

# **Integration between ASEAN-5 and the World: A Structural Assessment of International Parity Conditions**

Chan Tze Haw\* and Hooy Chee Wooi

School of Management, Universiti Sains Malaysia 11800 USM, Penang, Malaysia

Tel: 604-653-5284; Email: [thchan@usm.my](mailto:thchan@usm.my)

Tel: 604-653-2897; Email: [cwhooy@usm.my](mailto:cwhooy@usm.my)

\*Corresponding author

## **Abstract**

This study constructs a structural system that allows for possible interactions between the goods and capital markets for ASEAN5 vis-à-vis China, Japan and the US over 1996: Jan - 2012: Feb. Our model jointly assesses the Purchasing Power (PPP) and Uncovered Interest Parity (UIP) conditions in the presence of  $I(1)$  exogenous variables. Advanced econometric procedures including the structural VARX, over-identifying restrictions, bootstrapping, and persistent profiles analysis are utilized. For ASEAN5-US, the finding upholds support for long run PPP and UIP, when exchange rate regime and structural break of subprime crisis are taken into accounts, but the results are rather mixed for ASEAN5-Japan. For ASEAN5-China, the undervalued exchange rate regime may exert some drawback on the PPP theorem. In addition, the finding reveals that exchange rate plays a significant role in the price transmission mechanism and the price channel will affect the validity of UIP. The faster pace of adjustment towards price instead of interest rate equilibrium implies the nonappearance of sequencing problem in economic integration. On the whole, while the US link persists, the progression of economic integration has gradually shifted towards the China-based partnership. This could be attributed to the financial liberalization process among ASEAN economies, the Chinese open trade policy and her regional commitment to the ASEAN+3+2+1 cooperation. Our model can also be referred as an early warning system for ASEAN-5 economic defense against global shocks.

Keywords: PPP, UIP, ASEAN5, Regional Integration, Structural VARX

JEL Classification: C12; C23; F31; F40

## 1.0 Introduction

Open economy macroeconomics issues are now very much at the core of major changes throughout the world. Institutional developments towards worldwide integration have taken place so rapidly that one could not have even imagined two decades ago. Deregulation, globalization and technology advancement have already transformed the global trade and capital marketplace, and will continue to do so. On one hand, proponents often stress that economic integration promotes competition and enhances trade expansion, improves risk sharing and increases the efficiency of capital allocation that result in more productive investments and hence better economic growth. Opponents, on the contrary, argue that greater integration resulted in volatile market prices and contagion effects that entail with greater transmission of shocks across countries or region<sup>1</sup>.

Being in one of the fast-growing regions, most ASEAN economies have pursued the trend of wide-scale financial deregulation<sup>2</sup> and exchange rate liberalization since the 1970s, in order to maximize economic efficiency and hence digesting the global challenges. Yet, the 1997 financial turmoil, in conjunction with the 2008 Subprime crisis, has revealed the need of ASEAN and regional partners (especially the US, China and Japan) to formulate new development paths towards sustainable growth. Inspired by the institution of the European Union – at one point, growing efforts have been made to promote regional economic integration, monetary collaboration and trading blocs among the Asia Pacific region. On November 20, 2007 during the 13<sup>th</sup> Summit in Singapore, ASEAN Leaders signed the ASEAN Charter and the ASEAN Economic Community (AEC) Blueprint for further cooperation within the ASEAN+3+2+1 framework<sup>3</sup>. The twentieth ASEAN summit on April, 2012 further signifies

---

<sup>1</sup> In portfolio analysis, stock market integration leads to different implications. Habitually, changes in the covariance structure of cross-country stock returns affect asset prices and the return volatility of investment portfolios. Increase in these covariances due to a highly integrated world stock market would imply the similar pricing of securities returns which resulted in fewer domestic risks that can be diversified internationally and benefits for cross-border diversification eventually diminishes (Stulz, 1995; Akdogan, 1996; Karolyi and Stulz, 1996). Likewise, in the corporate finance view, high stock market integration implies less opportunity to acquire capital at lower cost across borders, which further discourages the activities of foreign listings (Hooy and Goh, 2008).

<sup>2</sup> Typically such deregulation embraces the abandonment of exchange controls, the abolition of interest rate ceilings, the liberalization of the scope of business activity (e.g. liberalization of segmentation barriers and restriction on geographical areas of operation) and finally, the liberalization of financial markets. ASEAN economies have pursued financial liberalization at similar stages but different timings. Singapore (1975) and Malaysia (1978) were among the first to liberalize their interest rate controls. In Indonesia and the Philippines, interest rates were fully deregulated in the early 1980s. As for Thailand, the interest rate ceiling was not abolished until the late 1980s.

<sup>3</sup> Members included the ASEAN 10 + Japan, China, South Korea + Australia, New Zealand + India.

the theme of ‘ASEAN: One Community, One Destiny’ which aims towards the building of an ASEAN Community by 2015<sup>4</sup>. The episode, to some extent, has led to the resurgence of interest in justifying regionalism versus multilateralism<sup>5</sup>.

The dynamics and increasing macroeconomic interdependence among the ASEAN and neighboring world giants (the US, China and Japan) has resulted far-reaching implications for the regional economy. If we refer to [Figure 1](#), China has emerged as the major trading partner for ASEAN in 2010, overtaking Japan and the US. But in terms of foreign direct investments, Japan remains as major contributor. At the same time, ASEAN members have increased the trading and investment ties among themselves. In the expansion of deeper engagement, policy makers have to appraise both the recent global changes and direct impact on domestic stabilization policy. For instance, the US spillover effect and financial reform, the rise of China as a regional and global force and, the Japan’s lost decade but long-term investment and aids in the ASEAN region. In addition, recent proposal of Trans-Pacific Partnership (TPP) negotiations on regional trade arrangements has elevated further debates among scholars ([Armstrong, 2011](#)), since the 2011 Honolulu APEC meeting.

**[Insert Figure 1]**

In the past decade, major disputes rose among regional dialogs and conventions have focused on three issues. First, the sequencing of economic integration ([Pomfret, 2005](#); [Eichengreen, 2006](#); [Chan, 2012](#)); second, the ‘decoupling’ of emerging economies for global market; and, third, the dominant position of external power in regional market. The first issue was highly concerned due to the series of global crises in the 1990s. Literature cautions that it can be counterproductive to open the international accounts before eliminating domestic macroeconomic imbalances, and the main effect will then be to provide avenues for capital flight. Such argument is supported by [Eichengreen, et al \(2003\)](#), among others – who revealed that capital account liberalization initiated before the current account openness can have strongly distortionary effects, and by [Wyplosz \(2004, 2006\)](#) – who observed that Asia countries envision monetary cooperation while having failed to develop a framework for common trade agreements.

---

<sup>4</sup> ASEAN charter comprises of three Community Blueprints, namely, the ASEAN Political-Security Community (APSC), the ASEAN Economic Community (AEC) and the ASEAN Socio-Cultural Community (ASCC).

<sup>5</sup> The usual debates concern if the RTAs are truly beneficial to the region’s economies and, whether the regionalism has been a building bloc or stumbling bloc to Multilateral Trading Arrangements (MTAs) required by the WTO.

The second issue questions the defend mechanism among emerging economies (e.g. ASEAN) against external shocks and global uncertainties. Some regional economists argue that the increased regional integration may help the region ‘decouple’ from the global financial turmoil (e.g. the Subprime crisis) and in better position to sustain fast growth, in consideration of the huge demand market and production base in China, Japan and India.

The third issue then relates to the degree of integration and dominant position of external power in the region. A convenient way is to examine the international parity conditions, e.g. purchasing power parity (PPP) and uncovered interest rate parity (UIP). Both theories are popular in the assessment of goods and capital market integration (Cheung, *et al.*, 2003; Cavoli, *et al.*, 2004; Kargbo, 2009). Nevertheless, the respective empirical evidence of PPP and UIP, which has hitherto been abundant, is still inconclusive<sup>6</sup>. Other than the methodological concerns, a rather mixed and puzzling evidence that have accumulated on time series properties of UIP and PPP could be due to the failure account for the interdependence of adjustments in the international asset and commodity markets (Juselius, 1995; Özmen and Gökcan, 2004).

To tackle the mentioned issues, a comprehensive investigation of the fundamental blocks of international finance theories is necessary. As theoretical propositions, PPP and UIP provide clues of how price and monetary effects are transmitted globally<sup>7</sup>. This paper hereby constructs the joint assessment of PPP and UIP for ASEAN-5 vis-à-vis the US, Japan and China within a system. The study period spans from 1996: Jan to 2012: Feb, where most countries being studied were experiencing trade expansion and economic liberalization. The exchange rate regime and financial crises are also taken into accounts. More important,

---

<sup>6</sup> The Asian studies are generally supportive of capital market integration, but finding of the leading role of the US and Japan in the Asia-Pacific region was inconclusive. Chinn and Frankel (1995), for instance, found that although Indonesia and Thailand were integrated with Japan, real interest parity (RIP) holds only for US-Singapore, US-Taiwan, and Japan-Taiwan. Phylaktis (1997, 1999) then found that Asia-Pacific capital markets are considerably integrated but the leading roles of Japan and the US are contradictory. In a similar work, Baharumshah and Chan (2007) confirmed the high degree of regional capital mobility and substantial financial integration among the East Asian economies, supporting the US leading role instead of Japan. Among China-based studies, Cheung *et al.* (2003) examined three parity conditions consecutively and concluded that parities hold among China-Taiwan-Hong Kong. Meanwhile, Cavoli *et al.* (2004) examined the parity conditions for ASEAN5, East Asia and China but failed to find clear indication of intensified regional financial integration.

<sup>7</sup> By implication, PPP acts as a backward adjustment mechanism in the goods market whereas the UIP can be thought of an arbitrage relationship that function as forward-looking market clearing mechanism in capital market (Juselius, 1995).

unlike previous works that study the PPP or UIP separately, we assess the interaction and transmission effects of prices, interest rates and exchange rates within a structural system, as inspired by Juselius (1995), Özmen and Gökcan (2004)<sup>8</sup>. Such approach allows for the possible interactions between goods and capital market, which will potentially constitute the foundation of an early warning system particularly for ASEAN5 against external shocks. In addition, we employ the estimation procedures advanced by Pesaran et al (2000) and Assenmacher-Wesche and Pesaran (2009). We construct a cointegrating VARX with two long-run equilibrium relationships (PPP and UIP) in the presence of  $I(1)$  weak exogenous or long-run forcing variables (the US, China and Japan variables)<sup>9</sup>. To further assess the effect of system-wide shocks on the cointegrating relations, we apply the Persistence Profile analysis developed by Pesaran and Shin (1996). The methodology builds on transparent and theoretically coherent foundation that offers a practical approach to relationships suggested by economic theory and works ideally for small and open economies (Pesaran et al., 2000).

Our study is organized in the following manner. Section 2 shows the theoretical representation of PPP and UIP that forms the basis of our empirical model. This is then followed by the estimation procedures of VARX and VECMX and data description. Estimation results are discussed in section 3. Finally, in section 4, conclusion and policy implications are drawn.

## 2.0 Theory and Methodology

PPP and UIP are both building blocks and equilibrium theories of exchange rate. PPP implies internationally produced goods as perfect substitutes for domestic goods, whereas UIP assumes zero risk premium so that financial assets are substitutes in cross-border capital markets. If we let  $EX_t$  be the ASEAN log spot exchange rate against the USD, Japanese yen

---

<sup>8</sup> Johansen and Juselius (1992) and Juselius (1995) argued that previous studies on international parity conditions may have overlooked the links between goods and asset markets, and partly due to the lack of a precise specification of the sampling distribution of the data. They have shown supportive evidence for the PPP and UIP relations in the UK case using a systemic multivariate cointegration framework. Similar analyses have been performed on different series of developed nations and some non-identical but similar conclusions were observed (see *inter alia*, Sjoo, 1995; Caporale, et al., 1995; Özmen and Gökcan, 2004).

<sup>9</sup> Our study period covers 16 years with 194 monthly observations, which is considered short for international parities study. Given this, we use the nonparametric bootstrap method, an alternative to the large sample data tests based on asymptotic theory. Bootstrap's ability to provide asymptotic refinements often leads to a reduction of size distortions in finite sample bias and it generally yields consistent estimators and test statistics (Mantalos and Shukur, 1998; Chang et al, 2006). This method is employed to test the number of VARX cointegrating ranks and, to estimate the log-likelihood ratio (LR) critical values of the restriction tests. Bootstrapping is also used to estimate the confidence intervals of Persistent Profile.

or Chinese yuan (Renmimbi), while  $P_t$  and  $P_t^*$  be the log domestic (ASEAN) and foreign (US, China, or Japan) price levels respectively, the PPP condition is then defined as

$$P_t = P_t^* + EX_t \quad (1)$$

while UIP condition states that the interest rate differential between two countries equals to the expected change in the spot exchange rates, such that

$$R_t - R_t^* = E_t(EX_{t+1}) - EX_t \quad (2)$$

with  $R_t$  and  $R_t^*$  being the respective nominal interest rates denominated in domestic and foreign currencies compounded over the time period  $t - (t - 1)$ , and  $E_t(\cdot)$  denotes the expected value formed at time  $t$ . When the forecast horizon grows, it seems reasonable to expect deviations from long-run PPP to be increasingly important in the formation of expectations, thereby providing a link between the goods and the capital markets. More specifically, if the expected exchange rate is given by

$$E_t(EX_{t+1}) = P_t - P_t^* \quad (3)$$

a relation combining the PPP and the UIP conditions can be derived by inserting (3) into (2):

$$P_t - P_t^* - EX_t = R_t - R_t^* \quad (4)$$

(1) - (4) are simple economic hypotheses which define ‘long-run’ equilibrium in the capital and goods markets in a very simplified world. For empirical analysis purpose, Eq. (4) will be adopted in our VARX and VECMX estimations, which are specially designed for small and open economies such as ASEAN.

## 2.1 The VARX Estimation

[Pesaran \*et al.\* \(2000\)](#) modified and generalized the approach to the problem of estimation and hypothesis testing in the context of the augmented vector error correction model. [Garratt \*et al.\* \(2003, 2006\)](#) extended the idea and developed the VARX along the same lines. They distinguish between an  $m_y \times 1$  vector of endogenous variables  $y_t$  and an  $m_x \times 1$  vector of exogenous  $I(1)$  variables  $x_t$  among the core variables in  $z_t = (y_t', x_t')$  with  $m = m_y + m_x$ . In our case, the two exogenous foreign variables as ‘long-run forcing’ variables are the respective US, China and Japan prices and interest rates. ‘Forcing’ variable means that changes in  $P_t^*$  and  $R_t^*$  have a direct influence on, but may not be affected by ASEAN variables in the model. This ends up with a conditional vector error correction model (VECMX) with five variables

and two structural cointegration relations, in which the two long-run relations ( $r = 2$ ) correspond to PPP and UIP respectively.

Since our study covers the period of Asia financial crisis, fixed exchange regime and the subprime crisis, structural break(s) are necessarily included in the model. Depending on the break dates detected by [Zivots-Andrew \(1992\)](#) test, we impose the shift dummy variable ( $D_{crisis,t}$ ) and the impulse dummy variable ( $\Delta D_{crisis,t}$ ), where  $\Delta D_{crisis,t} = D_{crisis,t} - D_{crisis,t-1}$ . The former captures the shift in the long-run relations, whereas the latter applies for the short-run dynamic models. The VECMX is then given by

$$\Delta y_t = -\Pi_y z_{t-1} + \Lambda \Delta x_t + \sum_{i=1}^{p-1} \Psi_i z_{t-i} + c_0 + c_1 t + c_2 D_{crisis,t} + v_t \quad (5)$$

$$\Delta x_t = \sum_{i=1}^{p-1} \Gamma_{xi} \Delta z_{t-i} + c_{x0} + \mu_t \quad (6)$$

with the VARX cointegrating model including a trend term:

$$z_t = (P_t, R_t, EX_t, P_t^*, R_t^*)' \quad (7)$$

There are  $r=2$  cointegrating relations among the  $5 \times 1$  vector of variables  $z_t$  in the conditional model (5) contains three endogenous (ASEAN) variables,  $y_t = \{P_t, R_t, EX_t\}$  and marginal model (6) with two weakly exogenous foreign (US, China, Japan) variables,  $x_t = \{P_t^*, R_t^*\}$ .  $\Pi_y = \alpha_y \beta'$ ,  $\alpha_y$  is an  $m_y \times r$  matrix of error correction coefficients and  $\beta'$  is an  $m \times r$  matrix of long-run coefficients and  $\Psi_i$  and  $\Lambda$  are the short-run parameters,  $t$  is time trend,  $c_0$  is the intercept, and  $p$  is the order of VECMX. In the marginal model,  $\Gamma_{xi}$  are the short-run parameters, and  $c_{x0}$  is the intercept. It is assumed that  $u_t$  and  $v_t$  are serially uncorrelated and normally distributed. Notice that we need to restrict the trend coefficients in equation (5) in order to avoid the quadratic trends and the cumulative effects of  $D_{crisis,t}$  in the level solution ([Pesaran et al., 2000](#)), as follow:

$$c_1 = \Pi_y d_1, \quad c_2 = \Pi_y d_2 \quad (8)$$

where  $c_1$  and  $c_2$  are an arbitrary  $m_y \times 1$  vector of fixed constants. Note that  $d_1$  and  $d_2$  are unrestricted if  $\Pi_y$  is full rank; in that case  $d_1 = \Pi_y^{-1} c_1$  and  $d_2 = \Pi_y^{-1} c_2$ . However, if  $\Pi_y$  is rank deficient,  $d_1$  and  $d_2$  cannot be fully identified from  $c_1$  and  $c_2$  but can be estimated from the reduced form coefficients. In this case, the reduced form trend coefficients are restricted. For PPP condition in (1) and UIP condition in (2) to have an empirical meaning, economic theory predicts that:

$$(P_t - P_t^* - EX_t) \sim I(0) \quad (9)$$

and  $(R_t - R_t^*) \sim I(0) \quad (10)$

To verify PPP and IRP, these structural long-run relations require the following (over)-identification restrictions on the cointegration matrix  $\beta$  ( $\Pi_y = \alpha_y \beta'$ ) in Eq (5) and (7).

$$\beta' = \begin{pmatrix} 1 & 0 & -1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & -1 & 0 & 0 & 0 \end{pmatrix} \quad (11)$$

where  $\beta_1(PPP) = \beta_{11} \beta_{12} \beta_{13} \beta_{14} \beta_{15} \beta_{16} \beta_{17} \beta_{18}$

$\beta_2(UIP) = \beta_{21} \beta_{22} \beta_{23} \beta_{24} \beta_{25} \beta_{26} \beta_{27} \beta_{28}$

Due to space constraint, this paper will not report the corresponding VECMX models. Instead, we will focus on the long run relationships. Besides, the comprehensive restriction tests and persistent profile analysis have provided us the sufficient clues about the research outcome.

## 2.2 Data Description

Our analyses are based on monthly observations, spanning from 1996: Jan to 2012: Feb, covering 16 years with 194 monthly observations. The study period and variables used are dictated by data availability and the liberalization process of our sample countries, particularly China. We follow Cheung, et al (2003) to use the short term 3-month interbank rates in analyses, because the long term government bond rates are unavailable for Indonesia and China. According to Cheung, et al (2003) and Xie (2002), the interbank market in China was substantially controlled before the establishment of a unified national interbank market in January 1996. In other words, extending the interest rate series backward would not yield more information relevant to assessing financial integration between ASEAN5-China. However, the bond results without China and Indonesia, though not reported, are available upon request from the authors. The bilateral exchange rates of ASEAN against USD, Renmimbi and yuan are also used in the analyses. An increase of RM/Renmimbi, for example, implies ringgit depreciation against Chinese yuan, and vice versa. As for price variables, the ASEAN5 and Chinese consumer prices that adjusted for seasonal effects are recompiled and used. All data are sourced from DataStream and cross-checked with the International Financial Statistics, IMF.

### 3. Empirical Discussion

The preliminary examination of the data properties is conducted using the unit root test of [Zivots-Andrew \(1992\)](#). The data are overwhelmingly integrated of  $I(1)$  where unit roots are rejected at first difference. This test allows for endogenous structural break, and, for most cases ( $P_t, R_t, EX_t$ ), the break dates fall on the Asian financial crisis (1997/98) and subprime crisis (2008) periods.<sup>10</sup> We thereby impose two dummy variables on the following long run VARX models.

#### 3.1 Long-run Relationship and Restriction Tests

Before proceeding to the cointegration test of long-run relationship, we have to determine the lag orders of endogenous and exogenous variable outlined in [Eq \(7\)](#). For this purpose, the Akaike Information Criterion (AIC) is applied to the underlying unrestricted VARX model. For most cases, AIC has selected the lag orders of 2 or 3 for both conditional and marginal models ( $k=2, 2; k=3, 2$ ). Next, we need to determine the number of cointegrating relations given by  $r = \text{rank}$ . The cointegration model contains three domestic variables –  $P_t, R_t, EX_t$ , and two foreign variables –  $P_t^*, R_t^*$ . Following [Pesaran, et al. \(2000\)](#), the modified [Johansen-Juselius \(1992\)](#) cointegration test is conducted using  $\lambda$ -max for model with weakly exogenous regressors. The test results are reported in [Table 1a-1e](#). It appears that  $\lambda$ -max test statistics indicate the presence of two cointegrating relations ( $r=2$ ) for 22 out of 30 cases among the combination of ASEAN5 economies vis-à-vis the US, China and Japan at 5%-10% significant levels based on the bootstrapped critical values by 1000 replications. Such result is in line with the theoretical expectation that PPP and UIP may jointly hold. The PPP relation captures the long run equilibrium of domestic (ASEAN5) and foreign (US, China, Japan) prices measured in common currency due to bilateral trading. The UIP relation then captures the equilibrium outcome between ASEAN5 and the US, China and Japan interest rates due to the effect of the arbitrage process between them in regional capital market.

**[Insert Table 1a-1e]**

In order to produce the long run estimate of the Malaysia-China parities model, we then impose exact-identifying / normalized restrictions ( $\beta_{11} = 1, \beta_{12} = 0; \beta_{21} = 0, \beta_{22} = 1$ ). In

---

<sup>10</sup> Results of unit root tests are not presented here but are available upon request.

Table 2a-2c, the exactly identified ML estimates of the two cointegrating vectors and their asymptotic standard errors are presented. For cointegrating vector one (CV1) that corresponds to PPP, exchange rate and foreign price are statistically significant and carry the expected negative sign, in 10 out of 15 cases. The supports are more evident for the ASEAN5-US and ASEAN-Japan. It indicates an established long run PPP relation that goods-market arbitrage will tend to move the US-based exchange rate (e.g. SG/USD) to equalize prices in the two countries. As for ASEAN-China, the undervalued exchange rate regime may have exerted some drawback on the PPP theorem.

**[Insert Table 2a-2c]**

Referring to the CV2 that correspond to UIP, foreign rates of interest are also significant and signed correctly (except the Philippines) in most cases, suggesting a potential UIP relationship for ASEAN-US, ASEAN-China and ASEAN-Japan. UIP states that the financial market (or, the capital account between two currency areas) will only be in equilibrium if, after adjusting for differential risks investors receiving the same rate of return (interest) in both markets. So, if the return on a Malaysia  $n$ -period interest is one percentage point higher than that on China rate, one would expect, on average, the yuan to appreciate by one percent over the next  $n$  periods. In addition, exchange rate and foreign prices also plays a significant role in the UIP relation. As for dummy variables, possible positive crisis effect is reported for PPP and negative crisis effect is reported for UIP. Both parity relations are positively affected by the exchange rate regime.

To further justify the PPP and UIP theorem, we proceed to re-estimate the cointegration relations with seven additional hypotheses using over-identifying restrictions, in addition to the exact-identifying restrictions ( $\beta_{11} = 1, \beta_{12} = 0; \beta_{21} = 0, \beta_{22} = 1$ ). Since LR tests ( $\chi^2$ ) could over-reject in small samples (Affandi, 2007; Garratt, *et al.*, 2006), the bootstrapped critical values based on 1,000 replications of the LR statistic are computed (see Table 3a-3e). Using the observed initial values of each variable, the estimated model, and a set of random innovations, an artificial data set is generated for each of the 1,000 replications under the assumption that the estimated version of the model is the true data-generating process.

First, we test the co-trending hypothesis— if the trend coefficients are zero in the two cointegrating relations ( $\beta_{16} = 0, \beta_{26} = 0$ ). Take Malaysia-China for example, the bootstrapped

critical values for the joint test are 11.32 (95%) and 9.15 (90%) respectively, while the LR statistic ( $\chi^2$ ) of over-identifying restriction is reported as  $\chi^2 = 13.27$  in [Table 3b](#), hypothesis (a). Hence, the restriction is rejected and the co-trending assumption does not hold. We proceed with the co-breaking hypotheses (D98, D08) and the restrictions also been rejected, suggesting that PPP and UIP relations are neither co-trending nor co-breaking in the long run. Next, [Eq. 9](#) suggests that exchange rate (EX), foreign price (P\*) and foreign interest (R\*) enter the long run PPP relations with ( $\beta_{11} = 1, \beta_{13} = -1, \beta_{14} = -1$ ). The reported  $\chi^2$  (9.18) is well below the bootstrapped critical values of 14.56 (95%) and 12.34 (90%). Hence, long run PPP holds. Nevertheless, UIP alone does hold ( $\chi^2 = 13.68^*$ ) when the absolute UIP restriction is imposed ( $\beta_{22} = 1, \beta_{25} = -1$ ). However, in the case when both PPP and UIP are jointly restricted ( $\beta_{13} = -1, \beta_{14} = -1, \beta_{15} = 0, \beta_{23} = 0, \beta_{24} = 0, \beta_{25} = -1$ ), hypothesis (f) cannot be rejected at 95% and 90% confidence levels. Overall, our empirical finding confirms the long run validity of joint PPP-UIP for Malaysia-China in the liberalization era. The empirical supports are obtained under the combined assumption that the cointegrating relations are not co-trending or co-breaking. This would imply that the currency pegging to the USD during 1998-2005 do provide supportive evidence for the long run relationships of PPP and UIP between Malaysia-China. Such finding is in line with [Johansen and Juselius \(1992\)](#), [Juselius \(1995\)](#) and [Juselius and MacDonald \(2004\)](#) that possible interactions between the goods and the capital markets should be allowed to establish the international parity relations.

**[Insert Table 3a-3c]**

The empirical evidence, as overall, coincides with the financial liberalization process and the gradual ruling out of restrictions on capital movements in ASEAN5, and China. In June 1996, the ceiling rates of inter-bank loans were removed and the interest rates have expanded twice in China within 1998-99 while state-owned financial institutions are allowed to be commercialized. 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 deposit. When China is taken as foreign variable, support for PPP and UIP would confirm the improved influence of China in the regional goods and financial markets since 1990s. Future fluctuations of the ASEAN5 economic variables can possibly be determined or forecasted, using the Chinese variables as part of the information set. In addition, the results do indicate the benefits of using bootstrapping method in finite sample, which yields consistent estimators and test statistics.

### 3.2 *Speed of Convergence and Shock Responses*

To this end, it is still incomplete to conclude how the price and monetary transmission mechanism worked. One should consider the Persistence Profile analysis and generalized Variance Decompositions. In addition to error correction modeling, a good way of measuring the speed of convergence of the cointegrating relations to equilibrium is to examine the dynamic responses of the endogenous variables to various types of shocks. This paper focuses on the effect of system-wide shocks on the cointegrating relations using the Persistence Profile analysis developed by [Pesaran and Shin \(1996\)](#). On impact, the Persistence Profile is normalized to take the value of unity, but the rate at which it tends toward zero provides information on the speed with which the equilibrium correction takes place in response to shocks. In addition to the point estimates, the 2.5% and 97.5% Confidence Bounds—which are generated by employing the nonparametric bootstrap method using 1,000 replications—are also illustrated as dotted lines in [Figure 2a-2e](#).

**[Insert Figure 2a-2e]**

The system-wide shock has affected all long-run relations significantly in the beginning, before the effects eventually disappear in the long run. Take Thailand-US for example, the half-life for PPP relation is about 6-7 months and the whole effect takes around 18 months to complete. The speed of convergence is generally faster than what was documented by [Rogoff \(1996\)](#) but in line with the recent Asian PPP studies (e.g. [Baharumshah, Aggarwal and Chan, 2007](#); [Baharumshah, Chan and Fountas, 2008](#); [Chan, Chong and Hooy, 2011](#)). As for Thailand-US' UIP relation, the half-life is shown at about 5-6 months and the adjustments completed within a year. The result seems to suggest that the convergence process (half-life) in the goods market (PPP) is slower than in financial market (UIP). But if we look at the other cases of ASEAN-US, ASEAN-China and ASEAN-China, the half-lives for PPP (8-12 months) are generally shorter than that of UIP (10-15 months). This would suggest, by and large, a faster convergence in the PPP relation rather than the UIP relation. The faster pace of adjustment (following system-wide shocks) towards price instead of interest equilibrium is in line with theoretical prediction. Except Thailand and the Philippines, the overall finding implies the nonappearance of sequencing problem in market integration for ASEAN5 vis-à-vis the US, China and Japan.

The varying speed of the adjustments to long run PPP and UIP across the countries reviewed may reflect ASEAN5's position in pursuing liberalization in goods and capital markets at multi-speed. The rapid growth in the regional capital flows has contributed to cross-border investments and optimal allocation of resources and, in some cases has facilitated the movement towards financial convergence and closer monetary cooperation. Conservative policies directed at increasing domestic savings to increase the rate of capital formation and hence productivity growth, are no longer the solely option in open economy macroeconomics. Instead, cross-border capital flows raise the chances of risk-sharing, portfolio diversification, and thus enable countries in the region to smooth out consumption.

Putting together, the greater integration among APEC and neighboring economic giants implies the better equalization of the marginal utility of home and foreign currencies, which in turn allows for better risk sharing. The integration process is attributed not only to the liberalization process among the ASEAN economies, but also to the Japan and Chinese trade policy and the regional commitment for the ASEAN+3+2+1 cooperation. This coincides with [Baharumshah et al \(2005\)](#) and [Chan and Baharumshah \(2012\)](#)'s finding of mean reversion behavior in the Japan- and China-based real interest differentials, which implies the increased influence of both nations in the regional capital market. Besides, the prospect of WTO membership is indeed instrumental for ASEAN to move towards liberalizing its external sectors and capital accounts. Moreover, the shorter half-lives reported over time encourage us to foresee a brighter feasibility towards regional financial deepening and regional currency arrangements. By taking cooperative action, ASEAN members 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 may decelerate the growth and development of domestic economies. After all, monetary and exchange rate policy cooperation would enable this region to exert an important influence upon the future evolution of the global trade and financial system.

#### **4. Conclusion and Policy Implication**

Inspired by the work of [Juselius \(1995\)](#), [Pesaran et al. \(2000\)](#), and [Juselius and MacDonald \(2004\)](#), this study constructs a structural VARX modeling system that jointly assess PPP and IRP for Malaysia-China, which concurrently allowing  $I(1)$  exogenous variables in the analysis. Few important findings emerged from our analysis. First, we find overwhelming

evidence of both PPP and UIP in the liberalization era (1996-2012), when exchange rate regime and structural breaks were taken into accounts. Second, deviations are shorter lived for PPP. The faster pace of adjustment towards price instead of the interest rate equilibrium implies that sequencing problem in market integration is not an issue. Such supportive empirics are established based on a series of advanced econometric procedures and theoretical formulation which consider possible interactions between the goods and the capital markets. In other words, the present economic linkage provides a platform to promote bilateral free trade agreement, and hence enhancing the closer economic collaboration and financial arrangements for sustainable development.

However, the parity conditions are not entirely supported for ASEAN5-China. A closer monitor of the Chinese prices and monetary changes is essential with the promotion of a more flexible exchange rate between ASEAN5-China. And, supply chain diversification would reduce the risk of imported inflation and financial turmoil. In such consideration, our model contributes as an early warning system for ASEAN5's economic defense against global shocks.

**Acknowledgements:** This paper is still preliminary. Do not quote any of the findings without the authors' permission. This research was supported by a research university grant from Universiti Sains Malaysia [Grant no: 1001/PMGT/816150]. The usual disclaimer applies.

### Reference

- Armstrong, S. (2011). China's participation in the Trans-Pacific Partnership. East Asia Forum. Available at <http://www.eastasiaforum.org/2011/12/11/china-participation-in-the-trans-pacific-partnership/#more-23335>
- Affandi, Y. (2007). A Small Monetary System for Indonesia: A Long Run Structural Approach. Unpublished Ph.D. Thesis, University of Cambridge.
- Alper, C. E., Ardic, O. P. and Fendoglu, S. (2009) The Economics of the uncovered interest parity condition for emerging markets. *Journal of Economic Surveys*, 23(1), 115-138.
- Assenmacher-Wesche, K. and Pesaran, M. H. (2009). A VECX\* model of the Swiss economy. *Economic Studies*, 2009-6, Swiss National Bank.
- Baharumshah, A.Z., Aggarwal, R. and Chan, T.-H. (2007) East Asian Real Exchange Rates and PPP: New Evidence from Panel-data Tests. *Global Economic Review*, 36(2), 103-119.

- Baharumshah, A.Z., Chan, T.-H. and Fountas, S. 2008. Re-examining purchasing power parity for East-Asian currencies: 1976-2002. *Applied Financial Economics*, 18(1), 75-85.
- Baharumshah, A.Z., Chan, T.-H., Masih, M. and Evan L. (2011). Financial Integration of East Asian Economies: Evidence from Real Interest Parity. *Applied Economics*, 43 (16), 1979-1990.
- Caporale, G. M., Kalyvitis, and S., Pittis, N. (1995) Testing for PPP and UIP in a FIML framework: some evidence for Germany and Japan, D.P. no. 30-95, Centre for Economic Forecasting, London Business School, London, UK
- Cavoli, T., R. Rajan, S. and Siregar, R. (2004) A survey of financial integration in East Asia: how far? How much further to go? CIES Discussion Paper No. 0401, University of Adelaide, Australia.
- Chan, T.-H. and C. W. Hooy (2011) Malaysia-China Trade and Macroeconomic Linkages in the Globalization Era: A VECX\* Modeling. Leverhulme Centre for Research on Globalisation and Economic Policy (GEP), *International Conference on Globalisation Trends and Cycles: The Asian Experience*. University of Nottingham. 12<sup>th</sup> -13<sup>th</sup> January.
- Chan, T.-H., Chong, L. L. and C. W. Hooy (2011) Japan-US Real Exchange Rate Behavior: Evidence from Linear and Non-linear Endogenous Break(s) Tests. *Asian Academy of Management Journal of Accounting and Finance* (forthcoming)
- Chang, Y., J. Y. Park, and K. Song (2006). Bootstrapping cointegrating regressions. *Journal of Econometrics*, 133, 703–739.
- Cheung, Y.-W., Chinn, M. D. and Fujii, E. (2003) China, Hong Kong and Taiwan: a quantitative assessment of real and financial integration. *China Economic Review*, 1(3), 281-303.
- Corsetti, G., Pesenti, P. and Roubini, N. (1999). What caused the Asian currency and financial crisis? *Japan and the World Economy*, 11(3), 305-373, October.
- Coudert, V. and Couharde, C. (2007) Real equilibrium exchange rate in China: is the renminbi undervalued? *Journal of Asian Economics*, 18(4), 568-594.
- Eichengreen, B. J. (2006) On the sequencing of regional integration: General considerations and an application to Asia, *The North American Journal of Economics and Finance*, 17(3), 329-334.
- Finke, M. and Rahn, J. (2005) Just how undervalued is the Chinese renminbi? *World Economy*, 28, 465-631.
- Garratt, A., K. Lee, M. H. Pesaran, and Y. Shin (2003) A Long Run Structural Macroeconometric Model of the UK. *Economic Journal*, 113, 412-455.

- Garratt, A., Lee, K., Pesaran, M. H. and Shin, Y. (2006) Global and national macroeconomic modelling: a long run structural approach. Oxford University Press, Oxford.
- Gregory, R. P. and Shelley, G. (2011) Purchasing power parity and the Chinese yuan, *Economics Bulletin*, 31(2), 1247-1255.
- Johansen, S. and Juselius, K. (1992) Testing Structural Hypotheses in a Multivariate Cointegration Analysis of the PPP and the UIP for UK. *Journal of Econometrics*, 53, 211 -244.
- Juselius, K. (1995). Do purchasing power parity and uncovered interest rate parity hold in the long run? An example of likelihood inference in a multivariate time-series model. *Journal of Econometrics*, 69, 211-240.
- Juselius, K. and MacDonald, R. (2004). International parity relationships between the USA and Japan. *Japan and the World Economy*, 16, 17-34.
- Kargbo, J. M. (2009) Financial integration and parity reversion in real exchange rates of emerging markets. *Applied Economics Letters*, 16(1), 29 - 33
- Makin, J. H. (1997), Two New Paradigms. American Enterprise Institute, (October).
- Mantalos, P. and G. Shukur (1998). Size and power of the error correction model cointegration test. A bootstrap approach. *Oxford Bulletin of Economics and Statistics*, 60, 249–255.
- McKibbin, W. J. and W. T. Woo (2003) The Consequences of China's WTO Accession for Its Neighbors. *Asian Economic Papers*, MIT Press, 2(2), 1-38.
- Okamoto, Y. (2005) China and India: Challenges and Opportunities for ASEAN from Japanese Perspectives. Paper presented at the 30<sup>th</sup> Annual conference of the Federation of ASEAN Economic Associations (FAFE), November 24-25.
- Özmen, E. and Gökcan, A. (2004) Deviations from PPP and UIP in a financially open economy: the Turkish evidence. *Applied Financial Economics*, 14(11), 779-784.
- Pesaran, M. H. and Y. Shin (1996) Cointegration and Speed of Convergence to Equilibrium, *Journal of Econometrics*, 71, 117-143.
- Pesaran, M. H., Shin, Y., and Smith, R. J. (2000) Structural analysis of vector error correction models with exogenous I(1) variables. *Journal of Econometrics*, 97, 293-343.
- Pomfret, R. (2005) Sequencing trade and monetary integration: issues and application to Asia. *Journal of Asian Economics*, 16(1), 105-124.
- Rogoff, K. (1996) The purchasing power parity puzzle. *Journal of Economic Literature*, 34, 647-668.

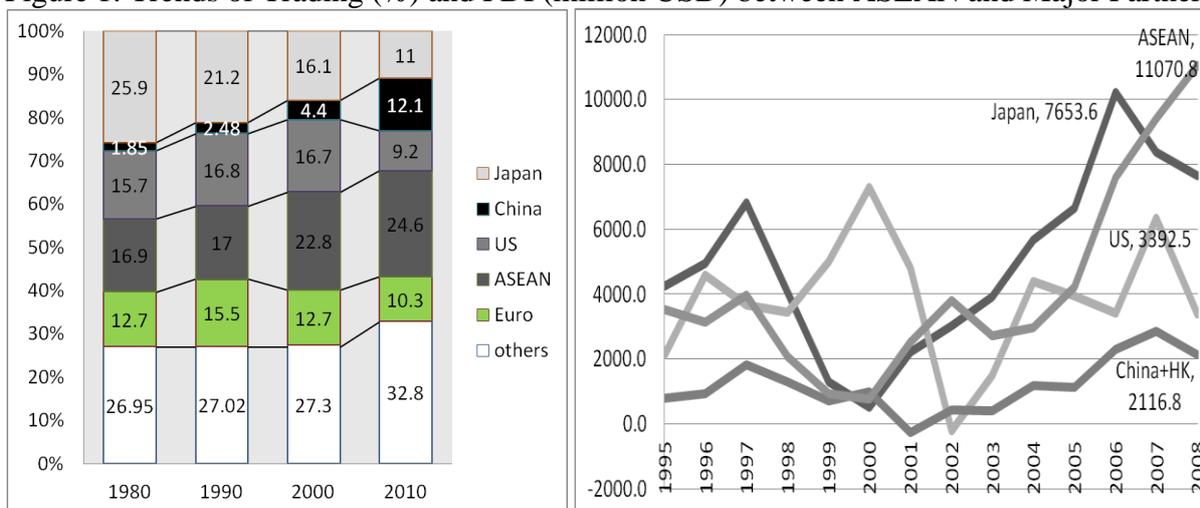
Sjoo, B. (1995) Foreign transmission effects in Sweden: do PPP and UIP hold in the long run? *Advances in International Banking and Finance*, 1, 129– 149.

The Economist (various issues), Big Mac index, available online [http://www.economist.com/node/17257797?story\\_id=17257797&CFID=163214234&CFTOKEN=64541760](http://www.economist.com/node/17257797?story_id=17257797&CFID=163214234&CFTOKEN=64541760).

Yongjian, E., A. Yanxiang, G. and Chau-Chen, Y. (2009) Real Exchange Rate Behavior under Peg: Evidence from the Chinese RMB and Malaysian MYR. *Review of Pacific Basin Financial Markets and Policies*, 12 (1), 141–158.

Zivot, E. and Andrews, D. (1992) Further evidence on the great crash, the oil price shock, and the unit root hypothesis. *Journal of Business and Economic Statistics*, 10, 251-270.

Figure 1: Trends of Trading (%) and FDI (million USD) between ASEAN and Major Partners



Sources: Direction of Trade Statistics Yearbook 1987, 1997, 2004, 2011 (IMF); ASEAN Statistical Yearbook 2003 & 2008