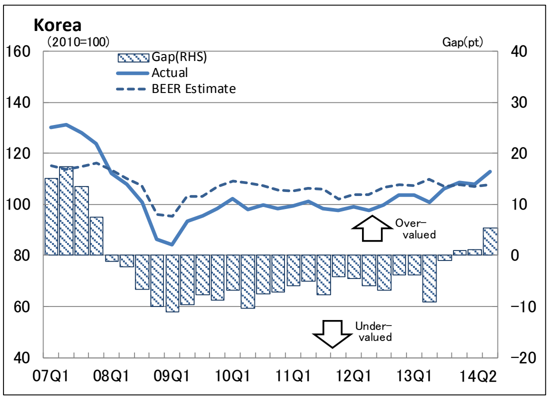
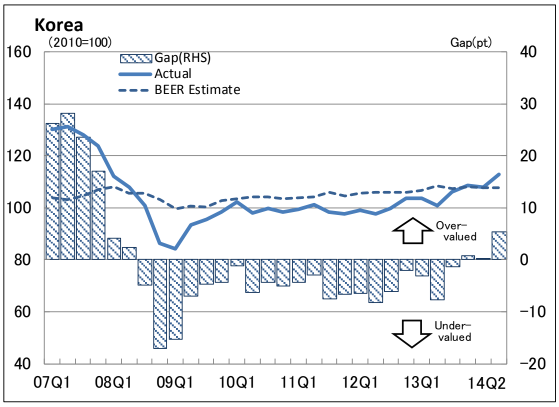
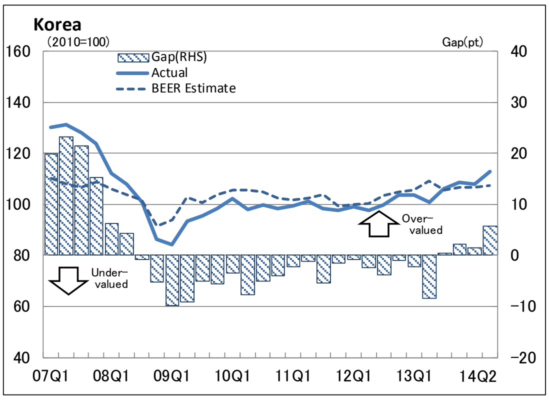


<Model C (REER)>

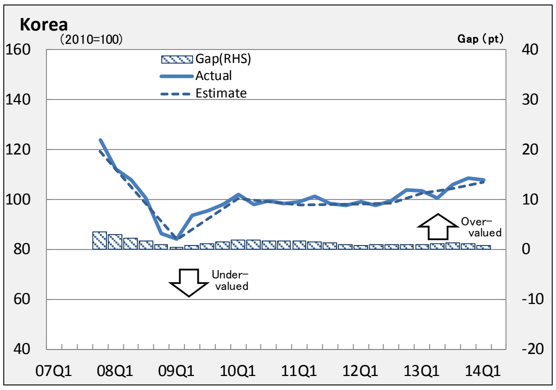


<Model D (REER)>

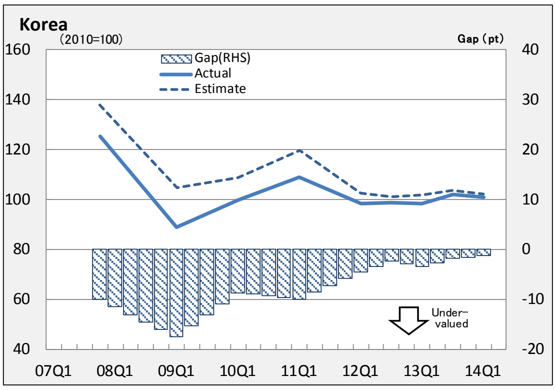


Peterson Institute's FEER

<REER>



<FEER consistent dollar rate>

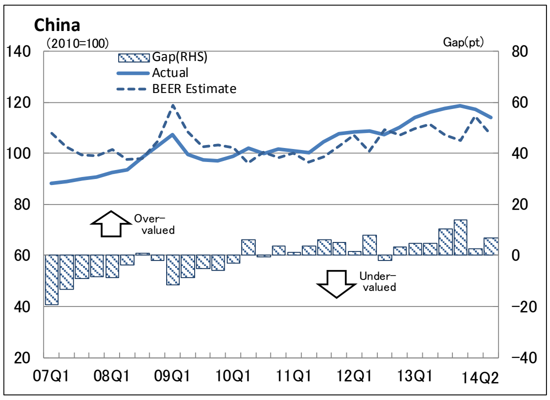


Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS's REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author's estimation

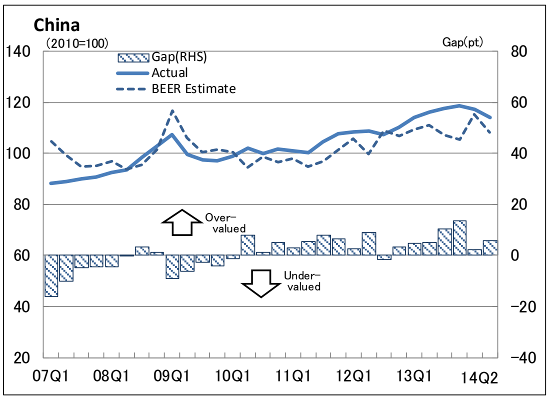
Figure 5. Comparison of BEER and FEER (China)

<u>Panel Estimated BEER (REER)</u>

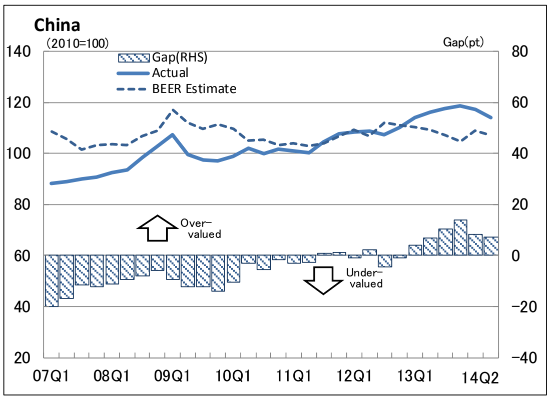
<Model A (REER)>



<Model B (REER)>



<Model C (REER)>



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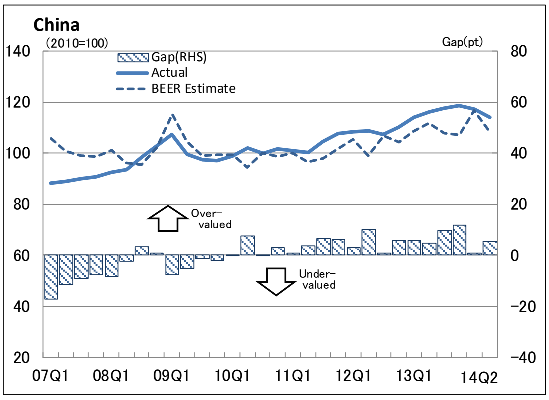
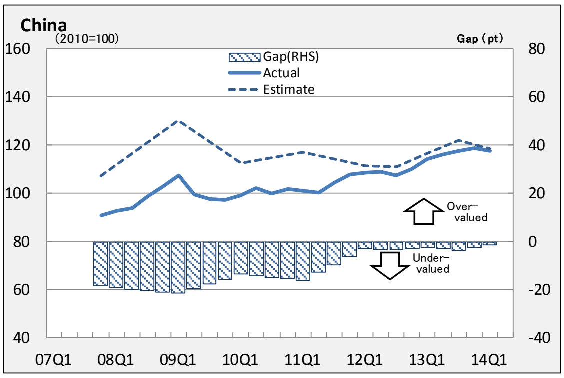
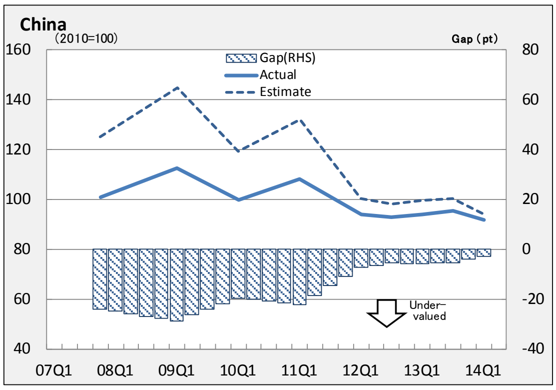


<u>Peterson Institute's FEER</u>

<REER>



<FEER consistent dollar rate>

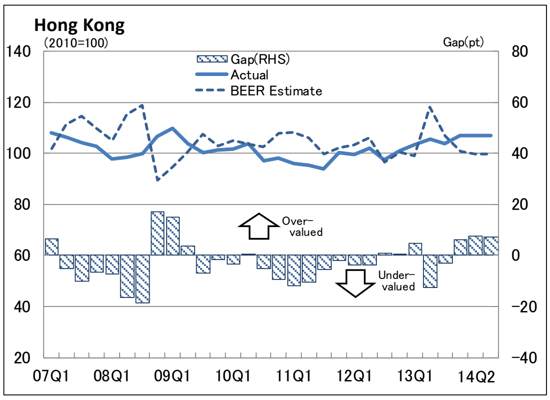


Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS's REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author's estimation

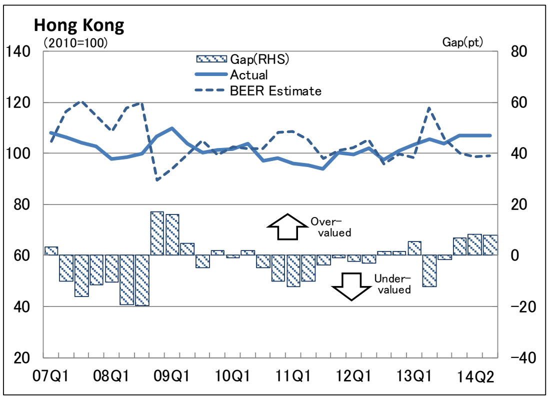
Figure 6. Comparison of BEER and FEER (Hong Kong)

Panel Estimated BEER (REER)

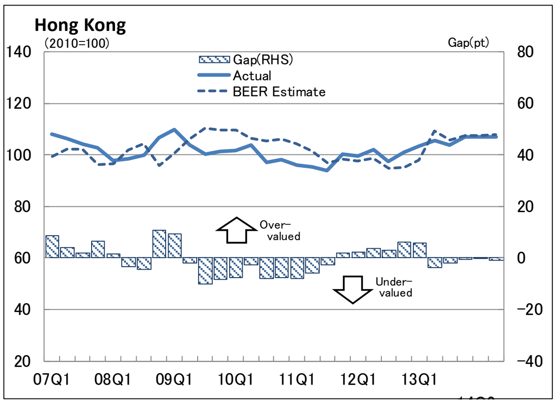
<Model A (REER)>



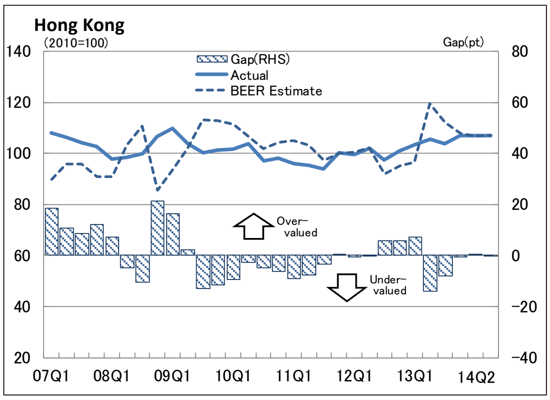
<Model B (REER)>



<Model C (REER)>

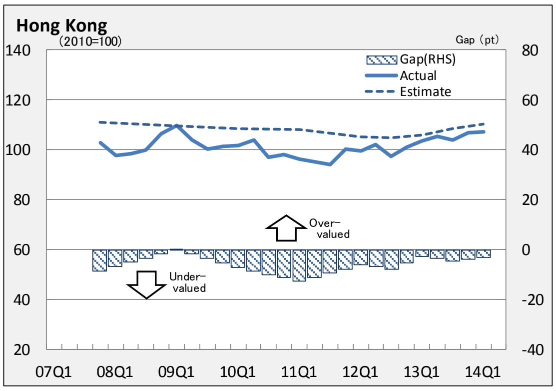


<Model D (REER)>

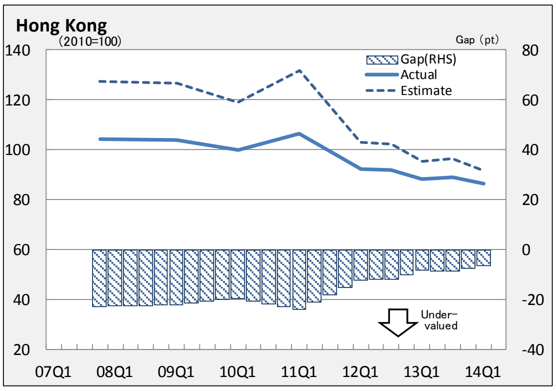


Peterson Institute's FEER

<REER>



<FEER consistent dollar rate>

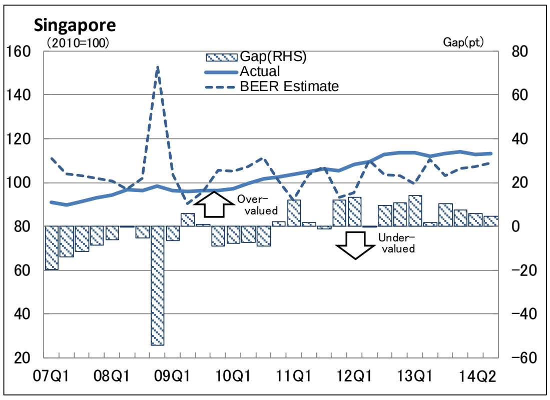


Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS's REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author's estimation

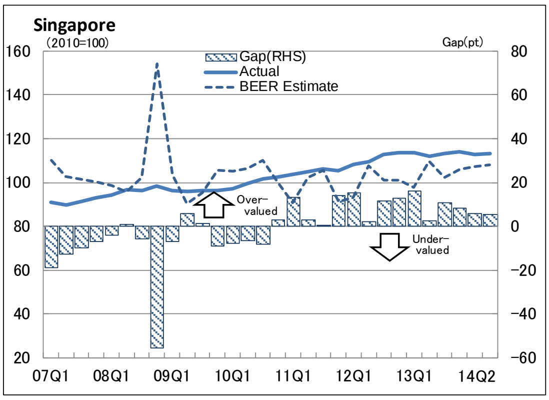
Figure 7. Comparison of BEER and FEER (Singapore)

Panel Estimated BEER (REER)

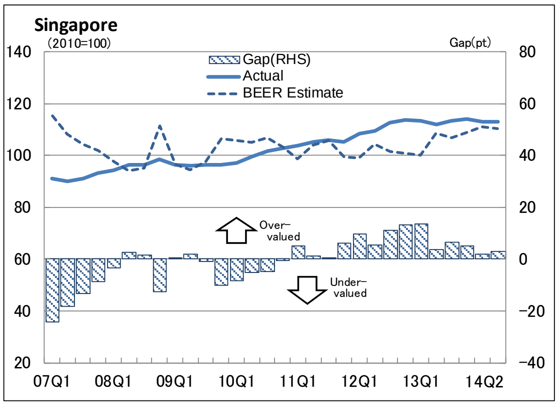
<Model A (REER)>



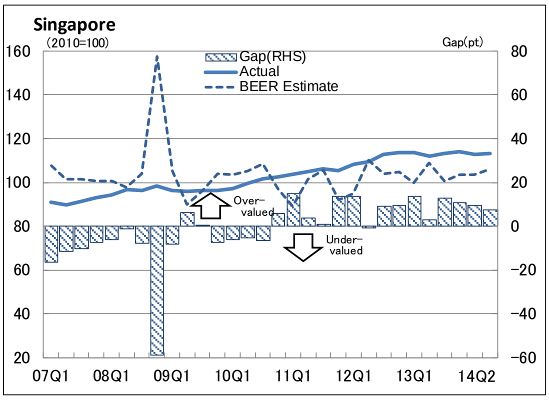
<Model B (REER)>



<Model C (REER)>

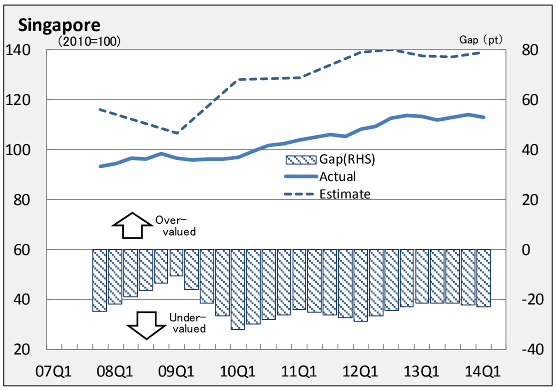


<Model D (REER)>

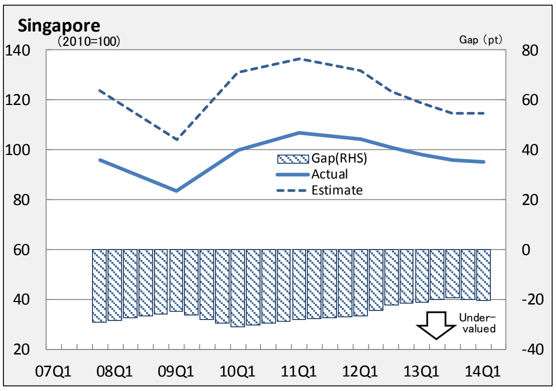


Peterson Institute's FEER

<REER>



<FEER consistent dollar rate>

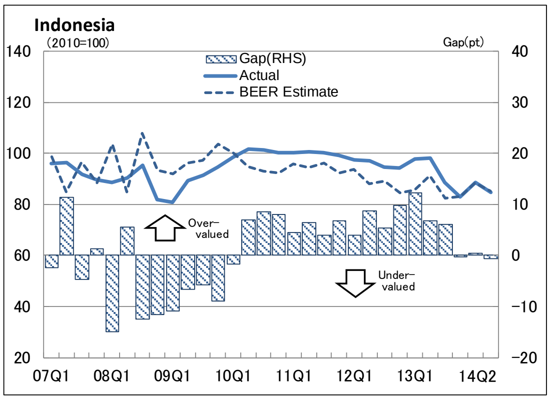


Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS's REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author's estimation

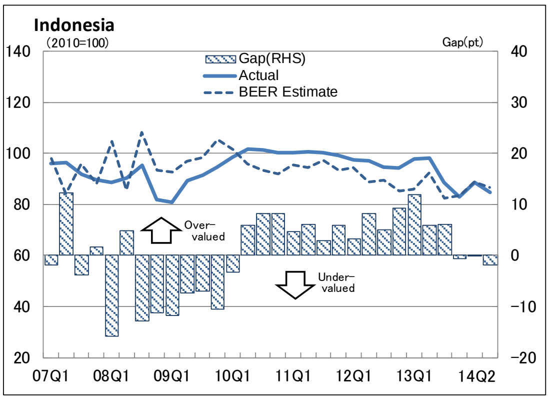
Figure 8. Comparison of BEER and FEER (Indonesia)

Panel Estimated BEER (REER)

<Model A (REER)>



<Model B (REER)>



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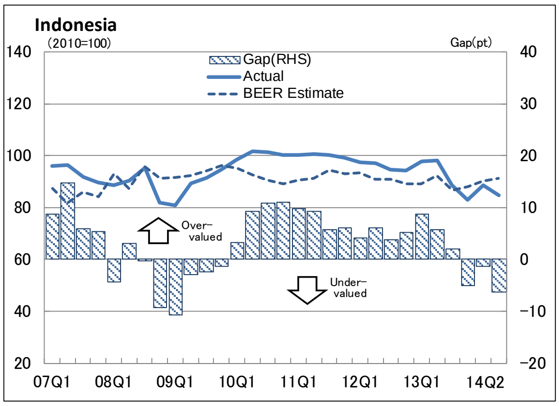
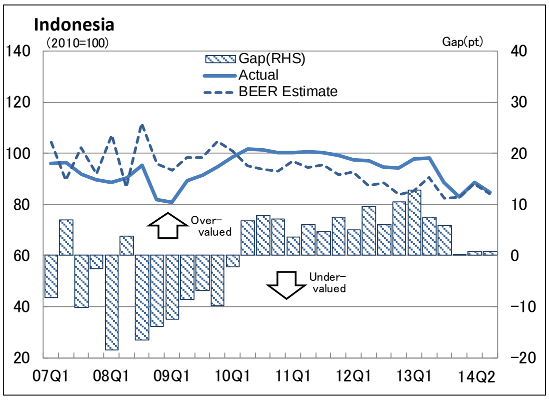
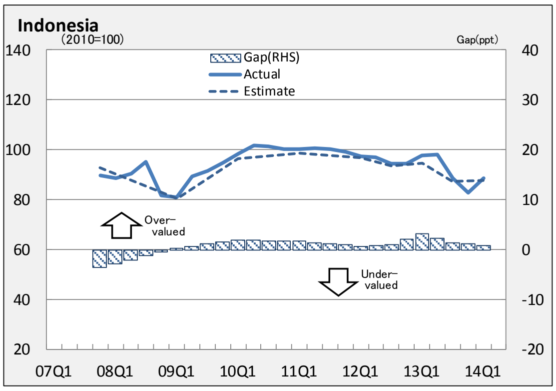


<Model D (REER)>

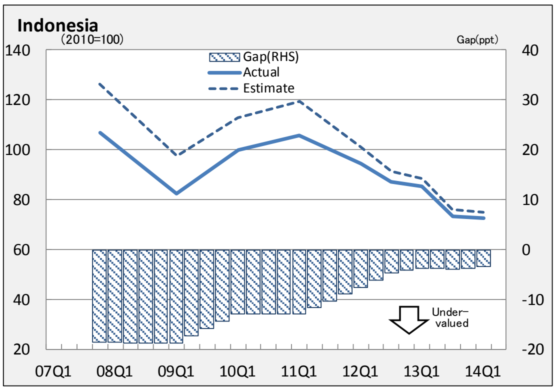


Peterson Institute's FEER

<REER>



<FEER consistent dollar rate>

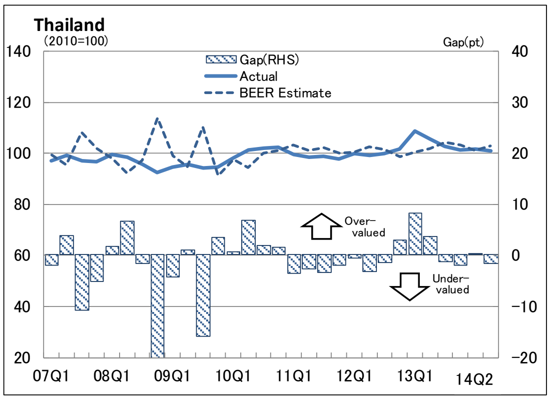


Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS's REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author's estimation

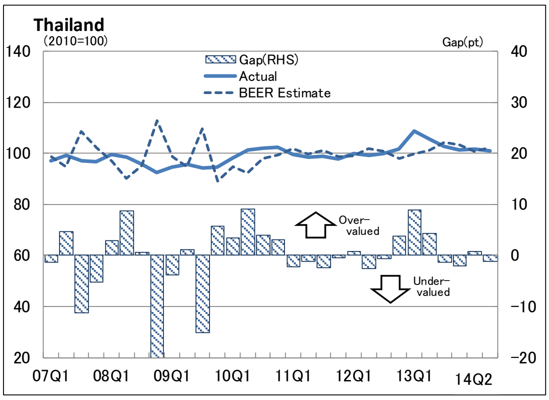
Figure 9. Comparison of BEER and FEER (Thailand)

Panel Estimated BEER (REER)

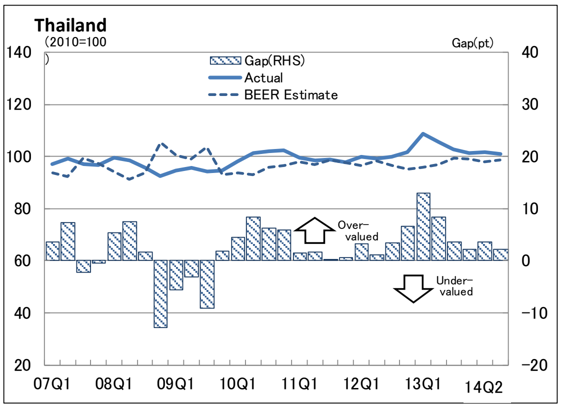
<Model A (REER)>



<Model B (REER)>



<Model C (REER)>



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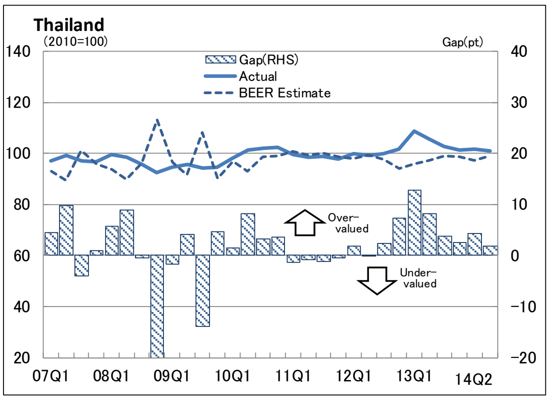
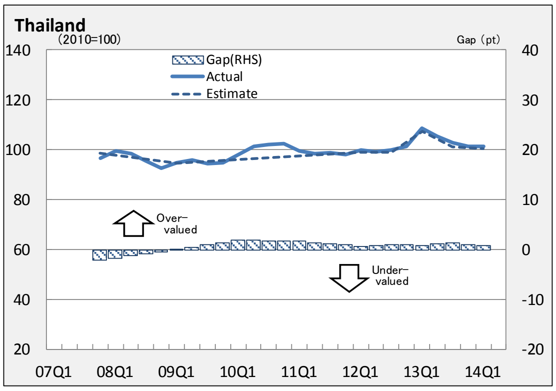
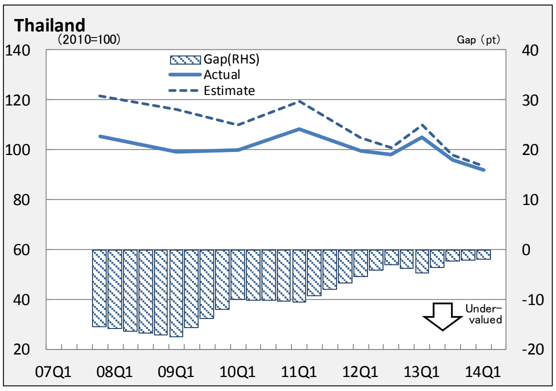


Peterson Institute's FEER

<REER>



<FEER consistent dollar rate>

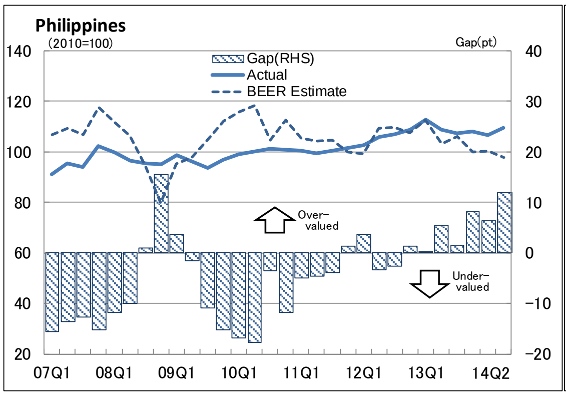


Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS's REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author's estimation

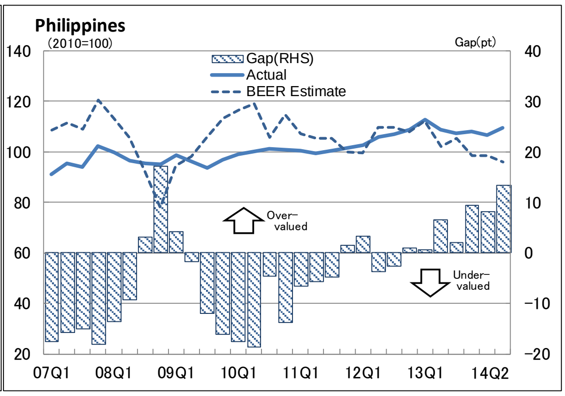
Figure 10. Comparison of BEER and FEER (Philippines)

<u>Panel Estimated BEER (REER)</u>

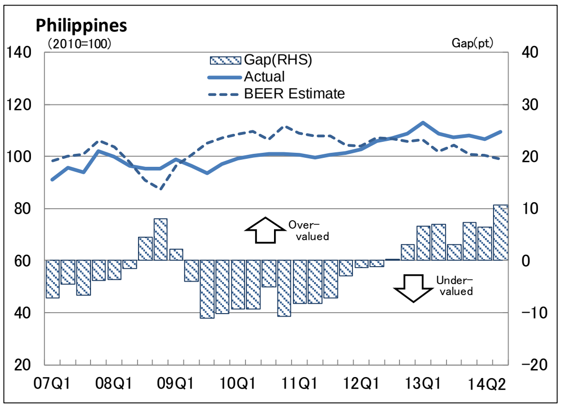
<Model A (REER)>



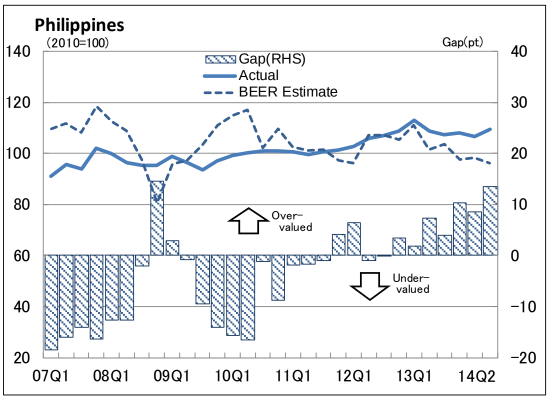
<Model B (REER)>



<Model C (REER)>

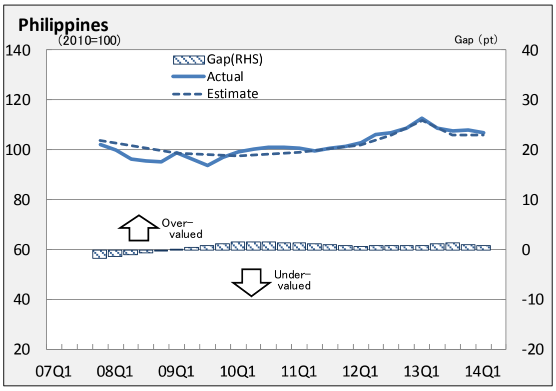


<Model D (REER)>

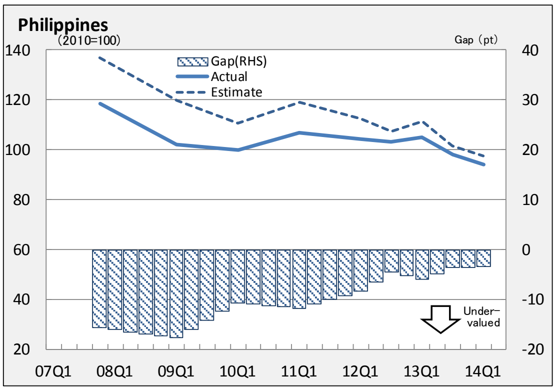


<u>Peterson Institute's FEER</u>

<REER>



<FEER consistent dollar rate>

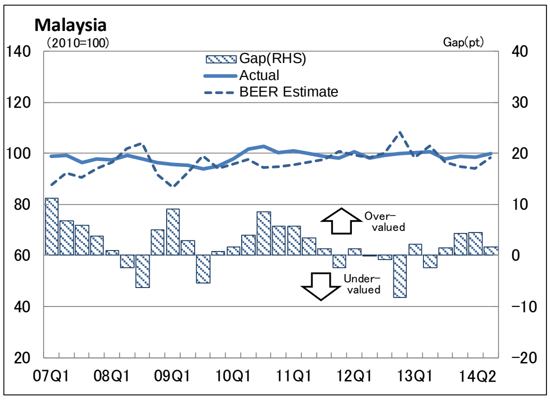


Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS's REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author's estimation

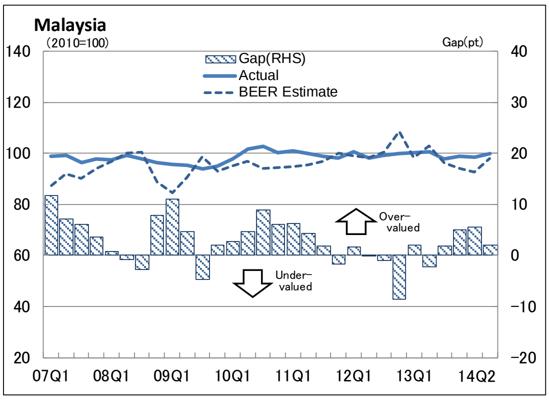
Figure 11. Comparison of BEER and FEER (Malaysia)

Panel Estimated BEER (REER)

<Model A (REER)>



<Model B (REER)>



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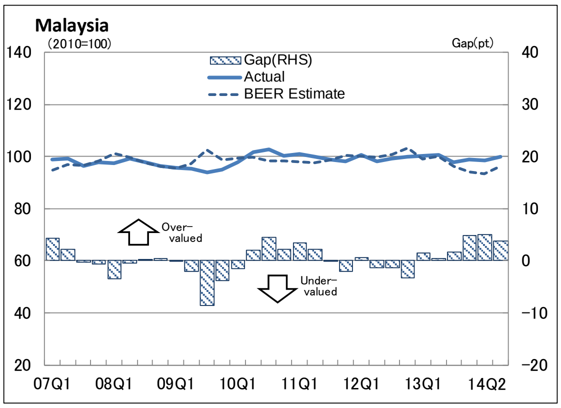

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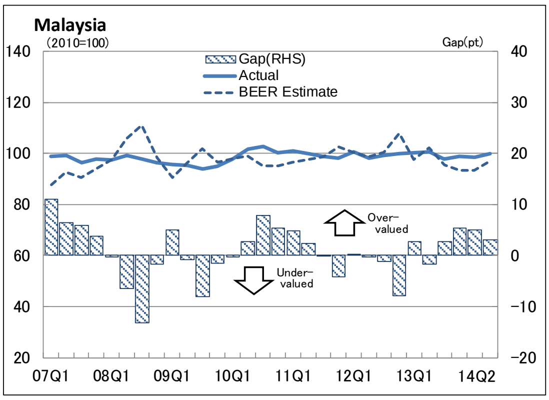
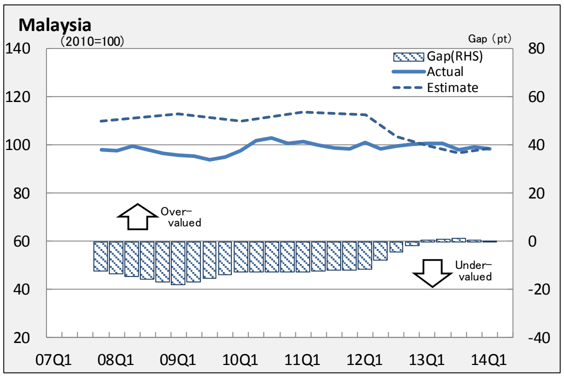
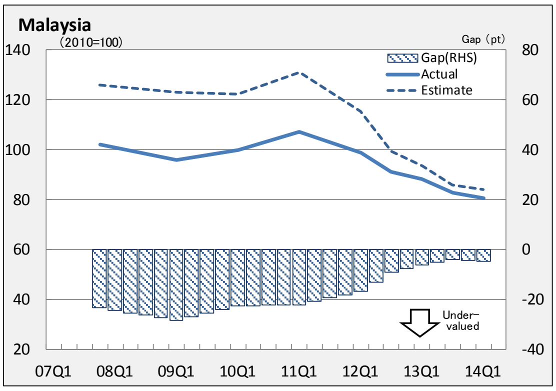


Peterson Institute's FEER

<REER>



<FEER consistent dollar rate>



Note: Actual value of REER estimated by Peterson Institute is assumed to be the BIS's REER (Broad base).
Source: Cline, Cline and Williamson (various years), BIS, Author's estimation

Table 1. Definition of Development Stage

Stage	I Immature debtor	II Mature debtor	III Debtor repayer	IV Immature creditor	V Mature creditor	VI Shrinking creditor
Trade Balance	Deficit(-)	Surplus(+)	Surplus(++)	Surplus(+)	Deficit(-)	Deficit(-)
Income Balance	Deficit(-)	Deficit(--)	Deficit(-)	Surplus(+)	Surplus(++)	Surplus(+)
Current Account	Deficit(-)	Deficit(-)	Surplus(+)	Surplus(++)	Surplus(+)	Deficit(-)
Net Financial Asset	Minus(-)	Minus(-)	Minus(-)	Plus(+)	Plus(+)	Plus(+)

Souces: Crowther (1957)

Table 2. IMF's Assessment of Equilibrium Exchange Rate Deviation

	2012 Assessment	2013 Assessment
	IMF's EBA	IMF's EBA
Japan	Under/Over-valued -20% to +10%	Under/Over-valued -15% to +15%
Korea	Undervalued -3% to -8%	Undervalued -6%
China	Undervalued -5% to -10%	Undervalued -5% to -10%
Hong Kong	Under/Over-valued -15% to +7%	Under/Over-valued -10% to +10%
Indonesia	Fair Value	Overvalued 0% to +10%
Malaysia	Undervalued -5% to -15%	Undervalued -5% to -10%
Philippines	N/A	N/A
Singapore	Undervalued -10% to 0%	Undervalued -4% to -16%
Thailand	Fair Value	Under/Over-valued -5% to +5%

Souces: IMF(2013), IMF(2014)

Table 3. Panel Unit Root Test

	Terms of Trade (TOT)	Non-trade/ trade price difference (TNT)	Non-trade/ trade price difference (⊿TNT)	Real Interest Difference (R)	Net Foreign Asset (NFA)	Governemnt Debt (λ)	Net Foreign Asset − Gov. Debt (NTA)
(Adjusted *t*-value)	-4.71***	-0.61	-10.21***	-2.88***	-2.61***	-2.75***	-2.98***
(*p*-value)	0.00	0.27	0.00	0.00	0.00	0.00	0.00
First Diffrence?	No	No	Yes	No	No	No	No
Average Lag chosen by AIC	1.44	0.56	0.67	1.67	1.00	1.33	0.78
Bartlett Kernel Lags	10	10	10	10	10	10	10

Note: *, **, and *** indicate 10%, 5%, 1% significant level.

Table 4. Panel Cointegration Test

	Eq. A	Eq. B	Eq. C	Eq. D
Explanatory Variables	TOT ⊿TNT R	TOT ⊿TNT R NFA	TOT ⊿TNT R NFA λ	TOT ⊿TNT R NTA
	t-stats	t-stats	t-stats	t-stats
Panel ν-stats	-1.879 **	-1.813 **	-1.879 **	-1.862 **
Panel ρ-stats	2.253 **	2.644 **	3.668 ***	2.966 ***
Panel t-stats (non-parametric)	1.878 **	2.193 **	3.067 ***	2.512 **
Panel t-stats (parametric)	1.990 **	1.412 *	2.144 **	2.383 ***
Group ρ-stats	3.238 ***	3.495 ***	4.455 ***	3.874 ***
Group t-stats (non-parametric)	2.667 ***	2.805 ***	2.83 ***	3.048 ***
Group t-stats (parametric)	3.480 ***	3.334 ***	2.052 **	3.882 ***
Number of countries	9	9	9	9
Number of regressors	3	4	5	4
Average observation per country	34	34	34	34

Note: *, **, and *** indicate 10%, 5%, 1% significant level.

Table 5. Estimation Results by Pooled Dynamic Ordinary Least Square (DOLS)

	Terms of Trade (TOT)	Non-trade/ trade price difference (TNT)	Real Interest Difference (R)	Net Foreign Asset (NFA)	Governemnt Debt (λ)	Net Foreign Asset - Gov. Debt (NTA)	Lags	Obs. per Country
Sign Condition	+/−	+	+	+	−	+		
Pooled DOLS A	**0.4923*****	**2.303****	**0.0203*****				1	31
t-stats	-10.57	1.73	-446.1					
Pooled DOLS B	**0.4178*****	**2.347****	**0.0256*****	**-0.0587*****			1	31
t-stats	-13.86	1.79	-530.9	-58.27				
Pooled DOLS C	**-0.0578*****	**0.9888*****	**0.0194*****	**0.1566*****	**-0.2171*****		1	31
t-stats	-12.55	4.96	-998.5	-87.94	-49.15			
Pooled DOLS D	**0.5894*****	**2.381****	**0.0162*****			**0.2282*****	1	31
t-stats	-10.09	1.88	-603.5			-58.0		

Note: *, **, and *** indicate 10%, 5%, 1% significant level.
1-lag is included. 10 lags used in the Bartlett kernel for the Newey-West long run variance.

Table 6. Estimation Results by DOLS (Eq. A: Panel and Individuals)

	Terms of Trade (TOT)	Non-trade/ trade price difference (TNT)	Real Interest Difference (R)
Sign Condition	+/-	+	+
Pooled DOLS	**0.492**	**2.303**	**0.020**
t-stats	-10.57	1.73	-446.10
Japan	**0.832**	**3.871**	**0.075**
t-stats	-0.58	0.98	-89.71
Korea	**1.461**	**5.040**	**0.082**
t-stats	2.70	1.69	-98.71
China	**▲0.810**	**6.320**	**0.044**
t-stats	-6.91	2.61	-144.70
Hong Kong	**▲1.098**	**2.652**	**0.001**
t-stats	-11.13	3.31	-338.10
Thailand	**0.693**	**3.126**	**0.001**
t-stats	-0.34	1.10	-64.47
Indonesia	**0.577**	**1.906**	**▲0.018**
t-stats	-1.46	0.59	-79.38
Philippines	**1.161**	**0.512**	**0.004**
t-stats	0.13	-0.18	-48.60
Singapore	**1.763**	**▲1.984**	**▲0.021**
t-stats	0.24	-1.20	-55.89
Malaysia	**▲0.147**	**▲0.717**	**0.015**
t-stats	-14.37	-3.70	-418.70
First Difference	No	Yes	No

Note: *, **, and *** indicate 10%, 5%, 1% significant level. 1-lag is included.
10 lags used in the Bartlett kernel for the Newey-West long run variance.

Table 7. Estimation Results by DOLS (Eq. B: Panel and Individuals)

	Terms of Trade (TOT)	Non-trade/ trade price difference (TNT)	Real Interest Difference (R)	Net Foreign Asset (NFA)
Sign Condition	+/−	+	+	+
Pooled DOLS	**0.418** ***	**2.347** **	**0.026** ***	**▲0.059** ***
t-stats	-13.86	1.79	-530.90	-58.27
Japan	**0.782** *	**3.132** *	**0.076** ***	**0.340** ***
t-stats	-1.36	1.36	-128.80	-8.48
Korea	**1.014**	**8.467** **	**0.083** ***	**▲0.297** ***
t-stats	0.03	2.13	-95.64	-5.06
China	**▲0.920** ***	**7.123** ***	**0.059** ***	**0.672** ***
t-stats	-8.37	5.68	-149.80	-1.55
Hong Kong	**▲1.490** ***	**1.657** ***	**▲0.008** ***	**▲0.060** ***
t-stats	-21.99	2.50	-543.20	-115.60
Thailand	**0.249**	**1.203**	**0.024** ***	**0.050** ***
t-stats	-1.10	0.11	-93.12	-5.73
Indonesia	**0.865**	**2.220**	**0.011** ***	**▲2.264** ***
t-stats	-0.63	1.16	-87.97	-4.47
Philippines	**2.064** ***	**▲1.718** ***	**0.012** ***	**0.690** ***
t-stats	2.61	-2.95	-178.80	-2.57
Singapore	**1.239**	**▲0.343**	**▲0.031** ***	**0.377** ***
t-stats	0.07	-0.82	-71.37	-3.48
Malaysia	**▲0.043** ***	**▲0.618** ***	**0.005** ***	**▲0.037** ***
t-stats	-10.84	-3.81	-243.90	-27.89
First Difference	No	Yes	No	No

Note: *, **, and *** indicate 10%, 5%, 1% significant level. 1-lag is included.
10 lags used in the Bartlett kernel for the Newey-West long run variance.

Table 8. Estimation Results by DOLS (Eq. C: Panel and Individuals)

	Terms of Trade (TOT)		Non-trade/ trade price difference (TNT)		Real Interest Difference (R)		Net Foreign Asset (NFA)		Governemnt Debt (λ)	
Sign Condition	+/-		+		+		+		-	
Pooled DOLS	**▲0.058**	***	**0.989**	***	**0.019**	***	**0.157**	***	**▲0.217**	***
t-stats	-12.55		4.96		-998.50		-87.94		-49.15	
Japan	**1.460**	***	**2.225**		**0.075**	***	**0.648**	***	**0.247**	***
t-stats	1.57		0.58		-89.33		-2.60		-7.59	
Korea	**2.170**	***	**▲4.000**	***	**0.068**	***	**0.603**	***	**▲0.082**	***
t-stats	16.57		-7.76		-558.60		-7.16		-17.36	
China	**▲0.563**	***	**5.128**	***	**0.049**	***	**0.870**	**	**0.556**	***
t-stats	-18.79		9.35		-349.00		-1.61		-8.60	
Hong Kong	**▲1.760**	***	**1.627**	**	**▲0.005**	***	**▲0.057**	***	**▲0.175**	***
t-stats	-29.84		1.75		-613.40		-139.8		-48.56	
Thailand	**▲2.127**	***	**▲1.053**	**	**0.004**	***	**0.144**	***	**▲1.124**	***
t-stats	-5.32		-2.06		-165.10		-10.32		-10.85	
Indonesia	**1.936**	***	**3.605**	***	**0.011**	***	**▲1.344**	***	**▲0.580**	***
t-stats	25.26		11.95		-351.30		-21.47		-36.49	
Philippines	**1.455**		**▲1.667**		**0.012**	***	**0.073**	***	**▲0.653**	***
t-stats	1.30		-4.25		-274.10		-3.98		-7.11	
Singapore	**▲2.671**		**0.169**		**▲0.056**	***	**0.451**	***	**▲0.618**	***
t-stats	-1.37		-0.64		-70.29		-3.89		-4.77	
Malaysia	**▲0.420**	***	**2.864**	***	**0.018**	***	**0.021**	***	**0.474**	***
t-stats	-27.05		5.94		-524.50		-73.01		-6.11	
First Difference	No		Yes		No		No		No	

Note: *, **, and *** indicate 10%, 5%, 1% significant level. 1-lag is included.
10 lags used in the Bartlett kernel for the Newey-West long run variance.

Table 9. Estimation Results by DOLS (Eq. D: Panel and Individuals)

	Terms of Trade (TOT)		Non-trade/ trade price difference (TNT)		Real Interest Difference (R)		Net Foreign Asset - Gov. Debt (NTA)	
Sign Condition	+/−		+		+		+	
Pooled DOLS	**0.589**	***	**2.381**	**	**0.016**	***	**0.228**	***
t-stats	-10.09		1.88		-603.50		-57.97	
Japan	**0.649**	*	**3.027**		**0.074**	***	**0.100**	***
t-stats	-1.59		0.87		-94.69		-16.71	
Korea	**1.080**		**7.170**	***	**0.085**	***	**▲0.039**	***
t-stats	0.29		2.44		-126.90		-8.10	
China	**▲0.477**	***	**8.115**	**	**0.031**	**	**0.128**	**
t-stats	-9.56		6.52		-214.70		-9.21	
Hong Kong	**▲1.312**	***	**2.541**	***	**▲0.005**	***	**▲0.031**	***
t-stats	-14.24		3.90		-368.10		-80.4	
Thailand	**0.538**		**1.299**		**0.009**	***	**0.068**	***
t-stats	-0.64		0.22		-103.40		-7.49	
Indonesia	**1.509**	***	**1.766**		**▲0.037**	***	**1.136**	
t-stats	3.57		1.16		-260.20		1.12	
Philippines	**1.801**	***	**▲1.863**	***	**0.013**	***	**0.372**	***
t-stats	3.84		-6.04		-303.60		-20.64	
Singapore	**1.675**		**0.000**		**▲0.039**	***	**0.327**	***
t-stats	0.25		-0.66		-87.70		-5.43	
Malaysia	**▲0.160**	***	**▲0.627**	***	**0.016**	***	**▲0.007**	***
t-stats	-12.19		-3.25		-251.20		-27.03	
First Difference	No		Yes		No		No	

Note: *, **, and *** indicate 10%, 5%, 1% significant level. 1-lag is included.
10 lags used in the Bartlett kernel for the Newey-West long run variance.

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Appendix: Data Sources

<table>
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<tr><td colspan="3">Real Effective Exchange Rate</td><td colspan="9"></td></tr>
<tr><td></td><td rowspan="3">Real Effective Exchange Rate</td><td>Source</td><td colspan="9">BIS "Effective Exchange Rate Indices"</td></tr>
<tr><td></td><td>Data</td><td colspan="9">REER (Broad Indices)</td></tr>
<tr><td></td><td>Data Availability</td><td colspan="9">1994/1～
(Monthly)</td></tr>
<tr><td colspan="3">Terms of Trade (tot)</td><td colspan="9"></td></tr>
<tr><td></td><td rowspan="3">Export Price</td><td>Source</td><td colspan="2">IFS</td><td>Haver Analytics</td><td colspan="6">IFS</td></tr>
<tr><td></td><td>Data</td><td>Export Unit Value</td><td></td><td>Export Price Index</td><td>Export Unit Value</td><td>Export Unit Value</td><td colspan="4">Export Unit Values / Prices</td></tr>
<tr><td></td><td>Data Availability</td><td>1994Q1～</td><td>1994Q1～</td><td>2005Q1～</td><td>1994Q1～</td><td>1994Q1～</td><td>1994Q1～
2005Q3</td><td>1996Q1～
2006Q4</td><td>1994Q1～</td><td>1994Q1～
1998Q4</td></tr>
<tr><td></td><td rowspan="3">Inport Price</td><td>Source</td><td colspan="2">IFS</td><td>Haver Analytics</td><td colspan="2">IFS</td><td rowspan="3"></td><td colspan="2">IFS</td><td rowspan="3"></td></tr>
<tr><td></td><td>Data</td><td>Import Unit Value</td><td></td><td>Import Price Index</td><td>Import Unit Value</td><td>Import Unit Value</td><td colspan="2">Import Unit Values / Prices</td></tr>
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2006Q4</td><td>1994Q1～</td></tr>
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<tr><td></td><td rowspan="3">CPI</td><td>Source</td><td colspan="3">OECD</td><td>Haver Analytics</td><td>Haver Analytics</td><td>OECD</td><td colspan="3">Haver Analytics</td></tr>
<tr><td></td><td>Data</td><td colspan="3">CPI</td><td>CPI</td><td>CPI</td><td>CPI</td><td colspan="3">CPI</td></tr>
<tr><td></td><td>Data Availability</td><td colspan="9">1993Q1～</td></tr>
<tr><td></td><td rowspan="3">PPI</td><td>Source</td><td colspan="2">IFS</td><td>Haver Analytics</td><td colspan="6">IFS</td></tr>
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<tr><td colspan="3">Net Foreign Asset</td><td colspan="9">Net Foreign Assets over GDP</td></tr>
<tr><td></td><td rowspan="3">Net International Investment Position</td><td>Source</td><td>IFS/MoF</td><td>Bank of Korea</td><td>Haver Analytics</td><td>Haver Analytics</td><td colspan="5">Haver Analytics</td></tr>
<tr><td></td><td>Data</td><td>IIP Total: Net Position</td><td>Net IIP</td><td>Net IIP</td><td>Net IIP</td><td colspan="5">Net IIP</td></tr>
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<tr><td></td><td rowspan="3">Nominal GDP</td><td>Source</td><td colspan="9">IMF (World Economic Outlook 2014 October)</td></tr>
<tr><td></td><td>Data</td><td colspan="9">Gross domestic product, current prices</td></tr>
<tr><td></td><td>Data Availability</td><td colspan="9">1993～
(Annual)</td></tr>
<tr><td colspan="3">Gross General Government Debt</td><td colspan="9"></td></tr>
<tr><td></td><td rowspan="3">Gross General Government Debt/Nominal GDP</td><td>Source</td><td colspan="9">IMF (World Economic Outlook 2014 October)</td></tr>
<tr><td></td><td>Data</td><td colspan="9">General Government Gross Debt
(Percent of GDP)</td></tr>
<tr><td></td><td>Data Availability</td><td colspan="3">1993～
(Annual)</td><td>2001～
(Annual)</td><td>1996～
(Annual)</td><td>2000～
(Annual)</td><td>1994～
(Annual)</td><td colspan="2">1993～
(Annual)</td></tr>
<tr><td colspan="3">Real Interest Rate Difference</td><td colspan="9"></td></tr>
<tr><td></td><td rowspan="3">Long-term Interest Rate</td><td>Source</td><td colspan="2">IFS</td><td colspan="3">Bloomberg</td><td colspan="2">Bloomberg</td><td colspan="2">IFS</td></tr>
<tr><td></td><td>Data</td><td>Government Bond Yield</td><td>YLD.ON Nat'l Housing Bonds</td><td colspan="2">10 Year Government Bond</td><td>Government Bond Yield</td><td colspan="2">10 Year Government Bond</td><td>10-Year Bond Yield</td><td>Government Bonds 5 Years</td></tr>
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