Real Financial Integration among the East Asian Economies: A SURADF Panel Approach

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ABSTRACT
To testify RIP, this study scrutinizes the mean-reversion behavior of bilateral real interest differentials (RIDs) in eight East Asian economies. We incorporate the ASEAN-5, South Korea and China (mainland) with the US and Japan taken as base countries. Four sub-samples within 1976-2004 are being considered to accentuate the effects of institutional changes and financial crises. To rectify the deficiency in extant univariate and panel tests, the newly proposed SURADF statistics by Breuer *et al.* (2002) is utilized. Overall, the findings are in favor of RIP such that RIDs are found mean-reverting (except China) and with faster adjustment, especially during the post-crisis era. Such outcome is in accord with the enhanced financial integration among the ASEAN-5 and South Korea with their major trading partners, suggesting that further economic cooperation and currency arrangements in the region are bright to preserve potential financial shocks. Conversely, the real financial integration among China-US and China-Japan are not yet empirically recognized notwithstanding the recent surge of capital flows into the mainland.

Keywords: Real Interest Differentials, SURADF Panel Unit Root Test, Half-life, Confidence Intervals, Financial Integration

JEL Classification: C3, F36, G15

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1.0   Introduction

Real Interest Parity (RIP hereafter) requires real rate of interest to be equalized across countries as indication of capital free flows and financial assets substitutability. It was scientifically used to measure the extent of real financial integration, which has been a subject of perennial interest to both academicians and policymakers in recent years. While RIP is an elegant hypothesis, the empirical supports of the seminal studies in the 1980s were overwhelmingly poor when the absolute condition of RIP were examined (see *inter alia* Mishkin, 1984; Cumby and Obstfeld, 1984; Cumby and Mishkin, 1986; Frankel and MacArthur, 1988). The literature on RIP has burgeoned following the development of nonsationarity time series econometrics. Numerous efforts using both univariate and multivariate techniques have emerged in the empirical literature to determine if RIP holds but still, the recent empirical findings are at best mixed.

To recapitulate briefly, the major findings of recent studies are: (i) poor supports for RIP on account of unit roots in real interest differential series is attributed to the low power of the conventional univariate unit root tests when the sample size is small (Wu and Fountas, 2000; Holmes, 2002; Baharumshah *et al*, 2005); (ii) the findings are not invariant to the choice of the based country e.g. US or Japan (Chinn and Frankel, 1995; Phylaktis; 1999) especially when the sample of analysis is extended to include the post-Asian crisis period (Chan *et al*, 2003; Baharumshah *et al*, 2005); (iii) better results are obtained when non-CPI deflator is used to generate real interest rates (Kim, 2006). (iv) inspection of the longer maturity yields shows favorable results of RIP (Goodwin and Grennes, 1994; Fujii and Chinn, 2001; Obstfeld and Taylor, 2002), suggesting that international financial and goods arbitrage conditions become more valid over long horizons as the economic variables are driven by the fundamentals.

The extents to which RIP holds through time have gained researchers' attention for several fundamental reasons. At the outset, RIP is the key working assumption in various monetary models of exchange rate determination in long run such as Frenkel (1976), Mussa (1976) and Frankel (1979)[1]. Next, RIP is founded on the theories of relative PPP and UIP, which imply the mobility of goods, services and financial assets across borders. But since RIP considers the rates of return in real terms, that is, in terms of a country's output, it also allows the non-financial assets (e.g. factors of production) movement across countries. In other words, the authentication of long run RIP provides valuable insight into the extent of real economic and real financial integration between countries. Many economists view this as equally essential to contemplate the effectiveness of domestic monetary authorities to influence real economic activity through the real interest rate channel in different time horizon. If RIP holds, this is limited to the influence national authorities can exert on the world interest rate. If it does not, authorities can use this channel effectively for the purpose of macroeconomic management, depending on the extent of persistency of short run deviation from RIP (see Mark, 1985; Feldstein 1991; Kim, 2006; among others)[2].

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[1] The general monetary exchange rate model developed by Frankel (1979) noted that, if there is a disequilibrium set of real interest rates, the real exchange rate will deviate from its long-run equilibrium value. If the real domestic interest rate is below the real foreign interest rate, then the real exchange rate of the domestic currency will be undervalued in relation to its long run equilibrium value, so that there is an expected appreciation of the real exchange rate of the domestic currency to compensate.

[2] An important channel in the operation of open economy stabilization policy is through the monetary policy, considering the degree of real economic variables being influenced by the real interest rates. This channel would not be available if real rates are equal across countries since the ability of the authorities to influence their own real rate would be limited to the extent to which they could influence the world rate (Mark, 1985; Kim, 2006). Unless real rates can differ across countries, policies directed at increasing domestic savings cannot increase the rate of capital formation and, hence, productivity (Feldstein, 1991). Baharumshah *et al* (2005) further noted that more financial integration will facilitate nominal interest rate convergence and, depending on the exchange rate regime, may lead to inflation convergence. As such, real interest rate convergence might also obtain, thus making national monetary policy a less effective stabilization policy tool, as real interest rates will be dictated by a leading country in the region.

In addition, the monetary approach to balance and payment and the intertemporal model to current account are based on the Mundell-Fleming framework that emphasized on international capital mobility and dynamics at the core of open-economy macroeconomics (Obsfeld, 2001). The increased capital mobility and regional financial integration give rise to an exchange rate-induced crowding effect and thereby, diminishes the effectiveness of fiscal policy. More recently, RIP is also treated as key hypothesis in assessing the feasibility of Optimum Currency Area (OCA)[3]. By theory, countries that are financially integrated to allow cross-border capital free flows at competitive level are mostly likely to form OCA and hence the monetary union. Conversely, any break down of RIP is likely to be on account of ex ante PPP not holding which implies that countries may engage in both quantity and price adjustment in response to asymmetric shocks (Holmes, 2005).

The above signify the importance of study in RIP and market integration, particularly for the deliberation of currency arrangements and monetary cooperation as well as fiscal coordination within the East Asian region. The issue has become more vital following the recent development of regional episodes. With the China's recent accession to WTO (November 2001) and the emergence of ASEAN10+3 Free Trade Area due to the Chiang Mai Initiative (May 2000)[4] and the Bali Dialogue (October 2003)[5], the need for an amendment of regional trade policy and financial arrangements anchoring by China or Japan may be well understood, but less being investigated[6]. Yet, the degree of market integration in East Asian achieved by increased capital flows and international trading remains a matter of debate. On one hand, we witness the open market practices prompted by technological breakthroughs, financial liberalization, and growth in the volume of trade (Obstfeld, 1998). On the other hand, the bond markets of most nations in the region are far from well-developed whilst the stock of cross-border holdings still is a small fraction of total financial assets and liabilities outstanding (Eijffinger and Lemmen, 2002).

This paper examines the Real interest Differentials (RID) hypothesis that involve the China, south Korea and ASEAN-5 vis-à-vis their major trading partners (e.g. US, Japan). In addition to the policy issues mentioned earlier, our study contributes to the existing literature in

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[3] As referred to the seminal work by Mundell (1961) and the following surveys done by Tavlas (1993) and De Grauwe (2005), the formation of an OCA currency area should include: (i) the openness and goods market integration; (ii) factor market integration; (iii) similarity in economic structure and symmetry in (real) shocks; (iv) financial market integration; and (v) policy coordination.

[4] During the Asian Development Bank meeting (6th May 2000) in Chiang Mai, the ASEAN-10, China, Japan, and South Korea (collectively known as ASEAN10+3) agreed to create a network of regional currency swap arrangements, associated with surveillance and monitoring mechanisms. The initiatives began to take concrete when multiple countries signed swap arrangements in 2001, some with ceilings as high as $3 billion. These eye-catching initiatives parallel plans by China and Southeast Asian countries to form a Free Trade Area, ongoing sub-regional economic development projects and the efforts to regularize meetings among finance and trade officials, have constituted towards regional integration.

[5] During the 9th ASEAN Summit on 7-8 October 2003, Bali (Indonesia), leaders from ASEAN, China, India, Japan and South Korea have expressed their strong support for the Bali Concord II as a solid platform to achieve an ASEAN Community based on political-security, economic and socio-cultural cooperation. Despite the countermand of trans-national crimes/ terrorism and communicable diseases, these countries have propounded the economic integration of ASEAN (at regional and sub-regional level) and the establishment of Asian Bond as an alternative for regional financing.

[6] Taken as blueprint, numerous RIP studies involving European countries have proven that the launch (January, 1999) and the common circulating of Euro currency (January, 2002) has eliminated foreign exchange risk among member countries and stimulated intra-European capital flows, which eventually lead to a fully integrated European capital market, with an international prominence in line with the economic strength of the EMU area.

four methodological aspects. First, four sub-samples within the post-Bretton wood era (1976M1-2004M4) are being considered to accentuate the effects of institutional changes and financial crises in the region. Second, we apply the dominant hypothesis to investigate if the RID series are sensitive to the choice of numeraire, e.g. the US or Japanese variable. Third, we utilize the series-specific panel unit root test advocated by Breuer *et al.* (2002) to examine the possible mean-reversion behavior of RID series. The so-called SURADF test process the estimation of ADF regressions within a seemingly unrelated regression (SUR) framework and is capable of increasing the likelihood of establishing well-defined results. By exploiting the information from the error covariances and allows for autoregressive process, it utilizes the well-established power advantages of panel estimation over the single equation-based unit root tests. SURADF allows for heterogeneity in lag structure across the panel and hence rectifies the deficiency in extant panel analyses, which do not accommodate heterogeneity across groups such as the individual specific effects and different patterns of residual serial correlations. SURADF can also further identify how many and which members of the panel contain a unit root and which ones do not. Fourth, to draw a complete picture of short run adjustments and the mean reversion process of RID series, we estimate the corresponding half-lives and the confidence intervals once stationarity is confirmed.

To this end, we have the rest of the paper organized as follows. Section 2 provides the overview of financial and exchange rate liberalization in China, South Korea and Asean-5. Section 3 then elaborates on the RIP theoretical framework that sets out the real interest differential hypothesis and hence the econometric methods employed in the study. The empirical findings are provided in Section 4 and finally in Section 5, we conclude.

2.0 Market Liberalization in selected East Asian Countries

Efforts of financial liberalization in the ASEAN-5 after 1973 followed almost the same pattern and took place primarily in three stages. In the first stage, foreign exchange controls as well as the ceilings on deposits and lending rates were removed at different pace during 1977-1985. Singapore (1975) and Malaysia (1978) were among the first countries to liberalize their interest rate controls. In Indonesia and Philippines, interest rates were fully deregulated in the early 1980s. Thailand did not abolish their interest rate ceilings until mid to late 1980s. In Korea, there was gradual liberalization from the late 1980s, with external factors being the major trigger for reform. In spite of intense nationalist sentiment, the prospect of becoming an OECD and GATT-member country was instrumental in the move towards liberalizing its financial market.

By the mid-1980s, interest rate liberalization along with economic progress had resulted in positive and stable real interest rates in these ASEAN countries. The authorities viewed interest rate stability as an important policy variable in promoting a stable financial system and contributing to a more effective monetary policy transmission mechanism. Indeed, real rates of interest remained positive high and stable most of the time since 1980s, with only occasionally turned negative (see Figure 1). With low inflation, such market practice has resulted in the commonly high rate of voluntary savings among many East Asian economies[7]. High levels of domestic financial savings, to great extent, sustained the East Asians' high investment levels prior to Asia Financial crisis 1997/98. In 1990, East Asians averagely saved 34% of GDP, compared to only half that in Latin America, and slightly more in South Asia. Also, the positive and stable real interest rates contributed to the increase in the volume of resources available to the financial system, as funds previously held outside the formal financial sector found their way to the banking system.

[Insert Figure 1]

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[7] But of all, Singapore is somewhat different such that the high saving rate is boosted by compulsory contributions to a central provident fund, which were as high as 40% of the payroll in the 1980s.

Capital inflows were most evident in the second stage of the liberalization process that witnessed the opening up of the capital accounts throughout the late 1980s. Guarantees were given to non-residents that they would be able to withdraw their investments. Also, restrictions on foreign asset holding by residents were relaxed. Many of these countries allowed the private sector to have access to external finance for the first time. The widespread liberalization of financial markets as well as external factors like a sustained decline in world interest rates and recession in the industrial economies led to a surge in foreign capital into the region and allowed them to enjoy the juicy fruit of laissez-faire from the growth of international capital markets. Between 1994 and 1996, 210 billion dollars flowed to ASEAN-5, which was about 20% of their GDP (Radelet and Sachs, 1998). Asia is among the high-growth region with an accumulated foreign direct investment stock of US$ 657 billion in 1996, which is half of the total amount (US$ 1.2 trillion) received by all the developing countries. Japan, Hong Kong, South Korea, Taiwan and the ASEAN-5 were in fact the major holdings of foreign capitals in the region[8].

Leading by Japan, these East Asian economies have performed noticeably well in the capital accumulation, trade expansion and income growth, and were once termed as the 'East Asian Miracle'. From 1965 to 1990, they have grown faster than all other regions of the world, averagely 7%, with relatively high saving and investment rates approaching 30%-50%. Associated by the stable and non-inflationary monetary and fiscal stance, outward-oriented policy was also highlighted as part of the development strategy to achieve sustainable growth as well as to alleviate poverty. Until the crash of the crisis in 1997, the so-called 'East Asian miracle' attracted much attention and a lot of articles have written about the subject. Indeed, the 'better learn from East Asia' was once the advise given to less-developed economies in Asia, Africa and Latin America.

On the other hand, China was characterized by the expansion of the central-planning system and the dominance of state-owned enterprises in the economy during 1949-1978, with a large number of previously active financial institutions being truncated into virtually one hierarchical organization - the People's Bank of China (PBC). The government budget-centered financial system was deemed incompetent for China's need to move toward a market-oriented economy. The process of financial liberalizing in China started late during 1986-88 and halt temporary, due to inflationary pressure. During that time, the government has responded to the growing demand in the market by taking initiatives in establishing new financial institutions, banks, and non-bank financial institutions. This is reflected not only in the increased number of financial institutions, but also the domination of state ownership in the financial service sector. The government has allowed state-owned financial institutions to be commercialized, e.g. to let them seek for profits and increasingly act like pure business entities. By early 1990s, banks and financial institution were allowed to set deposits rates freely above the administered rates within pre-specified margins. In June 1996, the ceiling rates of inter-bank loans were removed and the interest rates have expanded twice within 1998-99. By September 2000, the controls on large fixed deposits and foreign currency loans were lifted and the China Banking Association took over the responsibility of interest rates decision on small foreign currency deposits. In recent years, China has been the world largest recipient of direct overseas investment, with US$ 52.7 billion of foreign capital being utilized in 2002. However, the capital account

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[8] Of all, Thailand and Malaysia are particularly open to FDI, and over time have become progressively more so. In the decade up to the Asian economic crisis, Thailand was a huge capital importer, in some years running a current account deficit of more than 8% of GDP. While FDI increased to record levels, an increasing proportion of the total capital flow was portfolio and other short-term capital. The Government's objective to promote Bangkok as a regional capital market center in competition with Hong Kong, China and Singapore was a factor here, as virtually all restrictions on capital flows were removed. Following the 1997-98 capital flight and consequent collapse of the Thai baht, the Government maintained its open posture toward FDI, despite a growing nationalist backlash, and FDI flows actually increased for a period.

liberalization of China is still far more restricted and slow as compared to ASEAN-5. China still maintains very strict capital control and Renminbi is convertible for only 43 items in capital account under the IMF classification (Taghavi and Sun, 2005).

For many East Asia countries including China, the third stage of market liberalization is aligned with the major reforms since the wake of the economic crisis 1997-98. The post-crisis stage constituted a period of macroeconomic instability, a regime of grater volatility among the Asian currencies, and the recent difficulties associated with the financial crisis. Countries are no longer in common path of financial development. Malaysia, instead of seeking IMF rescue financing, decided to reverse its liberalization policy by imposing capital controls and exchange rate pegging with US dollar (US$1 = RM3.8) during October 1998 to July 2005. Such move was in contrast to South Korea that followed the IMF programme and substantially liberalized the capital account regime. Thailand has made some progress in broadening the scope of financial liberalization but still maintain a relatively large number of capital account restrictions as compared to Singapore, Hong Kong and South Korea. Indonesia has also requested IMF's assistance package of US$43 billion, mainly to restore the confidence of international financial markets in the short term by stabilizing the exchange rate through a combination of macroeconomic discipline (e.g. fiscal surplus, high interest rates and tight monetary policy), availability of sufficient foreign reserves and the reforms towards good corporate governance and market transparency. However, the economic recovery and financial reforms in Indonesia are more sluggish among the crisis-affected countries.

3.0 Theoretical Framework, Estimation Procedures and Data Description

For RIP to hold in absolute form, real returns on comparable financial assets traded in domestic and foreign markets should be equalized when both national financial markets are deregulated and international capital flows are liberalized. However, since real returns on bonds are hardly equalized (see Mishkin, 1984; Cumby and Obstfeld, 1984; among others), many studies have focused on the real interest rates linkages or the real interest differentials (RID) behavior rather than the absolute equality condition of RIP.

RIP is founded on the supposition of Uncovered Interest Parity (UIP hereafter) and Relative Purchasing Power Parity (RPPP hereafter). UIP[9] anticipates expected depreciation ($\Delta s^e_{t,t+k}$) being explained by interest rate differentials ($i^k_t - i^{k*}_t$) while RPPP holds in expectation that expected depreciation equals the expected inflation differential ($\pi^e_{t,t+k} - \pi^{e*}_{,t+kt}$). Together,

$$\text{UIP condition:} \qquad \Delta s^e_{t,t+k} = i^k_t - i^{k*}_t \tag{1}$$

$$\text{and,} \qquad \text{PPP condition:} \qquad \Delta s^e_{t,t+k} = \pi^e_{t,t+k} - \pi^{e*}_{,t+kt} \tag{2}$$

$$\text{equating (1) and (2) yields,} \qquad i^k_t - \pi^e_{t,t+k} = i^{k*}_t - \pi^{e*}_{,t+kt} \tag{3}$$

$$\text{and,} \qquad \text{ex ante RIP condition:} \qquad E_t(r_{t+k}) = E_t(r^*_{t+k}) \tag{4}$$

When rational expectations are considered, ex post RIP also implies ex ante RIP. To test for RIP when the real interest rates are I(1), the following cointegrating regression is estimated:

$$r_t = \beta_0 + \beta_1 r^*_t + \varepsilon_t \tag{6}$$

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[9] UIP assumes the absence of exchange risk premium and country premium.

where r_t represents the domestic ex post or observed real rate of interest and r_t^* the ex post or observed real rates in the base country (e.g. US or Japan). By imposing $(\beta_0, \beta_1) = (0, 1)$ on (6), we establish the Real Interest Differential (RID) model:

$$r_t - r_t^* = \varepsilon_t \qquad (7)$$

Given the specification in (7), RIP holds in long-run if ε_t is constant or at least the RID series is mean reverting. Suppose the deviations of the RID series ($y_t = \varepsilon_t$) from its long run value (y_0) follows an AR (1) process, then

$$y_t - y_0 = \alpha(y_{t-1} - y_0) + \mu_t \qquad (8)$$

where μ_t is a white noise. Then, the half-life (h) is defined as the horizon at which the percentage deviation from the long run equilibrium of RID is one half, that is $\alpha^h = \dfrac{1}{2}$ and $h = \dfrac{\ln(1/2)}{\ln(\alpha)}$. The two-sided 95% confidence intervals of the half-live which are based on normal sampling distributions is then defined as $\hat{h} \pm 1.96\hat{\sigma}_{\hat{\alpha}}\left(\dfrac{\ln(0.5)}{\hat{\alpha}}[\ln(\hat{\alpha})]^{-2}\right)$, where $\hat{\sigma}_{\hat{\alpha}}$ is an estimate of the standard deviation of α (see Rossi, 2004 for more details).

To test for the stationarity of ε_t in (7), we rely on the SURADF unit root test advocated by Breuer et al., (2002), which is based on the system of ADF equation:

$$\Delta y_{1,t} = \alpha_1 + \beta_1 y_{1,t-1} + \sum_{j=1} \varphi_j \Delta y_{1,t-j} + u_{1,t}$$
$$\Delta y_{2,t} = \alpha_2 + \beta_2 y_{2,t-1} + \sum_{j=1} \varphi_j \Delta y_{2,t-j} + u_{2,t}$$
$$\vdots$$
$$\vdots \qquad (9)$$
$$\vdots$$
$$\Delta y_{N,t} = \alpha_N + \beta_N y_{N,t-1} + \sum_{j=1} \varphi_j \Delta y_{N,t-j} + u_{N,t}$$

where $\beta_j = (\rho_j - 1)$ and ρ_j is the autoregressive coefficient for series j. This system is estimated by SUR procedure and the null and alternative hypotheses are tested individually as

$$H_0^1 : \beta_1 = 0; \qquad H_A^1 : \beta_1 < 0$$
$$H_0^2 : \beta_2 = 0; \qquad H_A^2 : \beta_2 < 0$$
$$\vdots$$
$$\vdots$$
$$\vdots$$
$$H_0^N : \beta_N = 0; \qquad H_A^N : \beta_N < 0$$

with the test statistics computed from SUR estimates of system (9). As this test has non-standard distributions, the critical values must be generated through simulations. In the Monte Carlo simulations, the intercepts and coefficients on the lagged values for each series are set equal to zero. In what follows, the lagged differences and the covariances matrix are obtained from the SUR estimation of actual RID series. The SURADF t-statistic for each of the series is computed individually for the coefficient on the lagged level. And, the experiments are replicated 10000 times and the critical values of 1%, 5% and 10% are tailored to each of the eight panel countries.

Data Description
Following the Fisher equation, real interest rates of a country can be estimated by having nominal rates adjusted for expected inflation. In our case, the expected inflation is estimated from consumer price index (CPI) by using the autoregressive distribution lag approach instead of having the actual inflation as proxy. The choice of the nominal interest rate proxy is dictated by data availability considerations. Short-term interest rates are utilized due to the fact that the bond markets are yet well-developed in the region. We deploy the monthly non-control nominal interest rates sourced from IMF, e.g. money market rates for Philippines and Thailand; call money rates for US, Japan and Indonesia; inter-bank money rates for Malaysia, South Korea and Singapore; base lending rates for China. The study sample spans from 1976:M1 to 2004:M4 in consideration of the pre- and post-liberalization era, with and without the Asian financial crisis.

4.0   Results Discussion
In the cointegration context, the definition of real interest equalization holds if the combination of the two integrated non-stationary real rates lead to an I(0) process of the differential rates. Otherwise if the RID series follow random walks, there will be absence of long run relationship among the variables and hence the rejection of RIP. We first perform the first-generation panel unit root tests on the RID series to gauge the mean reversion behavior. In Table 1, the results of panel tests that advocated by Breitung (2000), Im, Pesaran and Shin (IPS, 2003), Madala, Wu and and Choi (WMC, 1999, 2001) were reported. The overall results have been very supportive to reject the unit roots in the RID series across all time zones, suggesting that RIP holds for all countries over time and insensitive to the choice of numeraire.

<div align="center">**[Insert Table 1]**</div>

Nevertheless, such overwhelming finding could be, to some extent, questionable, as it ignores the facts that these countries are at different level of capital market development and financial openness. In other worlds, it raises the query of whether market integration and capital mobility have already reached the optimal level. It was well-noted that panel analyses utilize more observations and have incorporated information from both time series and cross-sectional variations to yield higher test power. But analysts are also increasingly aware of shortcomings in some of these early panel tests that do not accommodate heterogeneity across groups such as individual specific effects and different patterns of residual serial correlations (as for Quah, 1994; among others). More detail, Cerrato (2002) highlights four possible weaknesses of the early panel tests, including the contemporaneous correlations that may lead to a spurious rejection of the null; the possible heterogeneity of the first-order autoregressive coefficients that could induce misspecification and bias; the difficulty in interpreting the null hypothesis; and a lack of formal stability tests. Via the finite-sample Monte Carlo experiments, Karlsson and Löthgren (2000) show that panel unit root tests may lack power when only a fraction of the series in the panel is stationary, meaning that the rejection of the null of joint non-stationarity in a panel may be due to a single series within the panel being stationary. Banerjee *et al* (2001), also by simulation, demonstrate that panel unit root tests could suffer from severe size distortion, in panels with cointegration across units.

In such circumstances, we proceed with the newly proposed SURADF test advocated by Breuer *et al.* (2002) to examine the properties of the RID series. SURADF is capable of exploiting the well-established power advantages of panel estimation[10] while rectifying a deficiency in extant panel tests[11]. In Table 2.1, the SURADF estimation and critical values are reported. SUADF is based on individual rather then a joint null hypothesis as in earlier versions of the panel unit root tests. Overall, the null hypothesis of unit root is being rejected at 1% significant level and implies the mean reversion behavior of RIDs, over time in long proposition. Panel A-E demonstrate strong supports for real interest parity among the ASEAN-US, South Korea-US and Japan-US, for the pre- and post-liberalization era, and even when the analysis is extended to include the post crisis period. But for China-US, no evidence of mean-reversion is observed (1987-1997) until the post-crisis time (1997-2004) where only weak support for RIP is reported in Panel E.

[Insert Table 2.1]

In view of the case where Japan is taken as based country, similar supports for the long run RIP are obtained among ASEAN-Japan and South Korea-Japan (see Table 2.2). But for China-Japan, again, none of test statistics has rejected the null hypothesis of unit root, indicating that for any shocks on the series, deviations will be too persistent to witness necessary adjustment to the equilibrium level. In other words, RIP does not hold at all for China-Japan during 1987-2004, notwithstanding the recent surge of capital flows into the mainland.

[Insert Table 2.2]

Unit root test alone may not sufficient to justify the adjustment dynamics of RIP and the degree of real financial integration among countries. In consequent, numbers of researchers have estimated the half-lives to measure the persistency of deviations from RIP. However, recently aware, the point estimates of half-lives alone provide an incomplete picture of the speed of convergence towards RIP. Hence, the corresponding confidence intervals are computed to offer better indications of the uncertainty around estimates of half lives.

Table 3 reports that, overall in the full sample (Panel A), the US-based half-lives are approximately ranging from 9.3 to 34.1 months. More detail, it was reported at 5.2-30.9 months during 1987-1997, reducing from 16.2-42.9 months during the pre-liberalization era. When the post-crisis period is taken into account (as in Panel D), the speed of adjustment is faster as half-life is averagely 12.0 months. But for China-US alone, the estimated half-life is 35.6 months during 1987-2004. Although there are signs of decreasing deviations when the crisis period is included, the differences are insignificant and relatively small. Panel A also indicates that the confidence intervals for all half-lives at 95% level are finite but quite widespread for the Japan-US (0-70.4 months), Philippines-US (2-53 months) and Thailand-US (0-52.3 months) cases.

[Insert Table 3]

As for the cases of Indonesia-US and Malaysia-US, the confidence intervals are more stable and being in the vicinity of 27 months. Almost all sample periods have shown similar pattern of confidence intervals though various length of half-lives are reported. In brief, results in Table 4 may imply that RIP holds better for all studied countries (except China) in the post-

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[10] The SURADF test is based on the system of ADF equation which is estimated by the seemingly unrelated regression (SUR) procedure. In other words, the SURADF test reflects cross-movements of the regression residuals, which imply the co-movements of the deviations from RIP in the panel of countries and contribute to a more powerful test. Since the SURADF test considers the extra information of cross-sectional dependence, the power of the test improves as the degree of cross-sectional correlation increases.

[11] The SURADF estimation allows for heterogeneity in lag structure across the panel members and can further identify how many and which members of the panel contain a unit root and which ones do not.

liberalization era with crisis period included. While Malaysia seems to be most financially integrated with the US, the RIP condition is less stable for Japan-US (0-70.4 months), Philippines-US (2-53 months) and Thailand-US, suggesting that their ability to absorb financial shocks - especially when US is dominating - are lower.

When Japan is taken as based country, longer half-lives are also observed for the pre-liberalization era (Panel C: 14.5-33.6 months). For the post-liberalization era with and without crisis, 5.7-23.6 months and 2.6-30.2 months of half-lives are reported. Of all, China is again reported as the least integrated country with Japan. If we refer to the post-liberalization period with crisis (Panel E) alone, the half-lives are reported at much lower figures (2.2-11.1 months). This would suggest the policy adjustments towards the market oriented strategies and hence the growing integration among ASEAN-Japan and South Korea-Japan. To summarize, though the overall speed of adjustments in the US-based RID series is slightly faster to signify a greater real financial integration among the ASEAN-US, the financial influence of Japan has grown since the last Asian crisis. But for China, the evidence of real integration with US or Japan is far hazier.

5.0   Policy Implications and Concluding Remarks

The empirical results are generally in favor of RIP, as supported by the high degree of mean reversion and miniature deviations of the RID series. Such findings encourage us to conclude that ASEAN-5 and South Korea are well integrated with both US and Japan in the goods and financial markets. However, the dominant role of both countries is somewhat statistically indecisive. The increased integration after the post-liberalization and post-crisis periods is understandable as comparable pattern of economic development and liberalization process have created countries (ASEAN-5) with similar economic structures. Also, the abolition of legal restrictions on cross-border capital movements and technological advances that have lowered information and communication cost considerably have foster the process of market integration.

Conversely, the RIP condition does not hold for China and the real financial integration between the China-US and China-Japan is still empirically unrecognized. While China has experienced trade expansion and the influx of capital flows (especially from US and Japan) in the last decade, the process of financial liberalization is still far from being concrete. In fact, recent investigations have shown that only 45% of the capital account transactions are convertible by Renmimbi. Despite the less-deregulate market practice where interest rate ceilings and commercial banks are not yet fully liberalized, there is also strong political will to maintain monetary autonomy by the Chinese government. And perhaps due to the wake of the financial crises in 1990s (e.g. Mexico, 1995; Asian, 1997), Chinese officials have backed away from a strict schedule for capital account liberalization and moved towards a more gradual approach in opening its capital market, as noted in Taghavi and Sun (2005). Such policy movement may also attributable to the large scale of non-performing loans in China's banking sector and the lack of appropriate mechanism in transformation and institutional reforms in financial systems in the 1990s (see Liang, 2006).

Though the confirmation of RIP may imply that countries are more vulnerable to common external shocks, our analysis has also shown that countries have has improved their ability to absorb foreign disturbance or uncertainty as indicated by the shorter half-lives reported overtime, especially when the post-crisis period is included. As such, it is fair to foresee a brighter feasibility towards regional financial deepening and regional currency arrangements among the US, Japan, ASEAN-5 and South Korea. By taking cooperative action they would be in a better position to resist the adverse consequences of sudden and sizeable movements in global capital, and the potentially deleterious effects that this can have on the growth and development of their domestic economies. Such finding is in accord with Baharumshah et al (2007a, 2007b) who find faster market adjustments of East Asian PPP rates

in the post-crisis period, to maintain international competitiveness and to stabilize domestic income.

RIP is also hypothetically linked to the theoretical pre-condition of an optimum currency area (OCA). Countries that are financially integrated to allow cross-border capital free flows at competitive level are mostly likely to form OCA and hence the monetary union. Our findings would suggest that ASEAN-5 and South Korea can be a potential candidate group to form an OCA anchored by Japan, to preserve potential financial shocks. This is in line with Oh (2006) who views that monetary and exchange rate policy cooperation in East Asia would enable this region to exert an important influence upon the future evolution of the global trade and financial system. However, the Chinese participation of Asian OCA is less feasible in the near future, and necessary steps to strengthen the financial sectors are to be taken if China is to be financially competitive in the international arena.
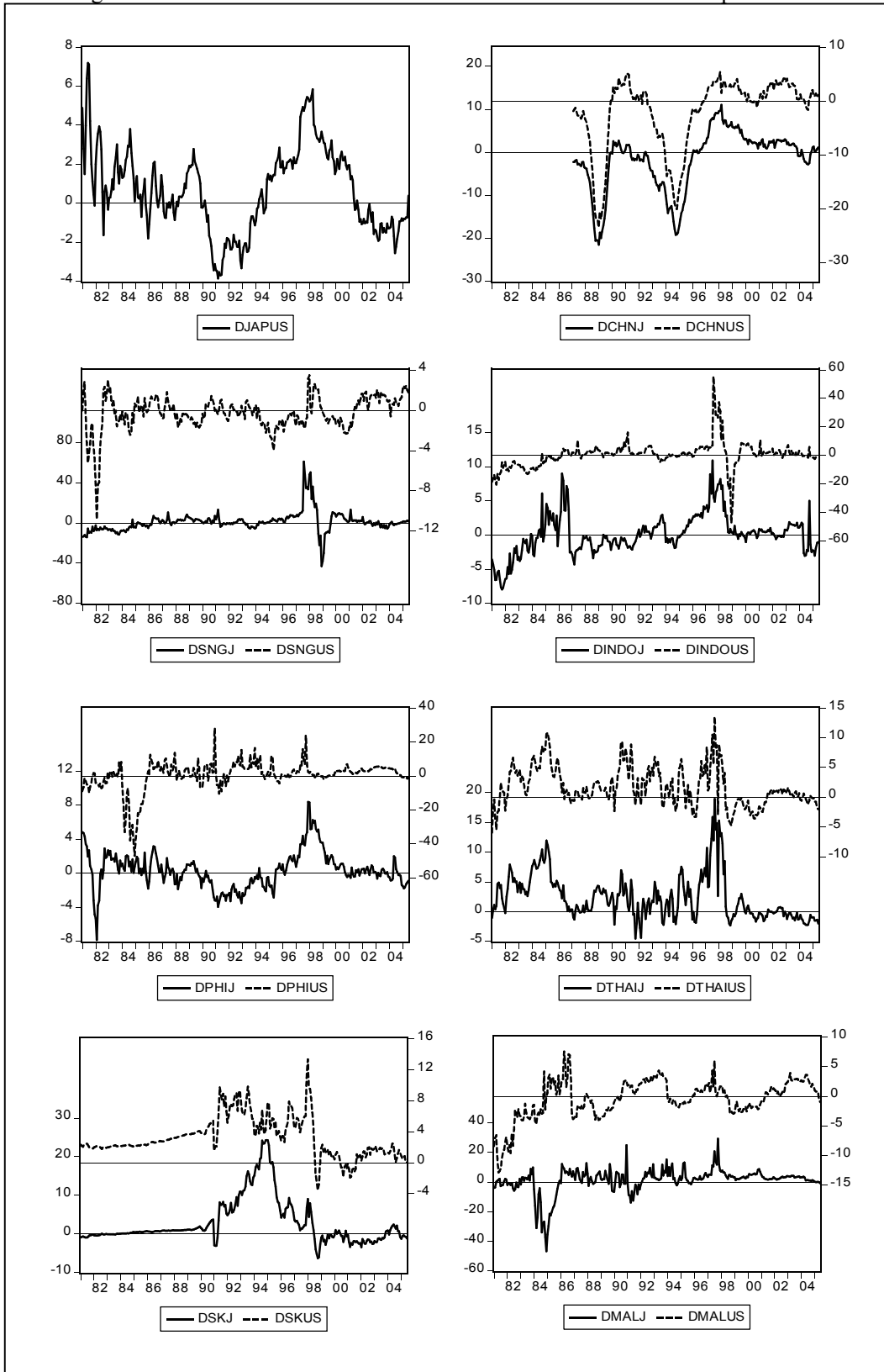
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Figure 1: Selected East Asians' Real Interest Differentials vis-à-vis Japan and US

Note: Japanese-based RIDs are referred to the right axes and US-based RIDs are referred to the left axes.

Table 1: Panel Unit Root Estimation on RID Series

	Panel Unit Root Tests			
	Breitung	IPS-W	MWC-ADF	MWC-PP
ASIA-US				
A: 1976M1–2004M4	-3.67 ***	-5.58 ***	66.84 ***	130.22 ***
B: 1976M1–1986M12	-1.54 *	-1.86 **	23.45 *	39.30 ***
C: 1987M1–1997M6	-3.70 ***	-2.59 ***	34.15 ***	78.90 ***
D: 1987M1–2004M4	-3.75 ***	-4.29 ***	50.88 ***	121.83 ***
E: 1997M7–2004M4	-1.53 *	-2.30 **	29.69 **	42.33 ***
ASIA-JAPAN				
A: 1976M1–2004M4	-3.04 ***	-4.73 ***	54.34 ***	101.43 ***
B: 1976M1–1986M12	-1.59 *	-1.80 **	19.44 *	26.69 ***
C: 1987M1–1997M6	-3.69 ***	-4.86 ***	63.24 ***	59.43 ***
D: 1987M1–2004M4	-5.09 ***	-6.60 ***	90.05 ***	96.95 ***
E: 1997M7–2004M4	-1.72 **	-1.85 **	22.38 *	28.15 **

Notes:

A- Full Sample

B- Pre-liberalization

C- Post-liberalization without Crisis

D- Post-liberalization with Crisis

E- Post-crisis

Asterisks *, ** and *** denote the significant level of 10%, 5% and 1% respectively. Breitung (2000) test is designed for homogenous panels which share a common unit root process whereas Im, Pesaran and Shin (IPS, 2003), Madala and Wu (1999) and Choi (2001) advocate unit root tests corrected for heterogeneous panels. While the Breitung and IPS-W tests assume asymptotic normality, the ADF-typed and PP-typed Fisher tests statistics proposed by Madala, Wu and Choi (MWC) are computed using an asymptotic Chi-square distribution. All tests employ the null hypothesis of a unit root in the series. The choices of lag length are based on the Modified Schwarz Information Criteria.

Table 2.1: SURADF Estimation on ASIA-US RID Series

	SURADF Test	Critical Values		
	Statistics	1%	5%	10%
A: Full Sample (1976M1–2004M4)				
Japan	-8.361***	-3.792	-3.198	-2.873
South Korea	-4.493***	-3.795	-3.216	-2.914
Indonesia	-9.307***	-3.562	-2.981	-2.695
Malaysia	-9.572***	-3.894	-3.290	-2.979
Philippines	-8.006***	-3.614	-3.011	-2.691
Singapore	-9.602***	-3.757	-3.145	-2.863
Thailand	-7.780***	-3.613	-2.981	-2.682
B: Pre-liberalization (1976M1–1986M12)				
Japan	-6.435***	-4.065	-3.432	-3.092
South Korea	-3.809**	-4.021	-3.403	-3.074
Indonesia	-7.027***	-4.129	-3.510	-3.170
Malaysia	-8.133***	-4.226	-3.604	-3.261
Philippines	-6.176***	-3.746	-3.105	-2.795
Singapore	-6.042***	-3.986	-3.400	-3.093
Thailand	-6.665***	-4.017	-3.396	-3.053
C: Post-liberalization without Crisis (1987M1–1997M6)				
China	-2.568	-3.819	-3.228	-2.901
Japan	-7.341***	-3.820	-3.158	-2.834
South Korea	-4.883***	-3.784	-3.128	-2.811
Indonesia	-5.647***	-3.766	-3.131	-2.812
Malaysia	-5.345***	-3.812	-3.171	-2.871
Philippines	-5.287***	-3.749	-3.106	-2.795
Singapore	-6.123***	-3.784	-3.110	-2.797
Thailand	-5.552***	-3.771	-3.092	-2.758
D: Post-liberalization with Crisis (1987M1–2004M4)				
China	-2.977**	-3.434	-2.872	-2.584
Japan	-7.332***	-3.431	-2.884	-2.569
South Korea	-5.008***	-3.443	-2.869	-2.565
Indonesia	-6.478***	-3.449	-2.888	-2.565
Malaysia	-7.322***	-3.417	-2.848	-2.564
Philippines	-5.713***	-3.453	-2.884	-2.568
Singapore	-7.943***	-3.465	-2.860	-2.566
Thailand	-7.261***	-3.441	-2.851	-2.556
E: Post-crisis (1997M7–2004M4)				
China	-3.365*	-4.064	-3.420	-3.075
Japan	-5.325***	-4.102	-3.402	-3.045
South Korea	-4.668***	-4.164	-3.453	-3.107
Indonesia	-5.933***	-4.154	-3.467	-3.116
Malaysia	-5.458***	-4.310	-3.564	-3.231
Philippines	-5.968***	-4.044	-3.295	-2.968
Singapore	-5.352***	-4.239	-3.542	-3.194
Thailand	-5.973***	-4.137	-3.446	-3.086

Notes: Critical values are simulated with 10000 replications for each sample series. Asterisks (*), (**) and (***) denote statistical significant at 10%, 5% and 1% level respectively. All estimations are conducted in RATS 5.02 using the algorithm kindly provided by Myles Wallace.

Table 2.2: SURADF Estimation on Asia-Japan RID Series

	SURADF Test	Critical Values		
	Statistics	1%	5%	10%
A: Full Sample (1976M1–2004M4)				
South Korea	-7.034***	-3.431	-2.846	-2.566
Indonesia	-9.195***	-3.441	-2.844	-2.565
Malaysia	-9.478***	-3.407	-2.854	-2.569
Philippines	-8.051***	-3.403	-2.868	-2.565
Singapore	-9.265***	-3.486	-2.861	-2.579
Thailand	-9.184***	-3.419	-2.853	-2.555
B: Pre-liberalization (1976M1–1986M12)				
South Korea	-4.143***	-3.913	-3.311	-2.984
Indonesia	-6.243***	-3.943	-3.332	-2.996
Malaysia	-5.872***	-3.852	-3.281	-2.961
Philippines	-4.737***	-3.746	-3.056	-2.726
Singapore	-7.115***	-3.748	-3.174	-2.842
Thailand	-6.211***	-3.739	-3.175	-2.860
C: Post-liberalization without Crisis (1987M1–1997M6)				
China	-1.992	-3.515	-2.931	-2.619
South Korea	-5.668***	-3.490	-2.880	-2.570
Indonesia	-5.388***	-3.484	-2.876	-2.580
Malaysia	-5.141***	-3.482	-2.846	-2.552
Philippines	-5.542***	-3.462	-2.862	-2.552
Singapore	-6.889***	-3.535	-2.918	-2.587
Thailand	-5.382***	-3.489	-2.897	-2.579
D: Post-liberalization with Crisis (1987M1–2004M4)				
China	-2.403	-3.451	-2.876	-2.579
South Korea	-4.574***	-3.454	-2.879	-2.574
Indonesia	-6.485***	-3.476	-2.886	-2.588
Malaysia	-6.616***	-3.447	-2.885	-2.586
Philippines	-5.752***	-3.449	-2.867	-2.565
Singapore	-7.513***	-3.406	-2.859	-2.557
Thailand	-6.506***	-3.490	-2.899	-2.573
E: Post-crisis (1997M7–2004M4)				
China	-2.489	-4.010	-3.332	-2.983
South Korea	-3.453**	-4.074	-3.423	-3.074
Indonesia	-4.317***	-3.944	-3.364	-3.024
Malaysia	-4.584***	-4.195	-3.601	-3.242
Philippines	-4.904***	-4.014	-3.351	-2.993
Singapore	-6.389***	-4.122	-3.358	-3.007
Thailand	-5.728***	-4.097	-3.443	-3.102

Note: See Table 2.1 for details.

Table 3: Half-Lives and Confidence Intervals

	ASIA-JAP			ASIA-US		
	β	Half-life	CI at 95%	β	Half-life	CI at 95%
A: Full Sample (1976M1–2004M4)						
Japan	-	-	-	-0.0206	34.07	[0, 70.38]
South Korea	-0.0214	32.74	[1.73, 63.75]	-0.0284	24.75	[9.18, 40.32]
Indonesia	-0.0378	18.67	[2.55, 34.79]	-0.0778	9.25	[0.46, 18.04]
Malaysia	-0.0626	11.41	[3.18, 19.64]	-0.0453	15.63	[2.18, 29.08]
Philippine	-0.0563	12.66	[3.12, 22.20]	-0.0256	27.47	[1.97, 52.98]
Singapore	-0.0282	24.90	[2.35, 47.46]	-0.0326	21.60	[1.28, 41.91]
Thailand	-0.0412	17.18	[3.20, 31.16]	-0.0274	25.65	[0, 52.29]
B: Pre-liberalization (1976M1–1986M12)						
Japan	-	-	-	-0.0175	39.86	[0, 100.06]
South Korea	-0.0490	14.50	[1.82, 27.19]	-0.0218	32.21	[0, 86.92]
Indonesia	-0.0438	16.15	[0, 39.13]	-0.0434	16.31	[3.18, 29.45]
Malaysia	-0.0436	16.23	[0, 37.00]	-0.0366	19.27	[0, 46.47]
Philippine	-0.0208	33.63	[0, 90.21]	-0.0163	42.88	[0, 132.26]
Singapore	-0.0377	18.73	[0, 51.21]	-0.0436	16.23	[0, 35.24]
Thailand	-0.0302	23.32	[0, 57.23]	-0.0253	27.71	[0, 74.52]
C: Post-liberalization without Crisis (1987M1–1997M6)						
China	-0.0298	23.59	[2.71, 44.46]	-0.0313	22.51	[5.06, 39.97]
Japan	-	-	-	-0.0227	30.87	[0, 81.92]
South Korea	-0.0726	9.89	[1.24, 18.53]	-0.0840	8.60	[1.18, 16.02]
Indonesia	-0.0447	15.84	[0, 31.84]	-0.1429	5.19	[2.09, 8.29]
Malaysia	-0.0999	7.28	[0.64, 13.92]	-0.1250	5.89	[0.68, 11.09]
Philippine	-0.0602	11.85	[0, 26.60]	-0.0550	12.94	[0, 27.24]
Singapore	-0.0526	13.53	[0, 28.60]	-0.1114	6.57	[2.48, 10.65]
Thailand	-0.1297	5.68	[0.59, 10.78]	-0.1602	4.66	[1.49, 7.84]
D: Post-liberalization with Crisis (1987M1–2004M4)						
China	-0.0232	30.17	[6.23, 54.11]	-0.0197	35.57	[0, 72.24]
Japan	-	-	-	-0.0519	13.71	[0, 28.65]
South Korea	-0.0656	10.90	[3.09, 18.72]	-0.0558	12.76	[2.63, 22.89]
Indonesia	-0.1324	5.57	[2.52, 8.63]	-0.1535	4.85	[2.40, 7.31]
Malaysia	-0.1147	6.38	[2.21, 10.56]	-0.1556	4.79	[2.14, 7.44]
Philippine	-0.0591	12.07	[0, 26.11]	-0.0458	15.46	[0, 33.18]
Singapore	-0.0721	9.96	[1.32, 18.59]	-0.1109	6.59	[0, 13.73]
Thailand	-0.3115	2.56	[1.48, 3.63]	-0.3542	2.29	[1.23, 3.34]
E: Post-crisis (1997M6–2004M4)						
China	-0.0387	18.26	[0, 44.32]	-0.1076	6.78	[0.13, 13.43]
Japan	-	-	-	-0.1619	4.62	[1.29, 7.94]
South Korea	-0.0646	11.07	[0.39, 21.75]	-0.1042	7.00	[2.07, 11.92]
Indonesia	-0.1912	3.96	[1.86, 6.06]	-0.1681	4.46	[1.49, 7.44]
Malaysia	-0.2092	3.65	[1.68, 5.62]	-0.1596	4.68	[1.93, 7.43]
Philippine	-0.2366	3.26	[0, 33.39]	-0.0600	11.89	[0, 28.77]
Singapore	-0.1859	4.06	[0.73, 7.40]	-0.2262	3.40	[0.76, 6.04]
Thailand	-0.3762	2.17	[0, 15.49]	-0.3720	2.19	[0.87, 3.52]