Revival of the Twin Deficits in Asian Crisis-affected Countries

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ABSTRACT

This paper revisits the twin deficits argument in the Asian crisis-affected countries. We also include data from the 1997 crisis to examine the disparities in the empirical regularities governing the two deficits in these countries. Empirical results suggest that causality runs from budget deficit to current account deficit for Malaysia, the Philippines (pre-crisis) and Thailand, which fits well with the Keynesian view. For Indonesia and Korea the causality runs in the opposite direction while a bi-directional causality exists for the Philippines in the post-crisis era. As these countries are at a crossroad in the aftermath of the 1997 crisis, managing these deficits are indeed important policy options in promoting macroeconomic stability and sustainability in the region.

1. INTRODUCTION

OVER THE YEARS, researchers have explored the link between the budget deficit (BD) and current account deficit (CAD)[2]. This is due to the fact that in order to maintain macroeconomic stability and sustained economic growth, CAD and BD must be kept under control. Developing countries are no exception, where several authors have documented that an unsustainable BD widens the CAD. Indeed, authors like Laney (1984) found that the relationship between these two variables is much stronger for developing countries.

Despite been an age-old issue, there has been a revival of interest in the 'twin deficits' phenomenon at the forefront of the policy debate, especially for the US economy in the new millennium (see for example, Obstfeld and Rogoff, 2005; Bartolini and Lahiri, 2006; Coughlin *et al.*, 2006; Frankel, 2006).[3] Eichengreen (2006) for instance, indicates that the growth of the US current account deficit was unsustainable and that the situation would interrupt capital inflows, leading to a sharp compression of the US current account and eventually worldwide imbalances. Makin and Narayan (2008) argued that the rise of the CAD in the US is strongly coincident with saving rates in East Asia, especially in the post 1997 period. Despite that, most analysts have suggested that the resolution to global imbalances is through the reduction of the CAD in the US. This would imply a decline in the rest of the world's collective current account surpluses. It further raises the issue of fragility in the global economy, especially in the emerging market economies of Asia (which consist of a vast accumulation of foreign reserves and high saving rates) which, worse still, a sudden halt in the presence of large CAD could collectively end up in a crash (Calvo and Talvi, 2006).

Obstfeld and Rogoff (2004), Blanchard *et al.*, (2005) and Mendoza *et al.*, (2007) raise the concern that unless major policy action is taken, the imbalances will generate global financial turbulence and possibly, a world economic crisis. As the worry about the risk of a disorderly unwinding of global imbalances arises in academic and policy circles, the current crisis can be viewed as the outcome of these episodes. With this motivation, we undertake an empirical study for five crisis-affected Asian countries (Indonesia, Korea, Malaysia, the Philippines and Thailand: Asian-5) to obtain further evidence on the twin deficits debate. Looking at the empirical work in the Asian context (see for example, Anoruo and Ramchander, 1998; Khalid and Teo, 1999; Kouassi *et al.*, 2004; Lau and Baharumshah, 2006; Baharumshah *et al.*, 2006; Baharumshah and Lau, 2007) they failed to establish consensus causality results. Therefore, it is of paramount importance for this study to reaffirm the causal relationship between BD and CAD. This paper also tentatively extends this line of research by examining a cluster of Asian-5 crisis-affected economies. Looking back at historical data, these countries recorded huge CAD and BD for most of 1990s. Interestingly, post 1997 crisis, the deficits amounted to about 4 percent and are recorded in BD. As we are in the midst of recession, the dynamic movement of the BD and CAD would be a concern for policymakers worldwide. Importantly, with the bailout incentives going on worldwide aimed at stimulating the economy (as has been adopted by most Asian countries since 1997), this would generate an additional impact on government budgets. In particular, the question of concern is: will the fiscal stimulus package introduced in these Asian countries lead to a further deterioration in the external balance? Therefore, the understanding of the interaction effects *between* BD and CAD is essential for establishing a proper macroeconomic policy implementation plan.

Besides answering this policy question, we are also interested in ascertaining the causal direction between CAD and BD. This may provide useful insights into how these economies are able to manage the deficits in the future. To accomplish the objective, rigorous systematic statistical tests of integration, cointegration and causality are offered in the present work. In this manner, we are able to ascertain the robustness of our empirical findings in relation to the link between these deficits. This paper also splits the sample period into two non overlapping sub-samples of pre and post-crisis (a unique approach not taken in the aforementioned literature) to investigate any disparities among the empirical regularities obtained. Therefore, the choice of the countries in this study is not without considerable merit.

This paper proceeds as follows. Section 2 describes the simple theoretical framework of national accounting for analysing the causal relationship of the twin deficits. This is followed by the empirical approach and data description adopted in the paper. Section 4 reports the empirical findings, while concluding remarks and further implications for empirical research is presented in Section 5 of the paper.

2. The twin deficits in national accounts

A wide range of models has emerged in the literature but, in most cases, the analytical results suggest the fiscal deficit is likely to lead to a worsening of the current account. The national account identity provides the basis of the relationship between the two deficits. The model starts with the national income identity for an open economy that can be represented as:

$$Y = C + I + G + X - M \tag{1}$$

where Y= gross domestic product (GDP), C = consumption, I = investment, G = government spending, X = exports and M = imports. Defining current account (CA) as the difference between export (X) and import (M), Equation (2) becomes:

$$CA = Y - (C + I + G) \tag{2}$$

where ($C + I + G$) are the spending of domestic residents (domestic absorption). In a closed economy, saving equals investment: $S = I$. This relationship means the external account has to equal the difference between national savings and investment. It implies the current account is closely related to the decisions of savings and investments in an economy. In an open economy, total savings (S) equal domestic investment (I) plus the current account CA, that is

$$S = I + CA \text{[4]} \tag{3}$$

Equation (3) states that unlike a closed economy, an open economy can seek domestically and internationally for the necessary funds for investments to enhance its income. In other words, external borrowing allows investment at levels beyond those that could be financed through domestic savings.

National savings can be decomposed further into private (*Sp*) and government savings (*Sg*). Using $Sp = Y - T - C$ and $Sg = T - G$, where *T* is government revenue, and substituting them into Equation 4, yields

$$CA = SP - I - (G - T) \tag{4}$$

Assuming savings-investment balance for simplicity, Equation (4) states that a rise in the budget deficit will increase the current account deficit, should private savings equal investment. Thus, it is clear from Equation (4) that the external account and fiscal balance are interrelated, or twinned. Researchers such as Hutchison and Pigott (1984), Zietz and Pemberton (1990), Bachman (1992), Rosensweig and Tallman (1993), Vamvoukas (1999), Piersanti (2000), Akbostanci and Tunç (2001) and Leachman and Francis (2002) found evidence that a worsening BD stimulates an increase in CAD. Recently, Acaravci and Ozturk (2008) found positive and unidirectional causality running from BD to CAD in Turkey, while Hakro (2009) supports a similar conclusion for Pakistan.

At the other end of the spectrum lies the Ricardian Equivalence Hypothesis (REH) taken from the seminal work of Barro (1974). This group of economists believes that consumers foresee the future increase in taxes. Knowing their future disposable income will be reduced because of the impending increase in taxes, households reduce their consumption spending and raise savings to smooth out the expected reduction in income. Thus, there are no subsequent effects noticeable on the current account deficit as the budget deficit increased; there is an absence of any Granger causality between the two deficits. Studies like Miller and Russek (1989), Enders and Lee (1990), Rahman and Mishra (1992), Evans and Hasan (1994), Wheeler (1999) and Kaufmann *et al.* (2002) offer support for the REH.

However, as pointed out by Darrat (1988) and Abell (1990) these are not the only possible outcomes between the two deficits. In fact, the two variables could be mutually dependent (see, Darrat, 1988; Kearney and Monadjemi, 1990; Normandin, 1999; Hatemi and Shukur, 2002; Kouassi *et al.*, 2004). Lau and Baharumshah (2006) who analyse nine Asian countries in a panel setting found that BD and CAD depend on each other; seen also by Jayaraman and Choong (2007) using data for Fiji, and Arize and Malindretos (2008) for most of the African countries in their investigation.

Causality running from CAD to BD, termed 'current account targeting' by Summers (1988), is also a possible outcome. Empirically the studies by Islam (1998), Anoruo and Ramchander (1998), Khalid and Teo (1999), Alkswani (2000) and Saleh (2006) support this proposition. Using data from Egypt, Marinheiro (2008) rejects the twin deficits hypothesis in support of reverse causality from CAD to BD. According to this study, this will occur if a government utilises its budget (fiscal) stances to target the current account balance.[5] This pattern of external adjustment might be especially relevant for developing countries (Khalid and Teo, 1999).

3. ECONOMETRIC STRATEGY AND DATA DESCRIPTION

3.1 Univariate unit root testing procedures

The Said and Dickey (1984, ADF) and Elliott *et al.* (1996, DFGLS) testing principles share the same null hypothesis of a unit root. Their differences however are centred on the way the latter specifies the alternative hypothesis and treats the presence of the deterministic components in a variable's data generating process (DGP). Specifically the DFGLS procedure relies on locally de-meaning and/or de-trending a series prior to the implementation of the usual auxiliary ADF regression. The use of the DFGLS test statistics is likely to minimise the danger of erroneous inferences when the series under investigation has a mean and/or linear trend in its DGP. Here, t_μ and t_τ stand for the standard ADF test statistics while τ_μ and τ_τ denoted the DFGLS test statistics where mean (μ) and (τ) trend stationarity respectively. The DFGLS τ_μ and τ_τ are constructed by estimating the following auxiliary regression:

$$\Delta x_1^m = \beta_0 x_{t-1}^m + \sum_{j=1}^{n} \beta_j \Delta x_{t-j}^m + \varepsilon_t \qquad (5)^6$$

where x_1^m is the locally de-meaned and/or de-trended process obtained from $x_t^m = x_t - \bar{\beta}' z_t$. Under this condition, $z_t = 1$ for the τ_μ while $z_t = (1\ t)$ for τ_τ and $\bar{\beta}'$ is the regression coefficient of $\tilde{x}_t$ on $\tilde{z}_t$ for which $(\tilde{x}_1, \tilde{x}_2, ..., \tilde{x}_T) = [x_1(1-\bar{\rho}L)x_2), ..., (1-\bar{\rho}L)x_T)]$ $(\tilde{z}_1, \tilde{z}_2, ..., \tilde{z}_T) = [z_1, (1-\bar{\rho}L)z_2, ...(1-\bar{\rho}L)z_T]$ under the local alternative of $\bar{\rho} = 1 + (\bar{c}/T)$. The τ_μ (τ_τ) test statistic is given by the usual t statistic for testing $\beta_0 = 0$ in the associated ADF type auxiliary regression for the appropriate variables shown in (5). In addition, this procedure requires the choice of the local to unity parameter $\bar{c}$ through $\bar{\rho} = 1 + (\bar{c}/T)$ are set to -7 in the case of τ_μ and -13.5 in the case of τ_τ (see Elliott *et al.*, 1996 for details).

In contrast, the Kwiatkowski *et al.* (1992, KPSS) procedure tests for level (η_μ) or trend stationarity (η_τ) against the alternative of a unit root. The KPSS test statistic for level (trend) stationary is:

$$\eta_\mu(\eta_\tau) = \frac{1}{s^2(k)T^2} \sum_{t=1}^{T} S_t^2 \qquad (6)$$

where $S_t = \sum_{i=1}^{t} u_i, u_t$ are the residuals from the regression of X_t on a constant (a constant and trend) for the level (trend) stationarity, $s^2(k)$ is the non-parametric estimate of the 'long run variance' of u_t while k stands for the lag truncation parameter. In this sense, KPSS involves a different maintained hypothesis from the ADF and DFGLS unit root tests.

3.2 Cointegration procedure

The system-based cointegration procedure developed by Johansen and Juselius (1990) to test for the absence or presence of long run equilibrium is adopted in this paper. One advantage of this approach is that the estimation procedure does not depend on the choice of normalisation and is much more robust than the Engle-Granger test (see Gonzalo, 1994). Phillips (1991) also documented the desirability of this technique in terms of symmetry, unbiasedness and efficiency. Their test utilises two likelihood ratio (LR) test statistics for the number of cointegrating vectors: namely the trace test and the maximum eigenvalue test. In the trace test the null hypotheses of `*r*` or fewer cointegrating vectors where $r = 0,1,2,\ldots,p-1,p$. In other words, the null hypothesis is $r < 0$ while the general hypothesis is $r \leq 1$, $r \leq 2,\ldots$, $r \leq p$.

$$\tau_{trace}(r) = -T \sum_{i=r+1}^{p} \ln(1-\lambda_1) \tag{7}$$

where λ_1= the *p-r* smallest squared canonical correlation of v_{0t} with respect to v_{1t} and *T* is the number of observations. The maximum eigenvalue examines the null hypothesis of exactly *r* cointegrating vectors with the test statistic follow as:

$$\tau_{\max}(r, r+1) - T \ln(1-\lambda_{r+1}) \tag{8}$$

The importance of applying a degree-of-freedom correction for the Johansen and Juselius (1990) framework is that it is necessary to reduce the excessive tendency of the test to falsely reject the null hypothesis of no cointegration. In this study, we rely on the correction factor suggested by Reinsel and Ahn (1992) that multiplies the test statistic by $(T-pk)/T$ to obtain adjusted test statistics, where *T* is total number of the observations, *p* is the number of variables in the system and *k* is the lag-length order of VAR system.

3.3 Granger causality tests

If cointegration is detected, then the Granger causality test must be conducted in vector error correction model (VECM) form to avoid problems of misspecification (Granger, 1988). Otherwise, the analyses may be conducted as a standard first difference vector autoregressive (VAR) model. VECM is a special case of VAR that imposes cointegration on its variables, where it allows us to distinguish between short run and long run Granger causality. The relevant error correction terms (ECTs) must be included in the VAR to avoid misspecification and omission of the important constraints. The existence of a cointegrated relationship in the long run indicates that the residuals from the cointegration equation can be used as an ECT as follows:

$$\Delta BD_t = \alpha_0 + \sum_{i=1}^{m} \beta_{1i} \Delta BD_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta CAD_{t-i} + \mu_1 ECT_{t-1} + \zeta_1 \quad (9)$$

$$\Delta CAD_t = \delta_0 + \sum_{i=1}^{n} \phi_{1i} \Delta CAD_{t-i} + \sum_{i=1}^{m} \phi_{2i} \Delta BD_{t-i} + \mu_2 ECT_{t-1} + \zeta_2 \quad (10)$$

where Δ is the lag operator, α_0, δ_0, β's and ϕ's are the estimated coefficients, *m* and *n* are the optimal lags of the series *BD* and *CAD*, ζ_{it}'s are the serially uncorrelated random error terms while μ_1 and μ_2 measure a single period response of the *BD* (*CAD*) to a departure from equilibrium. To test whether *BD* does not Granger cause movement in *CAD*, H0: $\phi_{2,\iota}$ for all *i* and μ_2 = 0 in Equation (10).[7] Rejection implies that BD causes CAD. Similar analogous restrictions and testing procedures can be applied in testing the hypothesis that CAD does not Granger cause movement in BD, where the null hypothesis H0: $\beta_{2,\iota}$ for all *i* and μ_1 = 0 in Equation (9). In the case where cointegration is absent, the standard first difference vector autoregressive (VAR) model is adopted. This simpler alternative of causality is feasible through the elimination of ECT from both equations above. In other words, it only contains short run causality information. As VECM is a special case of VAR, the optimal lag in Equations 9 and 10 are selected using the multivariate generalisation of Akaike Information Criteria (AIC) proposed by Gonzalo and Pitarakis (2002).[8]

3.4 Dynamic analysis: generalized variance decomposition (GVDCs)

In order to gauge the relative strength of the variables and the transmission mechanism responses, we shock the system and partition the forecast error variance decomposition (FEVD) for each of the variables in the system. However, it is well established that the results of FEVD based on Choleski's decomposition are generally sensitive to the ordering of the variables and the lag length (see Lutkepohl, 1991). To overcome this, the Generalised Variance Decomposition (GVDCs) suggested by Lee *et al.* (1992) is applied. The innovation of the GVDCs will be represented in percentage form and the strength of two variables to their own shocks and each other are measured by a value up to 100 per cent. For the purpose of the analysis, the GVDCs are executed using time horizons of 1 to 24 quarters. From this simple experiment, we are able to measure the relative strength of BD (CAD) shock to CAD (BD) for both sub-samples in the system.

3.5 Data sources

Quarterly data from post Bretton Woods are utilised in this analysis and we split the whole sample period into two non-overlapping sub-periods of first, pre-crisis (1976Q1 to 1997Q2) and second, the post-crisis (1997Q3 to 2008Q1).[9] The data are gathered from various issues of International Financial Statistics (IFS), published by the International Monetary Fund (IMF). The variables employed in the study are the current account deficit (CAD) and the budget deficit (BD), where the variables are expressed as a ratio to GDP in order to account for growth in the economy.[10] The IFS provide CAD denominated in US dollar while the BD and the nominal GDP are measured in domestic currency. For consistency and country comparisons, we express all the variables US dollars.

3.6 Correlation coefficients analysis

The correlation coefficient measures the linear association between two variables, specifically how strongly the two variables are linearly related. The results are displayed in matrix form in Table 1. It is evident from Table 1 that all the correlation coefficients show highly positive values. Although the correlation coefficient measures the extent to which two variables are related or associated, the interpretation of a strong correlation does not necessarily mean the evidence of cointegration or even causality. Thus, in the next section, results from more formal and precise methodologies will be discussed.

Table 1: Correlation between current account and budget deficits

Country	*Correlation*
Indonesia	0.804
Korea	0.895
Malaysia	0.880
Philippines	0.817
Thailand	0.917
Average Asian-5	0.886

Note: Average Asian-5 are calculated by summing up all the five countries CAD and BD and divided by GDP for the sample period. The correlation of the average Asian-5 countries provides additional information of the close relationship between these two variables.

4. THE RESULTS

4.1 Non-stationarity and Stationarity Tests

As a prelude to cointegration and VAR testing procedures, the variables under investigation must be stationary time series. For this purpose, we conduct two unit root and one stationary test discuss earlier on the series of CAD and BD and their first differences, in order to determine the stationarity or non-stationarity of the series. The results in Table 2 suggest the existence of a unit root or nonstationarity in level or I(1) for the two variables. The findings that the two variables have the same order of integration allows us to proceed with the Johansen cointegration analysis. The results hold true for both the pre and the post crisis periods.

Table 2: Unit Root and Stationary Tests

Panel A — pre-crisis

	Test statistics					
	t_μ	t_τ	τ_μ	τ_τ	η_μ	η_τ
			Levels			
Indonesia						
CAD	-2.316 (3)	-2.573 (3)	-1.309 (2)	-2.034 (2)	0.865 (2)*	0.268(2)*
BD	-1.974 (3)	-2.934 (3)	-0.904 (3)	-2.386 (3)	0.686 (3)*	0.1689 (3)*
Korea						
CAD	-1.818 (2)	-1.792 (2)	-1.400 (2)	-1.790 (2)	1.290 (1)*	0.833 (1)
BD	-2.090 (3)	-2.175 (3)	-0.672 (3)	-1.465 (3)	0.710 (1)*	0.459 (1)*
Malaysia						
CAD	-0.918(1)	-1.411(1)	-0.416(3)	-1.944(3)	0.643(3)*	0.255(3)*
BD	-0.061(1)	-2.199(1)	-0.448(3)	-2.955(3)	0.937(3)*	0.228(3)*
Philippines						
CAD	-1.245(1)	-0.901(1)	-0.437(3)	-2.822(3)	0.944(3)*	0.261(3)*
BD	-0.302(1)	-2.029(1)	-0.811(3)	-2.779(3)	1.028(3)*	0.226(3)*
Thailand						
CAD	-1.952(3)	-2.031(3)	-1.931(3)	-2.087(3)	0.516(3)*	0.159(3)*
BD	-2.028(3)	-1.857(3)	-2.103(3)	-2.337(3)	0.545(1)*	0.493(1)*
			First differences			
Indonesia						
ΔCAD	-5.955 (3)*	-5.931 (3)*	-3.364 (2)*	-4.694 (2)*	0.031 (2)	0.026 (2)
ΔBD	-6.713 (3)*	-6.668 (3)*	-3.467 (2)*	-6.315 (2)*	0.083 (3)	0.063 (3)
Korea						
ΔCAD	-7.814 (2)*	-7.733 (2)*	-4.674 (2)*	-5.126 (2)*	0.055 (1)	0.029 (1)
ΔBD	-8.544 (3)*	-8.485 (3)*	-7.704 (3)*	-9.172 (3)*	0.065 (1)	0.034 (1)
Malaysia						
ΔCAD	-6.962(1)*	-6.924(1)*	-12.775(3)*	-12.699(3)*	0.032(3)	0.032(3)
ΔBD	-4.830(1)*	-4.984(1)*	-10.244(3)*	-10.352(3)*	0.235(3)	0.138(3)
Philippines						
ΔCAD	-4.721(1)*	-4.870(1)*	-8.621(3)*	-8.680(3)*	0.188(3)	0.072(3)
ΔBD	-5.828(1)*	-5.930(1)*	-10.633(3)*	-10.727(3)*	0.156(3)	0.065(3)
Thailand						
ΔCAD	-4.646(3)*	-4.720(3)*	-6.987(3)*	-7.058(3)*	0.185(3)	0.064(3)
ΔBD	-5.935(3)*	-6.396(3)*	-6.974(3)*	-7.298(3)*	0.403(1)	0.126(1)

table 2 continued...

Panel B — post-crisis

	t_μ	t_τ	τ_μ	τ_τ	η_μ	η_τ
			Levels			
Indonesia						
CAD	-2.508(2)	-1.876(2)	-1.695 (2)	-1.984 (2)	0.865 (1)*	0.313 (1)*
BD	-1.722 (3)	-2.088 (3)	-1.661 (1)	-2.162 (1)	0.811 (1)*	0.248 (1)*
Korea						
CAD	-2.144 (1)	-2.956 (1)	-1.816 (1)	-2.327 (1)	1.075 (1)*	0.260 (1)*
BD	-1.973 (1)	-1.933 (1)	-0.860 (3)	-1.333 (3)	0.791 (2)*	0.283 (2)*
Malaysia						
CAD	-1.874(1)	-0.888(1)	-1.921(1)	-0.688(1)	0.727(1)*	0.206(1)*
BD	-1.408(1)	-1.011(1)	-0.782(1)	-2.498(1)	0.805(1)*	0.944(1)*
Philippines						
CAD	-0.250(1)	-2.576(1)	-0.438(1)	-0.466(1)	0.686(3)*	0.283(3)*
BD	-0.328(1)	-2.108(1)	-0.403(1)	-2.667(1)	0.973(3)*	0.284(3)*
Thailand						
CAD	-0.283(1)	-1.725(1)	-2.467(1)	-1.053(1)	1.011(3)*	0.281(3)*
BD	-0.579(1)	-2.219(1)	-1.366(1)	-1.801(1)	0.990(3)*	0.273(3)*
			First differences			
Indonesia						
ΔCAD	-4.156 (2)*	-4.023(2)*	-4.576 (2)*	-5.173 (2)*	0.177 (1)	0.038 (1)
ΔBD	-5.164 (3)*	-5.248 (3)*	-4.926 (1)*	-5.572 (1)*	0.173 (1)	0.091 (1)
Korea						
ΔCAD	-4.205 (1)*	-4.273 (1)*	-4.325 (1)*	-4.028 (1)*	0.154 (1)	0.095 (1)
ΔBD	-6.862 (1)*	-6.951 (1)*	-3.305 (3)*	-4.090 (3)*	0.068 (2)	0.048 (2)
Malaysia						
ΔCAD	-5.271(1)*	-6.122(1)*	-8.698(1)*	-10.107(1)*	0.238(1)	0.046(1)
ΔBD	-5.694(1)*	-5.932(1)*	-9.987(1)*	-10.474(1)*	0.163(1)	0.051(1)
Philippines						
ΔCAD	-4.850(1)*	-4.635(1)*	-7.919(1)*	-7.683(1)*	0.151(3)	0.062(3)
ΔBD	-4.755(1)*	-4.712(1)*	-6.915(1)*	-6.871(1)*	0.076(3)	0.064(3)
Thailand						
ΔCAD	-7.866(1)*	-9.295(1)*	-12.523(1)*	-16.275(1)*	0.172(3)	0.054(3)
ΔBD	-7.603(1)*	-7.727(1)*	-13.265(1)*	-13.829(1)*	0.147(3)	0.046(3)

Notes: The t, τ, and η statistics are for ADF, DFGLS and KPSS respectively. The subscript μ in the model allows a drift term while τ allows for a drift and deterministic trend. Asterisk (*) indicates statistically significant at 5 percent level. Figures in parentheses are the lag lengths. The asymptotic and finite sample critical values for ADF are obtained from MacKinnon (1996); the KPSS test critical values are obtained from Kwiatkowski *et al.* (1992, Table 1, pp. 166). The DFGLS for the drift term (μ) follows the MacKinnon (1996) critical values; the asymptotic distributions for the drift and deterministic trend (τ) are obtained from Elliott *et al.* (1996, Table 1, pp 825). Both the ADF and DFGLS test examine the null hypothesis of a unit root against the stationary alternative. KPSS tests the null hypothesis that the series is stationary against the alternative hypothesis of a unit root. Δ denotes first difference operator.

4.2 Cointegration and hypothesis testing results

Before testing for the existence of any cointegrating relationship between the two-dimensional variables using the Johansen procedure, it is necessary to determine the dynamic specification of the VAR model. It is widely known that the lag orders (*k*) can affect the number of cointegrating vectors in the system. For this purpose, the multivariate generalisation of Akaike Information Criteria (AIC) proposed by Gonzalo and Pitarakis (2002) are used to determine the optimal lag length for the vector autoregressive (VAR) model. The results for adopting the multivariate generalisation of AIC are tabulated in Appendix 1 for both sub-samples, pre and post-crisis. In the pre-crisis period, the multivariate generalisation indicates VAR(3) for Indonesia and Malaysia while VAR(4) is more appropriate for Korea and the Philippines. For Thailand, VAR(5) is the most appropriate lag length structure. In the post-crisis period, we found that VAR(2) was optimal lag length for Malaysia, the Philippines and Thailand while VAR(4) for Indonesia and VAR(3) for Korea. Despite a different lag structure selection for each particular country in the pre and post crisis periods, the residuals of each equation in the system do not exhibit any form of serial correlation or ARCH effects, thus satisfying normal residuals[11] specification behaviour.

Having determined the optimal lag structure for VAR estimation, we proceed to the cointegration tests. The results of the cointegration procedure (with and without the adjustment factor) are presented in Panel A of Tables 3 and 4. In the pre-crisis period, the null hypothesis of no cointegrating vector (r=0) in favour of at least one cointegrating vector is rejected at the 5 per cent significance level for all countries under investigation except the Philippines (see Panel A, Table 3). We note that both the trace and the maximum eigenvalue tests lead to the same conclusion — the presence of one cointegrating vector. Rejecting the null hypothesis of no cointegration implies that the two variables do not drift apart and share at least a common stochastic trend in the long run. On the other hand, both tests fail to reject the null hypothesis of non-cointegration in the case of the Philippines even at the 10 per cent level, results which hold with or without applying the Reinsel and Ahn (1992) correction factor.

To determine if these two variables in the system of the twin deficits hypothesis (for the four countries that are found to be cointegrated) belong to the cointegrating space, we apply the log-likelihood ratio (LR) test for the exclusion of each variable, as discussed in Johansen and Juselius (1990, p. 195). Panel B, Table 3 provides the test results of the exclusion restriction on CAD and BD. The null of restricting the coefficients of CAD and BD to zero can easily be rejected at the 5 per cent significance level for the four countries where the cointegrating relationship holds. Clearly, all the variables belong to the cointegrating space and cannot be ruled out from the analysis.

Table 3: Cointegration Test and Hypothesis Testing (pre-crisis)

Panel A: Johansen Multivariate Test

Null	*Alt.*	*λmax* unadjusted	*λmax* adjusted	*λmax* 95% CV	*Trace* unadjusted	*Trace* adjusted	*Trace* 95% CV
Indonesia (1976Q1 - 1997Q2)				*k*=3	*r*=1		
r = 0	r = 1	26.806*	24.935*	15.870	35.263*	30.012*	20.180
r ≤ 1	r = 2	8.457	7.866	9.160	8.457	7.866	9.160
Korea (1976Q1 - 1997Q2)				*k*=4	*r*=1		
r = 0	r = 1	17.557*	15.923*	14.880	20.886*	18.943*	17.860
r ≤ 1	r = 2	3.328	3.019	8.070	3.328	3.019	8.070
Malaysia (1976Q1 - 1997Q2)				*k*=3	*r*=1		
r = 0	r = 1	25.752*	23.955*	15.870	34.531*	32.121*	20.180
r ≤ 1	r = 2	8.778	8.165	9.160	8.778	8.165	9.160
Philippines (1976Q1 - 1997Q2)				*k*=4	*r*=0		
r = 0	r = 1	6.8670	6.228	15.870	12.0479	10.927	20.180
r ≤ 1	r = 2	5.1809	4.698	9.160	5.1809	4.698	9.160
Thailand (1976Q1 - 1997Q2)				*k*=5	*r*=1		
r = 0	r = 1	30.005	26.516	15.870	32.908*	29.082	20.180
r ≤ 1	r = 2	2.902	2.565	9.160	2.902	2.565	9.160

Panel B: Test of Exclusion Restrictions Based on Johansen Procedure

χ^2 - statistics (*p*-value)

Variables	*Indonesia*	*Korea*	*Malaysia*	*Phillipines*	*Thailand*
CAD	10.272 (0.001)*	10.326 (0.001)*	16.910(0.000)*	-	23.007 (0.000)*
BD	13.622 (0.000)*	13.583 (0.000)*	17.052 (0.000)*	-	21.955 (0.000)*
Intercept	5.746 (0.017)*	-	8.530 (0.003)*	-	12.021 (0.001)*

Notes: *k* is the lag length and *r* is the cointegrating vector(s). Chosen *r*: number of cointegrating vectors that are significant under both tests. The unadjusted and the adjusted statistics are the standard Johansen statistics and the statistics adjusted for small sample correction factor according to the Reinsel and Ahn (1992) methodology. The exclusion test is based on a likelihood ratio test and has a χ^2 (*r*) distribution, where the degree of freedom is *r*, the number of cointegrating vectors. Asterisk (*) denotes statistically significant at 5 per cent level.

Turning to the post-crisis period, one can see clearly the null hypothesis of no cointegrating vector (*r*=0) is soundly rejected at 5 per cent significance level only for Malaysia and Thailand. For the remaining three countries, both tests fail to reject the null hypothesis of non-cointegration (see Panel A, Table 4).[12] On the basis of these test results, we can interpret that a unique cointegrating relationship has emerged in two out of the five crisis-affected Asian countries (with and without the correction factor). Using the LR statistics in Panel B, it reveals that the two variables enter significantly in the long run relationship. This indicates that omission of any one of these variables may bias the empirical results. Additionally, it suggests that there is a stable long run equilibrium relationship between the two deficits. The results so far indicate disparities between the pre and the post crisis periods. This may be attributed to the success of the appropriate policy plan adopted by some of these countries soon after the financial turmoil in 1997.

Table 4: Cointegration Test and Hypothesis Testing (post-crisis)

Panel A: Johansen Multivariate Test

Null	*Alt.*	*λmax*			*Trace*		
		unadjusted	*adjusted*	*95% CV*	*unadjusted*	*adjusted*	*95% CV*
Indonesia (1997Q3 - 2008Q1)				*k*=4	*r*=0		
r = 0	r = 1	10.179	8.241	15.870	15.376	12.439	20.180
r ≤ 1	r = 2	5.196	4.203	9.160	5.196	4.203	9.1600
Korea (1997Q3 - 2008Q1)				*k*=3	*r*=0		
r = 0	r = 1	12.082	10.354	14.880	13.851	11.870	17.860
r ≤ 1	r = 2	1.769	1.516	8.070	1.769	1.516	8.070
Malaysia (1997Q3 - 2008Q1)				*k*=2	*r*=1		
r = 0	r = 1	22.863*	20.685*	11.030	22.981*	20.774*	12.360
r ≤ 1	r = 2	0.117	0.105	4.160	0.117	0.105	4.1600
Philippines (1997Q3 - 2008Q1)				*k*=2	*r*=0		
r = 0	r = 1	14.520	13.126	15.870	19.716	17.823	20.180
r ≤ 1	r = 2	5.195	4.697	9.160	5.195	4.697	9.1600
Thailand (1997Q3 - 2008Q1)				*k*=2	*r*=1		
r = 0	r = 1	23.149*	20.926	11.030	27.081*	24.481*	12.360
r ≤ 1	r = 2	3.932	3.554	4.160	3.932	3.554	4.160

Panel B: Test of Exclusion Restrictions Based on Johansen Procedure

χ^2 - statistics (*p*-value)

Variables	*Indonesia*	*Korea*	*Malaysia*	*Phillipines*	*Thailand*
CAD	-	-	6.259(0.012)*	-	11.415(0.001)*
BD	-	-	14.795(0.000)*	-	18.089(0.000)*
Intercept	-	-	-	-	-

Notes: See Table 3

4.3 Causality analysis of twin deficits

We start the discussion and summary of the Granger causality results in the pre-crisis period (Table 5) and then move onto the post-crisis period (Table 6). First, CAD is found to be endogenous in both Malaysia and Thailand. This is shown in the CAD equation where the ECT is statistically significant, suggesting that CAD solely bears the brunt of short run adjustment to bring about the long run equilibrium in Malaysia and Thailand. Second, for Indonesia and Korea, BD brings about long run equilibrium, as indicated by the significance of the ECT coefficient. Third, the t-statistics on the lagged residual are statistically significant and negative in all the countries supporting the Johansen results reported earlier. Fourth, we find that the speed of adjustment to long run equilibrium, as measured by the ECT coefficient following a disturbance, ranges from 0.042 (Indonesia) to 0.258 (Thailand). The magnitude of these coefficients indicates that the speed of adjustment towards the long-run path varies among these four countries. Specifically, Indonesia (4 percent), Korea (6 percent) and Malaysia (5 percent) need approximately about twenty-five, seventeen and twenty quarters while Thailand (26 percent) about four quarters to adjust to long run equilibrium due to short run adjustments.

Table 5: Granger Causality Results (pre-crisis)

Dependent Variables	*ΔCAD*	*ΔBD*	*ECT*	
	χ^2 – statistics (p-value)		*coefficient*	*t-ratio (p-value)*
Indonesia			-0.005	-0.799 (0.426)
ΔCAD	-	0.454 (0.500)	-0.042	-5.446 (0.000)
ΔBD	9.409 (0.002)	-		
Korea				
ΔCAD	-	0.628 (0.428)	-0.002	-0.098 (0.922)
ΔBD	10.786 (0.001)	-	-0.065	-4.107 (0.000)
Malaysia				
ΔCAD	-	25.050 (0.000)	-0.050	-2.961 (0.004)
ΔBD	0.482 (0.487)	-	0.001	0.001 (0.994)
Philippines				
ΔCAD	-	9.281 (0.002)	-	-
ΔBD	0.005 (0.942)	-	-	-
Thailand				
ΔCAD		6.499 (0.011)	-0.258	-4.689 (0.000)
ΔBD	0.124 (0.724)		0.032	1.565 (0.122)

Notes: The χ^2-statistic tests the joint significance of the lagged values of the independent variables, and the significance of the error correction term(s). The Vector Error Correction Model (VECM) formulation established only in four cases and one error correction term is included in Indonesia, Korea, Malaysia and Thailand system. For the Philippines model we use the standard VAR model since no significant cointegrating vector was found in Table 3. Δ is the first difference operator. Figures in parentheses are the *p*-values. Asterisk (*) indicates statistically significant at 5 per cent level.

Fifth, it is evident that the null hypothesis of BD does not cause (in Granger-sense) CAD is easily rejected at the 5 percent significance level (BD→CAD) for Malaysia, the Philippines and Thailand. This finding appears to support the twin deficits hypothesis that BD is the source of rising CAD; consistent with Baharumshah *et al.* (2006) and Baharumshah and Lau (2007). Sixth, the results for Korea and Indonesia show that the direction of causality runs predominantly from CAD to BD. Such evidence is contrary to what was found in the literature for the US and other developed economies. Nonetheless, Anoruo and Ramchander (1998), Kouassi *et al.* (2004) and Baharumshah *et al.* (2006) found that CAD causes BD for most of the developing economies of Asian, including Indonesia and Korea. This result may be attributed to the fact that government spending has deleterious effects on trade imbalances.

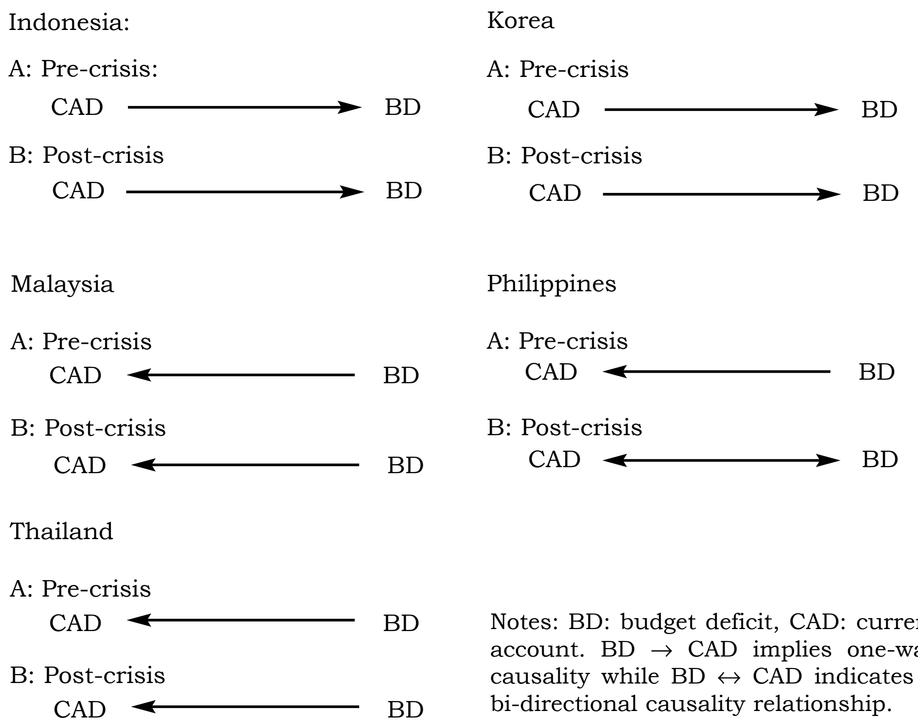
Table 6: Granger Causality Results (post-crisis)

Dependent Variables	*ΔCAD*	*ΔBD*	*ECT*	
	χ^2 – statistics (p-value)		*coefficient*	*t-ratio (p-value)*
Indonesia				
ΔCAD	-	0.045(0.830)	-	-
ΔBD	4.559 (0.033)	-	-	-
Korea				
ΔCAD	-	0.119(0.730)	-	-
ΔBD	26.790(0.000)	-	-	-
Malaysia				
ΔCAD	-	15.942(0.000)	-0.320	-5.298(0.000)
ΔBD	0.133(0.715)	-	-0.029	-0.913(0.366)
Philippines				
ΔCAD	-	7.206(0.007)	-	-
ΔBD	12.950(0.000)	-	-	-
Thailand				
ΔCAD		4.302(0.038)	-0.107	-3.532(0.001)
ΔBD	0.133(0.715)		-0.005	-0.134(0.893)

Notes: As per Table 3. The Vector Error Correction Model (VECM) formulation established only in two cases and one error correction term are included in the Malaysia and Thailand systems. For the remaining countries, we used the standard VAR model since no significant cointegration vector was found in Table 4.

In the post-crisis period (Table 6), first, CAD acts as the initial receptor of any exogenous shocks that disturb the equilibrium system in Malaysia and Thailand. Second, the ECT coefficient for Malaysia is 0.320 while Thailand recorded 0.107. This magnitude suggests that 32 percent of the adjustment is completed in one quarter, thus Malaysia needs roughly three quarters to return to long run equilibrium. In Thailand, however, about ten quarters are needed for the adjustment to be completed. Third, BD Granger causes CAD in Malaysia and Thailand. Fourth, for Korea and Indonesia, the results show that the direction of causality runs predominantly from CAD to BD. Fifth, bi-directional short run causality exists in the Philippines (BD↔CAD). This two-way causality between the two deficits was also found in Khalid and Teo (1999). The directions of causal relations from Tables 5 and 6 are summarised graphically in Figure 1.

Figure 1: Flow Diagram of Causality Linkages



Notes: BD: budget deficit, CAD: current account. BD → CAD implies one-way causality while BD ↔ CAD indicates a bi-directional causality relationship.

The results Tables 5 and 6 suggest there are differences in managing the two deficits in the pre and post-crisis periods. For instance, in Malaysia there are considerable improvements in terms of ECT compared to the pre-crisis era. This further supports the cointegration test presented earlier and implies that greater efforts were made by the relevant authorities to bring the deficits back to a sustainable path and thus achieve macroeconomic stability in the later part of the sample period (see Hernández and Montiel, 2003). In a recent paper, Lau *et al.*, (2006) find robust results that the degree of mean reversion in CAD seems to be at a rather more rapid pace in the post-crisis period than pre-crisis.

4.4 GVDC Results

In order to strengthen the empirical evidence from causality analysis, the dynamic analyses of the system are examined. We use GVDCs to gauge the strength of the causal relationship between CAD and BD. These results strengthen the findings from the causality tests presented earlier. Tables 7 (pre-crisis) and 8 (post-crisis) provide a decomposition of the forecast error variances of the two variables up to the 24-quarter horizon. In the pre-crisis period, the GVDCs for Indonesia and Korea show that almost 8(23) percent of the forecast error variance in BD can be explain by CAD at the end of the 24-quarter horizon. This provides strong direct causality originating from CAD to BD. The same scenario was provided in the post-crisis period (Table 8). As the exogenous variable in the system, CAD explains 63 percent (Indonesia) and 16 percent (Korea) of the forecast error variance in BD for the entire forecast horizon. In this case, BD seems to be the endogenous variable in the system for both the sub-samples in these countries.

In contrast, changes in CAD are largely due to the movement in BD for Malaysia, the Philippines and Thailand in the pre-crisis period (Table 7). For example, innovation in BD explains 37 percent of the Philippines's and 62 percent of Thailand's CAD variance at the 24-quarter horizon. In the post-crisis period, 62(20) percent of CAD is being explained by innovations in BD (CAD) in Thailand. The same applies to the Philippines where BD exhibits similar quantitative patterns (see Panels D Table 7). Interestingly, at the end of 24 quarters, it is found that 5 percent of CAD is explained by BD while we observe that the effect of CAD on BD appears to be become weaker as the horizon increases (see Panel C, Table 7). These results are consistent with the earlier findings from the Granger causality tests. These as well as other results from the dynamic analysis are summarised in Tables 7 and 8.

5. CONCLUSION

Applying standard time series estimations, we find evidence supportive of a long run cointegration relationship between CAD and BD for all countries except the Philippines in the period prior to the 1997 Asian financial crisis. On the other hand, only two countries support the cointegration equilibrium in the post-crisis era: Malaysia and Thailand. We document that the strength of the relationship between the two deficits varies across the former crisis hit Asian-5 countries. For example, the evidence from the causality experiment supports the twin deficits hypothesis for Malaysia and Thailand (invariant to sampling period) while for the Philippines only in the pre-crisis period. Thus, it is clear that budget cuts (fiscal discipline) correct the CAD directly for these countries. Moreover, the strength and robustness of the causality path are well supported by the GVDCs analysis.

A different picture emerges for Indonesia and Korea, supporting Summer's (1988) view of current account targeting. There is evidence to suggest that the Indonesian and Korean authorities utilised BD to target their

Table 7: Generalised Variance decomposition (pre-crisis)

Percentage of variations in:	*Horizon (Quarters)*	*Due to innovations in*	
		CAD	*BD*
A: Indonesia			
Quarters Relative Variance in: CAD	1	**97.375**	2.625
	4	**98.313**	1.687
	8	**98.887**	1.113
	24	**99.409**	0.591
Quarters Relative Variance in: BD	1	1.782	**98.218**
	4	6.402	**93.598**
	8	6.979	**93.021**
	24	7.749	**92.251**
B: Korea			
Quarters Relative Variance in: CAD	1	**97.815**	2.185
	4	**95.896**	4.104
	8	**95.537**	4.463
	24	**95.318**	4.682
Quarters Relative Variance in: BD	1	5.784	**94.216**
	4	7.591	**92.409**
	8	12.105	**87.895**
	24	23.090	**76.910**
C: Malaysia			
Quarters Relative Variance in: CAD	1	**98.970**	1.030
	4	**98.850**	1.150
	8	**98.780**	1.220
	24	**98.770**	1.230
Quarters Relative Variance in: BD	1	0.615	**99.385**
	4	0.938	**99.062**
	8	0.812	**99.188**
	24	0.348	**99.652**
D: Philippines			
Quarters Relative Variance in: CAD	1	**99.211**	0.789
	4	**90.746**	9.254
	8	**83.423**	16.577
	24	**63.055**	36.945
Quarters Relative Variance in: BD	1	0.330	**99.670**
	4	1.232	**98.768**
	8	1.252	**98.748**
	24	1.083	**98.917**
E: Thailand			
Quarters Relative Variance in: CAD	1	**91.936**	8.037
	4	**93.852**	6.148
	8	**77.305**	22.695
	24	**37.720**	62.280
Quarters Relative Variance in: BD	1	6.520	**93.480**
	4	5.716	**94.284**
	8	6.616	**93.384**
	24	8.675	**91.325**

Note: The columns in bold represent their own shock.

8able 7: Generalised Variance decomposition (post-crisis)

Percentage of variations in:	*Horizon (Quarters)*	*Due to innovations in* *CAD*	*BD*
A: Indonesia			
Quarters Relative Variance in: CAD	1	**80.115**	19.885
	4	**81.749**	18.251
	8	**83.010**	16.990
	24	**85.506**	14.494
Quarters Relative Variance in: BD	1	19.802	**80.197**
	4	33.978	**66.021**
	8	48.113	**51.886**
	24	62.599	**37.400**
B: Korea			
Quarters Relative Variance in: CAD	1	**93.190**	6.810
	4	**95.344**	4.656
	8	**95.504**	4.496
	24	**94.831**	5.169
Quarters Relative Variance in: BD	1	6.437	**93.562**
	4	7.564	**92.435**
	8	9.426	**90.573**
	24	15.804	**84.195**
C: Malaysia			
Quarters Relative Variance in: CAD	1	**96.820**	3.179
	4	**96.258**	3.741
	8	**95.973**	4.026
	24	**94.926**	5.073
Quarters Relative Variance in: BD	1	2.222	**97.778**
	4	1.065	**98.935**
	8	0.727	**99.273**
	24	0.487	**99.513**
D: Philippines			
Quarters Relative Variance in: CAD	1	**85.221**	14.778
	4	**76.945**	23.054
	8	**71.195**	28.804
	24	**66.969**	33.030
Quarters Relative Variance in: BD	1	24.421	**75.578**
	4	28.303	**71.696**
	8	29.077	**70.922**
	24	29.503	**70.496**
E: Thailand			
Quarters Relative Variance in: CAD	1	**98.840**	1.160
	4	**70.805**	29.195
	8	**57.049**	42.951
	24	**37.983**	62.017
Quarters Relative Variance in: BD	1	7.570	**92.430**
	4	16.847	**83.153**
	8	18.660	**81.340**
	24	20.321	**79.679**

Notes: As per Table 7.

CAD for the sample period under investigation. Only for the case of the Philippines (post-crisis) did the outcome support a two-way causality between the two deficits. Perhaps, the mirror relationship implies that the fiscal and trade policies in the Philippines are not sustainable. A further implication is that one simply cannot rely on cutting down the BD by raising national savings in an attempt to reduce the CAD. In this sense, the budget variable is not a fully controlled policy (exogenous) variable. The authorities should pay close attention to this phenomenon.

An important question to emerge is, where do these countries go from here? As the 1997 crisis is more than a decade ago, the economies now face a new challenge. Under the present conditions of the world economy, huge debt imbalances might lead to a hard landing for countries that appear to be insolvent. Looking ahead, managing these deficits is indeed an important national agenda item for these countries. Along this line, sustaining BD and CAD complemented with an appropriate policy coordination of monetary and fiscal blend are necessary to promote macroeconomic stability and sustainability in the region. Also, export promotion may be another policy option that the authorities may pursue due to the 'virtuous' cyclical impact to the economy. With the global uncertainties and interest of interdependence among the countries in the region, it is clear that the twin deficits are seemingly apparent in the global context.

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Endnotes

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2. At least three important developments in the global economy: (1) the appreciation of the dollar and the unusual shift in current account as well as fiscal deficits, which is not in favour of the US during the 1980s; (2) countries in Europe (e.g. Germany and Sweden) faced problems in the early stages of the 1990s where the rise in budget deficits was accompanied by a real appreciation of their national currencies that adversely affected their current accounts (see Ibrahim and Kumah, 1996). The fiscal expansion following the unification of Germany, which moved the DM and interest rate

upwards, also raised a lively debate on the twin deficit issue and; (3) in East Asia, most of the regional currencies lost value prior to the 1997 financial crisis. Most of these countries (ASEAN in particular) experienced large and persistent current account deficits. In fact, Milesi-Ferretti and Razin (1996) and Monetary Authority of Singapore (1997) point out that the fiscal expansion (budget deficit) contributed to the deterioration of the external balance (current account) in most ASEAN countries.

3. A series of papers in the special issue of *Journal of Policy Modeling* (Vol. 28 No.6, pp. 603-712, 2006) are dedicated to the debate on 'Twin deficits, growth and stability of the US economy'. The interest arises due to the recent declines in the US current account and fiscal balances and the impact to the world economic instability.

4. To get Equation (3), one may decomposed the government spending into government consumption and investment categories as $G = C_G + I_G$ where C_G includes expenditure on defence, education, health and social security while I_G is the fixed capital formation component of machinery, equipment and buildings. Substitute into (2) $CA = Y - (C + I + C_G + I_G)$. Rearranged to become $CA = (Y - C - C_G) - (I + I_G)$ which equals $CA = S - I$ or $S = I + CA$ as (3) above.

5. This is especially true for a small open developing economy that depends on foreign capital inflows (e.g. foreign direct investment) to finance its economic development (Baharumshah *et al.*, 2006). In other words, the budget position of a country will be affected by large capital inflows or through debt accumulation and with that a country will eventually run into a budget deficit. The experience of Latin American countries and to some extent the East Asian countries fits this scenario (Reisen, 1998).

6. Alternatively, the ADF equation is defined as $\Delta y_t = K + \alpha \ y_{t-1} + \beta \ t + \sum_{j=1}^{k} d_j \Delta \ y_{t-j} + \mu_t$ for a unit root of variable y_t , t = 1, ..., T is an index of time, Δy_{t-j} is the lagged first differences to accommodate serial correlation in the errors, μ_t the error term, K being the intercept term and β_t contains the trend.

7. The F-test or Wald χ^2 of the explanatory variables (in first differences) indicates the short run causal effects ($\phi_{2,i} = 0$ for all i) while the long run causal (μ_2 = 0) relationship is implied through the significance of the lagged ECT which contains the long run information.

8. The lag structures were conveniently determined before the cointegration analysis. See section 4.2 for the detail elaboration while Appendix A contain the empirical results.

9.As per advice of the editor of the journal, we update the data period to 2008Q1.

10. Quarterly observations of GDP were extrapolated from the annual series employing the Gandolfo (1981) quadratic interpolation approach that was also outlined in Bergstrom (1990).

11. A full set of the diagnostic tests for each of the countries is available from the authors upon request.

12. The discussion is based on a sampling period from 1976:Q1 to 2008:Q1. We find consistent results from the earlier version of the paper where ending sampling period differs by each country (Korea, Malaysia and the Philippines 1976Q1 - 2006Q1, Indonesia 1976Q1 - 2004Q4 and Thailand, 1976Q1 - 2005Q4). We are grateful to the editor and the anonymous referees for drawing our attention to this issue.

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