

FULL TITLE : Budget and Current Account Deficits in SEACEN Countries: Evidence Based on the Panel Approach.

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Budget and Current Account Deficits in SEACEN Countries: Evidence Based on the Panel Approach

ABSTRACT: In this paper, the twin deficits hypothesis was examined using data of nine SEACEN countries. To compensate for the lack of time series observations, data was pooled from the nine countries into one panel. The effects of interest rate and exchange rate in the causal chain between budget and current account deficits were stressed. At the empirical level, there is enough evidence to support the view that Asian budget deficit causes current account deficit directly as well as indirectly. From the policy perspective, the statistical analysis suggests that managing budget deficit offers scope for improvement in the current account deficit. However, this finding does not support the policy of manipulating the intermediate variables to reduce the twin deficits to a sustainable level since these variables appear to be endogenous in the system.

1. Introduction

Most observers consider large and persistent current account deficits to be the cause of macroeconomic imbalances that have important implications on long-term economic progress. Numerous researchers have explored the possible long-run (positive) link between budget and current account deficits. The so-called ‘twin deficits hypothesis’ that emerged in the 1980s marked a period of strong appreciation of the dollar and an unusual shift in current account as well as fiscal deficits, not in favor of the US¹. This close connection between current and budget deficits is not unique to the US. Countries in Europe (e.g. Germany and Sweden) faced similar problems in the early part of the 1990s where the rise in budget deficits was accompanied by a real appreciation of their national currencies that adversely affected the current accounts (see Ibrahim and Kumah, 1996).

Developing economies have also experienced the simultaneous upsurge of budget and current account deficits (Laney, 1984; Khalid and Teo, 1999; Anoruo and

Ramchander, 1998; Edwards, 2001; Megarbane, 2002)². In fact, writers like Laney (1984) for instance, tested for the significance of the relationship between budget and current account deficits in 59 countries. Laney noted that the unsustainable budget (debts) in the early 1980s had widened the current account deficits and went on to say that the relationship between these two variables is much stronger in the developing countries. For instance, Latin America countries (Mexico, Brazil, Venezuela and Argentina) went through an international debt crisis. The high debts obligation was due to the oil price shocks of the 1970s leading to inflationary import prices, which in turn led to serious balance of payments problems. Indeed the lending momentum burst in August 1982, when the Mexican government was unable to meet its debt obligation.

Meanwhile, the article by Milesi-Ferretti and Razin (1996) and the Monetary Authority of Singapore (1997) addressed the twin deficits issues in the ASEAN. The results of these investigations showed that the fiscal position for most of these countries provided a reasonable explanation for the current account deficits in the 1980s and early 1990s. The fiscal and the external balances followed a joint path in the ASEAN countries, and hence were supportive of the twin deficit hypothesis.

The emergence of the current account and budget deficits phenomenon in many of the countries has drawn increasing attention to the problem of twin deficits. The 1994 Mexican crisis was the outcome of a long term debt crisis. Before the collapse, the economy recorded a current account deficit of 6.8 to 8.0 percent of the GDP, primarily due to the appreciation of the peso and declining in domestic savings rates. Pegging the peso and high interest rates combination caused influx of capital inflows

(private short term debts). On the same course, the East Asian countries also experienced a significant appreciation of their currencies during the 1997/98 crises. Real appreciation of the currency contributed to the slowdown in exports and trade deficits³.

A review of the literature in the last two decades suggests the following: first, it highlights the importance of financial variables such as interest rate and exchange rate in the budget-current account deficit nexus. Most of the earlier studies have ignored the role of these two financial variables in bridging the link between the two deficits. Second, unlike the debt crises of the 1980s that was driven by a budget deficit, the 1994 Mexican and the 1997-98 East Asian crises were due to imbalances in the current account. Third, the body of evidence has not yielded a consensus on the causal relationship between the two deficits. In our view this is important, as it will determine the source of the problem and provide the right policy mix to address the issue of external imbalances in the developing countries. For instance, if large government deficits cause the current account to move into deficit then the policy recommendation is clear – maintaining a large fiscal deficit will not correct the current account deficit. On the other hand, if the causal relationship is just the opposite than policies that do not address capital movements will not alter the current account deficit and the consequent fiscal position as well as the problems associated with large fiscal deficits.

Motivated by the work of McCoskey and Kao (1999) and the emergence of the twin deficits phenomenon in many countries in the last decade, this paper first attempts to provide an in-depth analysis of the twin deficits for a panel of South East Asian

Central Banks countries (SEACEN: Malaysia, Singapore, Thailand, Indonesia, South Korea, Myanmar, Nepal, Sri Lanka and the Philippines). The second objective of this paper is to trace the transmission mechanism through which fiscal budget affects current account deficit. The present article relies on previous work rather than develop a macroeconomic model to trace the linkage channel between the two deficits. A simple correlation analysis on all the sampled countries revealed a relatively high correlation (r) between current account and budget deficits, ranging from $r=0.73$ (Myanmar) to $r=0.92$ (Thailand). Interestingly, we also found that the average correlation of the SEACEN countries is also high ($r=0.88$).

The article contributes to existing literature in the following ways: first, to accomplish the two objectives, we drew on recent advances in the panel unit root technique adopted from Im *et al.* (1997) and the residual based multivariate panel cointegration tests pioneered by Pedroni (1997, 1999)⁴. In addition, we utilized the dynamic OLS (DOLS) method proposed in Kao and Chiang (2000) to establish the causal linkage between the two deficits. The inclusion of lags and leads variables eliminates the effect of endogeneity of the regressors, while the lagged difference of the dependent variables corrects the impact of the remaining autocorrelation of the residual. Second, we extended the twin deficits hypothesis to include two mediating variables, namely the short term interest rates and exchange rates and investigated their influence on the twin deficits nexus. These variables as we will show later allowed us to map out the transmission mechanism among the four variables in the dynamic panel VAR setting⁵. The articles by Abell (1990a, b), Enders and Lee (1990), Vamvoukas (1999) and Piersanti (2000), among others, found strong evidence to support the view that causality runs from a budget deficit to higher interest rate, to foreign capital inflow, to

an appreciation of the exchange rate and finally to trade deficit⁶. According to this view, budget deficit will impact the supply and demand of loans and this put a pressure on the interest rate, which in turn affects the trade balance.

The plan of the paper is as follows. Section 2 presents the relevant literature on the genre. Section 3 describes the simple macro foundation framework of national accounting for analyzing the causal relationship of the twin deficits. In Section 4, we briefly discuss the panel-based testing procedure and the data utilized. The empirical results are reported in Section 5. Finally, Section 6 contains concluding remarks and policy stance.

2. Previous Empirical Debate

The literature on the host subject is mainly centered on two major theoretical tenets. However, these are not the only possible outcomes between the two deficits. In fact, four testable hypotheses may arise from the twin deficits phenomenon. The first testable hypothesis is based on the conventional approach that employed macroeconomic models constructed from postulated behavioral relationship that purport to describe how the economy works in aggregate without explaining the behavior of the agents which make up the economy. Theoretically, using the well-known Mundell-Fleming model, some writers argued that an increase in budget deficit would induce upward pressure on interest rates, causing capital inflows, appreciation of exchange rates and deterioration in current account⁷. Hence, the conventional proposition suggests a positive and unidirectional Granger causality that runs from budget deficit to current account deficit. Researchers like Zietz and Pemberton (1990), Vamvoukas (1999), Piersanti (2000), Akbostanci and Tunç (2001)

and Leachman and Francis (2002), among others, found sufficient evidence to support this view.

Second, Buchanan (1976) rediscovered Ricardo's proposition known as the Ricardian Equivalence Hypothesis (hereafter REH) in the seminal work of Barro (1974). According to this view, an intertemporal shift between taxes and budget deficits does not matter for real interest rate, investment or current account balance. In the Ricardian proposition, the current account is viewed as the solution to a dynamic optimization problem where the objective is to allocate consumption optimally over time. Hence, the absence of any causality relationship between the two deficits would be in accordance with the REH. The empirical evidence found in Miller and Russek (1989), Enders and Lee (1990), Rahman and Mishra (1992), Evans and Hasan (1994) and Kaufmann *et al.* (2002), to name a few, is found to be consistent with Ricardian equivalence.

Third, a unidirectional causality that may run from current account to budget deficit may also exist. This outcome occurs when the deterioration in current account leads to a slower pace of growth and hence an increase in the budget deficit. In other words, large capital inflows due to debt accumulation will eventually lead to fiscal deficit. This reverse causation is termed 'current account targeting' by Summers (1988). He argued that external adjustment may be sought via fiscal policy. This causal pattern may be more relevant for developing countries that have accumulated large foreign debts. Recently, Alkswani (2000) provided empirical evidence on reverse causation between the two deficits for Saudi Arabia⁸. The study by Anoruo and Ramchander (1998) found trade deficit to cause fiscal deficit in some Asian countries. They argued

that governments in developing countries might engage in fiscal stimulus to lessen the deleterious economic and financial consequences of large trade imbalances. The economic slowdowns brought about by huge current account deficits not only increased government spending but also reduced tax revenue.

Finally, a bi-directional causality between the two deficits is also possible, that is, budget deficit Granger causes current account deficit and vice-versa (see the work by Darrat, 1988; Biswas *et al.*, 1992 and Normandin, 1999, to name a few). These authors went on to argue that in a bi-directional relationship, budget cut in isolation will not be effective to resolve a current account deficit dilemma. In fact, complementary options such as interest rate policy, exchange rate policy, trade policy with a budget cut are better options. The graphical representations of the transmission mechanism for the four testable possible outcomes are shown in Figure 1.

[Insert Figure 1]

The discussion above suggests the existence of a significant body of literature addressing the twin deficits issue with all the above-mentioned papers sharing a common feature. The modelling strategy has generally relied on pure time series data with the exception of the study by McCoskey and Kao (1999). The combination of 13 OECD countries into one panel yields inconclusive results as they found that the null of no cointegration to be accepted for most of the cases. Although a panel test is tempting especially for the goal of increasing power ability, poolability has to be interpreted with caution and in this example, it raised the empirical validity and accuracy of the twin deficits phenomenon.

3. Macro Accounting Framework

The macroeconomic accounting framework starts with the national income identity for an open economy that can be represented as

$$Y = C + I + G + X - M \quad (1)$$

where Y = gross domestic product (GDP), C = consumption, I = investment, G = government spending, X = export and M = import. Defining current account (CA) as the difference between export (X) and import (M), equation (1) becomes

$$CA = Y - (C + I + G) \quad (2)$$

where $(C + I + G)$ is spending of domestic residents (domestic absorption). Given that $Y - C = S$, equation (2) can be reexpressed as

$$S = I + CA \quad (3)$$

In a closed economy, $CA = 0$ and savings equals investment ($S = I$). Equation (3) states that unlike a closed economy, an open economy can seek necessary funds for investments both domestically and internationally to enhance its income. Hence, external borrowing allows domestic investment at levels beyond those that could be financed through national savings. If national savings exceed investment, the economy lends to the rest of the world and if the national savings are less than domestic investment, the current account is in deficit and it is necessary to borrow externally to finance the domestic investment. The national savings can further be decomposed into private (S_p) and government savings (S_g)

$$S_p = Y - T - C \quad (4)$$

where government savings (S_g) is the difference between tax revenue (T) and government expenditure (G)

$$S_g = T - G \quad (5)$$

Substituting equations (4) and (5) into equation (3) we have,

$$S_p = I + CA + (G-T) \quad (6)$$

or

$$CA = S_p - I - (G - T) \quad (7)$$

Equation (7) states that an increase in government spending will either crowd out private investment or lead to an inflow of foreign capital (or both) provided that there is no increase in taxes and private savings. In other words, if private savings and domestic investment are equal, or at least move in the same amount, then fiscal and external balances would be twin (see also Laney, 1984). It is also important to note that the response of private domestic investment (I) and foreign savings to a larger fiscal deficit depends on the degree of capital mobility. If capital mobility is high as in the case of most of the countries under investigation, then domestic interest rates will be relatively inelastic to a fiscal stimulus. It follows that an increase in budget deficit does not crowd out investment since foreign capital quickly offsets the fall in domestic savings that the fiscal deficit generates. The capital inflows put upward pressure on real exchange rate through either a rising of nominal exchange rate (under flexible rates) or a rising domestic price level (under fixed rates). Therefore, government deficit ultimately worsens current account deficit. This line of argument supports the conventional approach of Mundell-Fleming¹⁰.

At the other end of the spectrum, lies the Ricardian Equivalence Hypothesis. According to this hypothesis, consumers foresee a future increase in taxes following an increase in budget deficit. Knowing that 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 is no subsequent effect on the current account deficit as budget deficit increases.

4. Methodology and Data

The nature of the twin deficits phenomenon allows for the adoption of the cointegration and nonstationarity data analysis. In this section, a brief discussion on the methodology – the panel unit root, panel cointegration and the Granger causality tests conducted in the environment of dynamic OLS (DOLS) panel VAR framework – are provided. The last sub-section provides the data description.

4.1 Panel Unit Root Test

As in time series analysis, the first step in the estimation of dynamic panels is to test whether the variables at hand contain unit roots. To this end, we applied the mean group approach of t-bar test of Im *et al.* (1997, IPS)¹¹. The IPS test allows for the heterogeneity of dynamics and error variances across groups in the panel, which has superior power performance than the competing tests of ADF (single equation unit root procedure) and that of Levin and Lin's (1993, LL) panel raw unit root test (see also Levin *et al.*, 2002). Provided with this reason, we adopted the IPS procedure to test the nonstationarity of the variables under investigation. The IPS evaluates the null hypothesis as $H_0: \beta_i = 0$ for all i , against the alternative that all the series are stationary, $H_1: \beta_i < 0$ for all i . In short, the test statistics of t-bar are given as

$$\Gamma_i = \frac{\sqrt{N} \{\bar{t}_{NT} - E(t_T | \beta_i = 0)\}}{\sqrt{\text{Var}(t_T | \beta_i = 0)}} \Rightarrow N(0,1), \text{ where } \bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^N t_{iT} \quad (8)$$

such that \bar{t}_{NT} is the average augmented Dickey-Fuller (ADF) t-statistics for individual countries. The terms $E(t_T | \beta_i = 0)$ and $\text{Var}(t_T | \beta_i = 0)$ are the finite common mean

and variance of the individual ADF statistics t_{iT} , tabulated in IPS. The test statistics converge to the standard normal distribution as T (time periods dimension) and N (cross-sectional dimension of the panel) tend to infinity and N/T tends to zero under the null hypothesis of unit roots, $\beta_i = 0, i=1,2 \dots N$.

4.2 Panel Cointegration

If the relevant variables in the panel are nonstationary, the system can be tested for cointegration. Pedroni (1997; 1999) developed a number of statistics based on the residuals of the cointegrating regression. This system allows different individual effects across N or the cross-sectional interdependency. In particular, Pedroni's test is based on the null hypothesis of no cointegration versus the alternative hypothesis that suggests that the variables in the multi-country setting form a cointegrating relationship. Assuming a panel of N countries each with m regressors (X_m) and T time observations, generally the long run model may take the form

$$Y_{i,t} = \alpha_i + \phi_i t + \eta_{1i} X_{1i,t} + \eta_{2i} X_{2i,t} + \dots + \eta_{Mi} X_{Mi,t} + \varepsilon_{i,t} \quad (9)$$

for $t=1, \dots, T; i=1, \dots, N; m=1, \dots, M$

Equation (9) implies that all coefficients, and hence the cointegrating vector, vary across countries thus permitting full heterogeneity (η_i) and fixed effects (α_i). In addition, for some applications, we may also wish to include deterministic time trends which are specific to individual members of the panel and are captured by the term $\phi_i t$, although it will often be the case that we choose to omit these $\phi_i t$. Based on the cointegrating residuals, $\varepsilon_{i,t}$, Pedroni (1997; 1999) developed seven panel cointegration statistics for testing the null hypothesis of no cointegration. Panel ν -Statistic, Panel ρ -Statistics, Panel t -Statistic (non-parametric) and Panel t -Statistic (parametric) are

commonly referred to as within-dimension or panel cointegration test. The remaining three test statistics, the Group ρ -Statistics, the Group Panel t -Statistic (non-parametric) and the Group t -Statistic (parametric) are based on pooling along what is commonly referred to as between-dimension or group mean panel statistics¹². Specifically, the within-dimension statistics are constructed by summing up both the numerator and the denominator terms over the N dimension separately, whereas the between-dimension statistics are constructed by first dividing the numerator by the denominator prior to summing up over the N dimension.

For the within-dimension statistics, the test for the null hypothesis of no cointegration is implemented as a residual based test of $H_0: \gamma_i = I$ for all i , versus the alternative hypothesis $H_1: \gamma_i = \gamma < I$ for all i , so that it presumes a common value for $\gamma_i = \gamma$. In contrast, for the between-dimension statistics the null hypothesis of no cointegration is implemented as a residual based test of the null hypothesis $H_0: \gamma_i = I$ for all i , versus the alternative hypothesis $H_1: \gamma_i < I$ for all i . Here it does not presume a common value for $\gamma_i = \gamma$ under the alternative hypothesis which implies that the within dimension based statistics allow one to model an additional source of potential heterogeneity across individual members of the panel. Pedroni (1999) shows that under appropriate standardization based on the moments of vector of Brownian motion function, each of these statistics converges weakly to a standard normal distribution when both the T and N of the panel grow large. The standardized distributions for the above mentioned seven panel and group statistics can be expressed in the form of

$$\frac{e_{N,T} - \mu\sqrt{N}}{\sqrt{V}} \Rightarrow N(0,1) \quad (10)$$

where e_{NT} is the respective panel/group cointegration statistic and μ and ν are the expected mean and variance of the corresponding statistics. They are computed by Monte Carlo stochastic simulations and tabulated in Pedroni (1999, Table 2).

4.3 Granger Causality (DOLS Panel VAR Estimator)

Once the null hypothesis of no cointegration has been rejected, the coefficients of the long run relationships can be estimated using the Kao and Chiang (2000) DOLS method based on the Stock and Watson (1993) estimator for time series. Intuitively, the DOLS procedure involves running the following regression of

$$CAD_{i,t} = \alpha_i + \beta_1 BD_{i,t} + \beta_2 IR_{i,t} + \beta_3 EXC_{i,t} + \sum_{j=-q}^q c^1_{ij} \Delta BD_{i,t+j} + \sum_{j=-q}^q c^2_{ij} \Delta IR_{i,t+j} + \sum_{j=-q}^q c^3_{ij} \Delta EXC_{i,t+j} + \varepsilon_{it} \quad (11)$$

where $t = 1, \dots, T$ and $i = 1, \dots, N$. Equation (11) includes the leads and lags of $\Delta BD_{i,t}$, $\Delta IR_{i,t}$ and $\Delta EXC_{i,t}$ in the cointegrating regressions in order to produce asymptotically unbiased estimators and to avoid the problem of estimating nuisance parameters¹³. However, our key interest in this study is to determine the causal relationship existing between the current account deficit and its determinants. In order to establish the causal linkages between CAD, BD, IR, EXC, we built the four-dimensional panel VAR system upon the DOLS framework.

The empirical model is given by

$$\begin{aligned}
\begin{pmatrix} CAD_{it} \\ BD_{it} \\ IR_{it} \\ EXC_{it} \end{pmatrix} &= \begin{pmatrix} \alpha_{1it} \\ \alpha_{2it} \\ \alpha_{3it} \\ \alpha_{4it} \end{pmatrix} + \begin{pmatrix} 0 & \beta_{12}^{(1)} & \beta_{13}^{(1)} & \beta_{14}^{(1)} \\ \beta_{21}^{(1)} & 0 & \beta_{23}^{(1)} & \beta_{24}^{(1)} \\ \beta_{31}^{(1)} & \beta_{32}^{(1)} & 0 & \beta_{34}^{(1)} \\ \beta_{41}^{(1)} & \beta_{42}^{(1)} & \beta_{43}^{(1)} & 0 \end{pmatrix} \begin{pmatrix} CAD_{it} \\ BD_{it} \\ IR_{it} \\ EXC_{it} \end{pmatrix} + \begin{pmatrix} \varphi_{11}^{(1)} & \varphi_{12}^{(1)} & \varphi_{13}^{(1)} & \varphi_{14}^{(1)} \\ \varphi_{21}^{(1)} & \varphi_{22}^{(1)} & \varphi_{23}^{(1)} & \varphi_{24}^{(1)} \\ \varphi_{31}^{(1)} & \varphi_{32}^{(1)} & \varphi_{33}^{(1)} & \varphi_{34}^{(1)} \\ \varphi_{41}^{(1)} & \varphi_{42}^{(1)} & \varphi_{43}^{(1)} & \varphi_{44}^{(1)} \end{pmatrix} \begin{pmatrix} \Delta CAD_{it-1} \\ \Delta BD_{it-1} \\ \Delta IR_{it-1} \\ \Delta EXC_{it-1} \end{pmatrix} + \dots \\
&+ \begin{pmatrix} \varphi_{11}^{(q)} & \varphi_{12}^{(q)} & \varphi_{13}^{(q)} & \varphi_{14}^{(q)} \\ \varphi_{21}^{(q)} & \varphi_{22}^{(q)} & \varphi_{23}^{(q)} & \varphi_{24}^{(q)} \\ \varphi_{31}^{(q)} & \varphi_{32}^{(q)} & \varphi_{33}^{(q)} & \varphi_{34}^{(q)} \\ \varphi_{41}^{(q)} & \varphi_{42}^{(q)} & \varphi_{43}^{(q)} & \varphi_{44}^{(q)} \end{pmatrix} \begin{pmatrix} \Delta CAD_{it-q} \\ \Delta BD_{it-q} \\ \Delta IR_{it-q} \\ \Delta EXC_{it-q} \end{pmatrix} + \begin{pmatrix} \delta_{11}^{(1)} & \delta_{12}^{(1)} & \delta_{13}^{(1)} & \delta_{14}^{(1)} \\ \delta_{21}^{(1)} & \delta_{22}^{(1)} & \delta_{23}^{(1)} & \delta_{24}^{(1)} \\ \delta_{31}^{(1)} & \delta_{32}^{(1)} & \delta_{33}^{(1)} & \delta_{34}^{(1)} \\ \delta_{41}^{(1)} & \delta_{42}^{(1)} & \delta_{43}^{(1)} & \delta_{44}^{(1)} \end{pmatrix} \begin{pmatrix} \Delta CAD_{it+1} \\ \Delta BD_{it+1} \\ \Delta IR_{it+1} \\ \Delta EXC_{it+1} \end{pmatrix} + \dots \\
&+ \begin{pmatrix} \delta_{11}^{(q)} & \delta_{12}^{(q)} & \delta_{13}^{(q)} & \delta_{14}^{(q)} \\ \delta_{21}^{(q)} & \delta_{22}^{(q)} & \delta_{23}^{(q)} & \delta_{24}^{(q)} \\ \delta_{31}^{(q)} & \delta_{32}^{(q)} & \delta_{33}^{(q)} & \delta_{34}^{(q)} \\ \delta_{41}^{(q)} & \delta_{42}^{(q)} & \delta_{43}^{(q)} & \delta_{44}^{(q)} \end{pmatrix} \begin{pmatrix} \Delta CAD_{it+q} \\ \Delta BD_{it+q} \\ \Delta IR_{it+q} \\ \Delta EXC_{it+q} \end{pmatrix} \tag{12}
\end{aligned}$$

To test whether BD does not Granger cause movement in CAD, the null hypothesis

$$H_0: \beta_{12}^{(1)} = \varphi_{12}^{(1)} = \varphi_{12}^{(2)} = \dots = \varphi_{12}^{(q)} = \delta_{12}^{(1)} = \delta_{12}^{(2)} = \dots = \delta_{12}^{(q)} = 0 \quad \text{was tested against the}$$

alternative of Granger causality. The Wald test was employed to establish the long run

causality between these variables, which followed χ^2 distribution with p degree of

freedom. Moreover, the twin deficits phenomenon is a long run behavioral

relationship that requires methodologies for estimating long run equilibria. Thus, the

application of the dynamic panel VAR Granger causality method is suitable for

permitting the estimation of long run equilibrium states in establishing the direction of

the causality.

4.4 Data Description

Annual, rather than quarterly time series data, beginning 1980 and ending 2001 for all

the nine SEACEN countries were utilized in this paper. All data, which were not

seasonally adjusted and expressed in nominal terms, were obtained from several

issues of *SEACEN Financial Statistics* (SFS)¹⁴. The variables employed in the study are the current account deficit (CAD), the budget deficit (BD), the nominal exchange rate (EXC) denominated in US dollar and short term interest rate (IR). While conducting the panel-based procedure, we build upon a panel of four-dimensional variables with nine countries. In this sense, each of the variables, for instance CAD would have 198 observations ($t=22, n=9$) where t is the number of time series and n is the cross sectional units (countries). Both the CAD and BD are expressed as a ratio of the nominal gross domestic product (GDP). For most countries, the CAD and BD are expressed in domestic currency. For consistency in the panel, all the variables are expressed in US dollars.

5. Empirical Results

5.1 IPS Unit Root Test

To identify possible unit roots, the IPS test was performed on levels and then on first differences. The results summarized in Table 1 unanimously show that using panel data, we can reject the null hypothesis of nonstationarity at the 5 percent significance level when estimating the first differences. These results indicate that all the series are stationary in the first difference or all the series are generated by an $I(1)$ process when the individual country data are pooled together.

[Insert Table 1]

5.2 Pedroni Test

On determination of the presence of unit root in the variables, we proceeded to the panel cointegration tests. From the cointegration results in Table 2, we found strong

evidence to reject the null hypothesis of no cointegration for five out of the seven statistics provided by Pedroni (1999). Rejecting the null hypothesis of no cointegration between the $I(1)$ series in the panel implies that the four variables do not drift apart in the long run steady state relationship. More importantly, the results indicate the benefits of using pooled panel data from which more variability can be exploited from the cross-sectional information. Despite the disparities in the individual countries, we found CAD, BD, IR and EXC are cointegrated in the multi-country setting.

[Insert Table 2]

5.3 Dynamic Panel VAR Granger Causality

Several studies have examined cointegrating relationship between fiscal deficit and current account deficit and their results could not reject the null hypothesis that the two deficits are not cointegrated. Thus, the findings so far concur with the earlier work (e.g. Abell, 1990 a,b). While cointegration is necessary, however, it does not verify channels of interaction between the current account and fiscal deficit in the short run. Hence, more analysis of channels of interactions in the short and long run is necessary.

Given the fact that all the series under investigation are cointegrated, Equation (12) was estimated using the DOLS method adopted from Kao and Chiang (2000). The main interest of the whole exercise is to establish the causal linkages among the four-dimensional systems provided in Equation (12). The empirical results portrayed in Table 3 suggest that the null hypothesis that budget deficit does not cause current

account deficit is easily rejected at the 5 percent significance level. Moreover, the Wald test reveals bi-directional causal relations between the two variables. This suggests that internal deficit is not the prime cause of the external deficit and it is seen that the reverse causation running from external to internal deficits is much stronger in terms of significance¹⁵. This tallies with the earlier works by Anoruo and Ramchander (1998) and Khalid and Teo (1999) based on the experiences of the developing countries. Indeed, Khalid and Teo (1999) noted that a high connection between the two deficits is more likely to occur in the developing rather than the developed economies¹⁶. This finding appears to be at odds with the conventional view which emphasizes that the causal relationship runs from budget deficit to current account deficit and not vice versa.

[Insert Table 3]

The endogeneity of two deficit variables warrants an investigation into the indirect causality that may exist in the twin deficits phenomenon. This is important as it allows for the mapping of the role of the causing variables (interest and exchange rates) as well as the indirect causal relationship in the twin deficits hypothesis. Specifically, the causal chain that runs from budget deficits to interest rate, to capital flows, to exchange rate and finally to the current account deficit (BD→IR→EX→CAD) (see Volcker, 1984; Abell, 1990a, b). Table 3 reports that budget deficit Granger causes current account deficit by operating through the channel of exchange rate and interest rate. Earlier, the bi-directional causality existing among the two deficits was detected. As a matter of fact, these causal movements complete the whole story of the twin deficits debate.

The non-stationary panel data approach offers a more promising explanation in the empirical world given the well-known power deficiencies which plague pure time-series based tests for unit roots and cointegration (Banerjee, 1999). Although several advantages of the panel-based procedures exist especially in increasing power ability from the single equation counterparts and exploiting the cross-sectional variability among these nine Asian countries, the poolability had to be interpreted with caution. In this study, this caution was incorporated by estimating the relationship between current account balance and fiscal balance using the country-specific setting. Due to the limited time series observations, the *Granger non-causality* linkages between the two deficits was tested using the modified WALD (MWALD) proposed by Toda and Yamamoto (1995), allowing for causal inference to be conducted in the level VARs that may contain integrated and (non-) cointegrated processes whether the individual variables are $I(0)$, $I(1)$ or $I(2)$ process¹⁷.

Overwhelmingly, the results from the bivariate VAR model support the findings of bi-directional causality in the panel VAR setting. Specifically, bi-directional causality (BD↔CAD) existed in six out of nine countries under investigation (see Table 4). For the remaining countries, two support the conventional twin deficits hypothesis (BD→CAD) while Myanmar follows Summer's proposition of current account targeting (BD←CAD). To ensure the robustness of the results, the causality test was re-run with $d=2$. The results are not presented here but the key point to emphasis is that they are quantitatively similar to those presented in Table 4.

[Insert Table 4]

We re-estimated the four-dimensional panel VAR system using the DOLS framework by including the six bi-directional countries in the system while dropping the other three countries. The purpose is to show how robust our results are to the exclusion of the three countries (Myanmar, Singapore and South Korea) in the panel VAR system reported in Table 3. The results of the causality tests, which are displayed in Table 5, do not change the causal inference reported earlier in Table 3. These causal linkages among $BD \rightarrow IR \rightarrow EX \rightarrow CAD$ are summarized in Figure 2.

[Insert Table 5 and Figure 2]

The other possible causing (forcing) variables (investment, income, relative productivity, inflation) may explain how the current account changes over time. To show the robustness, we includes additional variable of income in the system. We found that exchange rate Granger cause income while the causal inference between budget deficit and current account deficit is as reported in Tables 3 and 5¹⁸.

To sum up, we found that statistical evidence supports the indirect relationship between the two deficits as suggested in Volcker (1984) and Abell (1990a, b) but our empirical regularities differ in the following ways¹⁹. First, we found that the causal relationship between budget and current account deficits works through two channels: one directly between budget deficit and current account deficit and the other through interest rate and exchange rate. Second, our results suggest that the continuous processes correspond to the conjecture of the ‘vicious or virtuous circle’ phenomena since a feedback relationship exists between the twin deficits²⁰.

6. Concluding Remarks

The empirical model incorporates most of the arguments in the literature concerning the sources of movements of the current account. The tests conducted show that the current accounts from nine Asian countries react to changes in such variables as government deficit, interest rate and exchange rate, perhaps suggesting that movements in these variables may alter the long-term trend of the current account. Hence, movement of these variables should not be ignored for the purpose of managing the current account.

This paper reaches some conclusions. First, it finds that interest rates, exchange rates and budget deficit seem to play an important role in explaining the current account balance. Second, it finds a two-way causal relationship between budget and current account deficit and that there exist two channels in which budget deficit affects the current account: directly $BD \rightarrow CA$ and indirectly via $BD \rightarrow IR \rightarrow EX \rightarrow CA$. The bi-directional causal relationship between the two deficits is also detected in a bivariate framework for most of the SEACEN countries. Third, we showed that nominal exchange rate affects the current account of the Asian countries. These results are consistent with the conventional wisdom that the worsening of the current account in Asian countries prior to the crisis was due to the appreciation of the real exchange rates (see also Baharumshah, 2001). The sharp depreciation of the Asian currencies vis-à-vis the dollar led to a large swing in the current account position of these sample countries.

From the policy perspective, the statistical analysis suggests that managing the budget deficit offers a scope for improvement in the current account deficits. However, the

findings may not support the policy of manipulating the intermediate targets (interest rates and exchange rates) in bringing down the twin deficits to sustainable levels since these variables appear to be endogenous in the system. Also, export promotion may be another option that policymakers may pursue due to the “virtuous” circle impact from the export sector growth.

This study also makes the case for increased government spending in response to dilemma associated with large current account deficit. This evidence maybe attributed to the fact that the governments of these countries are concerned with the deleterious economic consequences of trade imbalances on the domestic manufacturing industries (e.g. unemployment, fall in market share etc). Government aid as well as a fall in the tax revenues due to a decline in business in export sector, tends to support the causality from current account to budget deficits.

In addition, FDI is less likely than the other capital inflows, to stimulate private consumption and real appreciation problem. Frankel and Rose (1996) found that a high FDI to debt ratio is related to a low likelihood of a currency crisis for a panel of over 100 developing countries from 1977 through 1991. Why is this so? First, FDI is subjected less to sudden capital reversals and is governed by long-term profitability expectations. Second, FDI is likely to produce positive external spillovers. Third, in the absence of the financial sector and foreign exchange distortion, FDI can improve current account balance by accelerating growth and national savings (Fry, 1996; Thanoon and Baharumshah 2002). The intuition is straightforward: high rates of growth (for example 6-8%) may help to diminish the debt burden and the economy can easily grow itself out of the debt problem.

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Notes:

1. In the period 1980-1985, budget deficit in the US rose from \$74 billion to a total of \$212 billion in 1985. In the same period, the US real as well as nominal exchange rate depreciated. The depreciation led to a deterioration in the current account balance from a surplus of \$6.0 billion in 1980 to a deficit of \$124 billion by the year 1985. It is widely believed that the US current account deficit rose mainly because of the skyrocketing in budget deficit. The dramatic increases of the internal and external deficits are commonly referred to as the “twin deficits”—the positive correlation between current account and fiscal imbalances (see McCoskey and Kao, 1999; Edwards, 2001).
2. Anoruo and Ramchander (1998) looked at the case of Indonesia and the Philippines while Khalid and Teo (1999) examined the case of Indonesia. Edwards (2001) examined several Eastern European countries while Megarbane (2002) discussed the sustainability of the current account deficit in Slovakia.
3. Large current account imbalances are often assumed to play an important role in the propagation of currency crises. Kaminsky *et al.* (1998) and Edwards (2001) provide empirical evidence that large and persistent current account deficits increase the probability of a country experiencing a currency crisis. However, country experience indicates that large external imbalances do not necessarily imply a forthcoming crisis (Milesi-Ferretti and Razin, 1996).
4. Two excellent surveys on this subject matter are Banerjee (1999) on panel unit roots and cointegration tests and Baltagi and Kao (2000) that extends the discussion further into estimation and inference in the panel cointegration models.
5. The avenues of the mediating variables in the twin deficits processes are discussed in Abell (1990a, b) Kearney and Monadjemi (1990) and Anoruo and Ramchander (1998).
6. The conventional Mundell-Fleming framework can be summarized as follows: First, a positive relationship exists between the current account and budget deficit. Second, there exists a unidirectional Granger causality that runs from budget deficit to current account deficit. Other studies that have included interest rate and exchange rate in testing the twin deficits hypothesis include Rosensweig and Tallman (1993), McCoskey and Kao (1999) and Fountas and Tsoukis (2000).
7. Under a flexible exchange rate regime, an increase in budget deficit would induce upward pressure on interest rates, causing capital inflows and appreciation of exchange rate. The appreciated exchange rate will make exports less attractive and increase the attractiveness of import, subsequently worsening the current account balance. In the fixed exchange rate regime, a larger budget deficit stimulates higher real income or prices and would worsen the current account balance. Thus, the model implies that fiscal deficit widens the trade deficit under both fixed and flexible exchange rate regimes; see also Anoruo and Ramchander (1998).

8. The works by Islam (1998) for Brazil, Anoruo and Ramchander (1998) for the Philippines, India, Indonesia and Korea, and Khalid and Teo (1999) for Indonesia and Pakistan also support this hypothesis.
9. To get equation (3), one may decompose the government spending into government consumption and investment categories as $G = C_G + I_G$ where the C_G includes expenditure on defense, education, health and social security while I_G is the fixed capital formation component of machinery, equipment and buildings. Substitute back to (2) $CA = Y - (C + I + C_G + I_G)$. Rearranged it to become $CA = (Y - C - C_G) - (I + I_G)$ which further equals $CA = S - I$ or $S = I + CA$ as (3) above.
10. We would like to thank the two anonymous referees for many helpful comments.
11. IPS also proposed another mean group approach of *LM-bar* test for unit roots. In their Monte Carlo simulation, they showed that the *t-bar* test performed better than the *LM-bar* for small samples. In their substantial revised version they ignored the *LM-bar* test proposed earlier (see Im *et al.*, 2003).
12. For detailed description of the mathematical formulae for the seven panel cointegration statistics, one could refer to Pedroni (1999, Table 1).
13. The Monte Carlo simulations in Kao and Chiang (2000) have shown that the DOLS estimator outperforms both the ordinary least square (OLS) and fully modified ordinary least square (FMOLS) estimators for both the homogeneous and heterogeneous panels.
14. We acknowledge the limitations of choosing annual data rather than a more high frequency one. The countries included here are members of the International Monetary Fund and the data are also available from the pool of statistics collection program done at the IMF. However, due to the consistency, reliability and the choice of the countries, we chose to obtain all the data from SFS. In addition, most of the SEACEN country data are reported in annual frequency. Moreover, the panel-based procedures are adopted due to the limited time series variation in these countries. The short life span of the data from 1980 to 2001 (N=22) discourages estimation using pure time series estimation. For this reason, researchers may prefer to work with data that span through a century (annually) or more when adopting the pure time series procedures. However, we caution the reader on the adoption of the panel-based approaches because the twin deficits relationship is country-specific rather than clustered cases. Pooling the data would also disguise the country-specific features underlying this relationship. The authors are grateful to an anonymous referee for suggesting this point.
15. Some authors argue that the causation from budget to current account deficits is weaker than the reverse causation of the causality runs from current account to budget deficits. If this is true, our results so far suggest that this causation follows what is termed by Summers (1988) as current account targeting.
16. Khalid and Teo (1999) argued that a high correspondence between the two deficits was more likely to emerge in developing countries due to the differences in the structure of the economy. As such the macroeconomic dynamics governing the two deficits may be different from that of the developed economy. The fact that current account deficit Granger cause budget deficit suggest that policy makers in these countries tend to respond with additional government spending in response to domestic problems caused by trade balance (see also Darrat, 1988)
17. It is proven that in the integrated and (non-) cointegrated system, the MWALD test for restrictions on the parameters of a VAR(k) has an asymptotic χ^2 distribution when a VAR ($p = k + d_{max}$) is estimated, where d_{max} is the maximum order of integration suspected to occur in the system and k is the lag length selected for the estimation. Furthermore, this procedure imposes (non-) linear restrictions on the parameters of VARs models without pretest for unit root and cointegrating rank and the MWALD test statistics could be easily computed using the Seemingly Unrelated Regression (SUR) method technique.
18. The authors are grateful to anonymous referees for suggesting this point. To conserve space, these results are not reported here but are available upon request from the authors.

19. Abell (1990a, b) for instance, estimated a model that includes trade balance, government deficit, interest rate, income, trade-weighted exchange rate and money stock. He found that government deficits influence the trade balance through interest rate and exchange rate.
20. It is worth noting here that direct comparison with earlier works may not be useful here because of the different approach adopted in this study.

Table 1: IPS Panel Unit Root Test

Variables	IPS \bar{t} statistics	
	Without trend	With trend
	Level	
CA	-0.668 (0.252)	-1.229 (0.110)
BD	-0.203 (0.419)	-0.281 (0.389)
IR	-0.685 (0.246)	-0.403 (0.344)
EXC	-0.161 (0.436)	-0.131 (0.447)
First Difference		
Δ CA	-11.405 (0.000)	-10.653 (0.000)
Δ BD	-7.082 (0.000)	-6.037 (0.000)
Δ IR	-8.414 (0.000)	-6.588 (0.000)
Δ EXC	-5.007 (0.000)	-3.245 (0.001)

Notes: IPS indicates the Im *et al.* (1997) test. The critical values are taken from IPS (1997) Table 4. CA, BD, IR and EXC are defined in the main text. The estimates of the \bar{t} statistics are based on the normal ADF statistics. The parenthesized values are the probability of rejection while Δ denotes the first difference operator.

Table 2: Pedroni (1999) Cointegration Test for Heterogeneous Panels

Test Statistics	
Panel cointegration statistics (within-dimension)	
Panel v-statistic	3.096
Panel ρ -statistic	-0.983
Panel pp-statistic	-3.596
Panel adf-statistic	-3.428
Group mean panel cointegration statistics (between-dimension)	
Group ρ -statistic	-0.284
Group pp-statistic	-4.396
Group adf-statistic	-4.762

Notes: (a) The number of lag truncations used in the calculation of the seven Pedroni statistics is 3. The 5 percent critical value is -1.645 since the residual based test is the one-tailed test. Hence, large negative values (left tail) imply the rejection of the null hypothesis of no cointegration. One exception is the panel v-statistics which diverge to positive infinity (right tail) that requires a large positive value (larger than 1.645) to reject the null of no cointegration. The critical values for mean and variance of each statistic were obtained from Pedroni (1999, Table 2). All the estimations and the calculation of the panel cointegration statistics were carried out in RATS 4.2 using the algorithm kindly provided by Pedroni.

(b) *Panel v* is a non-parametric variance ratio statistic; *panel ρ* and the *panel pp* are analogous to the non-parametric Phillips-Perron ρ and t-statistics respectively; *panel adf* is the parametric statistic based on the Augmented Dickey-Fuller ADF statistic; *group ρ* and *group pp* are the non-parametric Phillips-Perron ρ and t-statistics while *group adf* is the standard parametric ADF statistic.

Table 3: Granger Causality Test Results (9 countries)

Dependent Variable	Δ CAD	Δ BD	Δ IR	Δ EX
	WALD (χ^2 -statistics)			
CAD	-	17.344 (0.004)	5.404 (0.611)	14.488 (0.013)
BD	25.854 (0.000)	-	11.106 (0.134)	8.345 (0.138)
IR	5.903 (0.316)	26.063 (0.000)	-	6.035 (0.535)
EXC	3.462 (0.629)	7.566 (0.372)	26.796 (0.000)	-

Notes: Parenthesized values are the probability of rejection of Granger non-causality. Estimations are based on the pooled data for 1980-2001 and 9 countries (N=9, T=22) with three lead and three lags of first differenced explanatory variables.

Table 4: Long Run Granger non-causality using MWALD Results

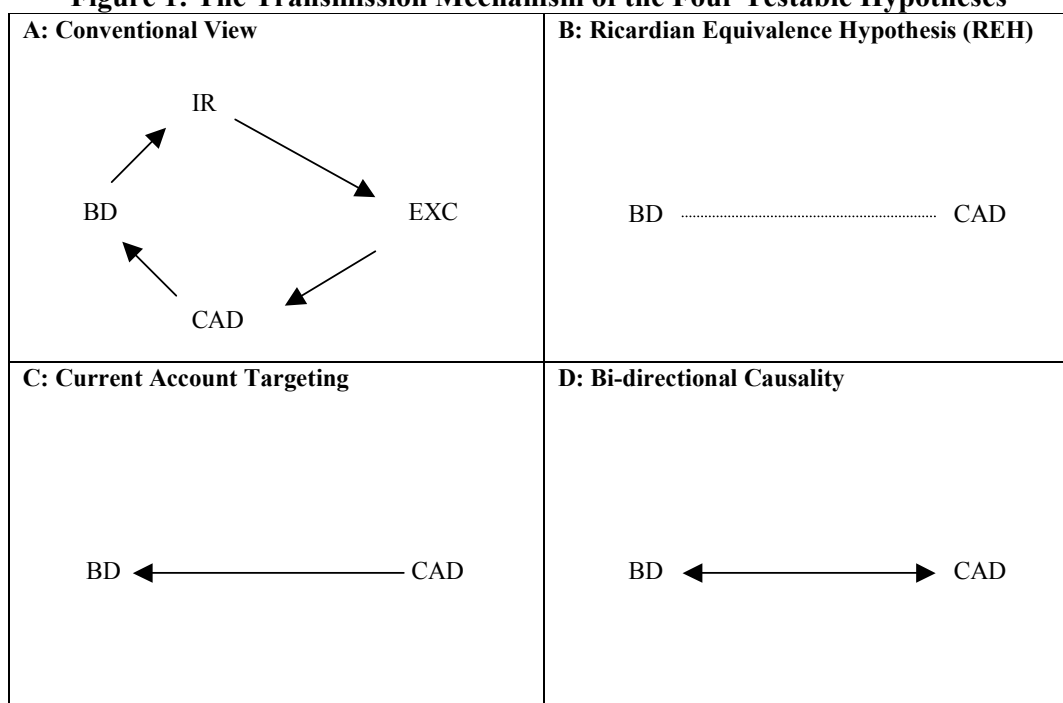
Null Hypothesis	Test Statistics		Conclusion
	MWALD	p-value	
A: Indonesia (k=4 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	8.021	0.018	Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	22.585	0.000	Reject Ho
B: Malaysia (k=3 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	8.033	0.018	Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	14.964	0.001	Reject Ho
C: Myanmar (k=5 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	5.439	0.066	Do not Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	10.454	0.005	Reject Ho
D: Nepal (k=5 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	6.921	0.034	Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	8.470	0.014	Reject Ho
E: Philippines (k=4 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	7.268	0.026	Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	9.268	0.010	Reject Ho
F: Singapore (k=3 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	8.089	0.017	Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	2.325	0.313	Do not Reject Ho
G: South Korea (k=5 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	18.378	0.000	Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	3.3184	0.190	Do not Reject Ho
H: Sri Lanka (k=5 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	7.494	0.024	Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	9.233	0.010	Reject Ho
I: Thailand (k=5 d=1)			
Budget deficits do not <i>Granger cause</i> current account deficits	13.447	0.001	Reject Ho
Current account deficits do not <i>Granger cause</i> budget deficits	15.650	0.000	Reject Ho

Note: k = optimum lag and d = maximal order of integration.

Table 5: Granger Causality Test Results (6 countries)

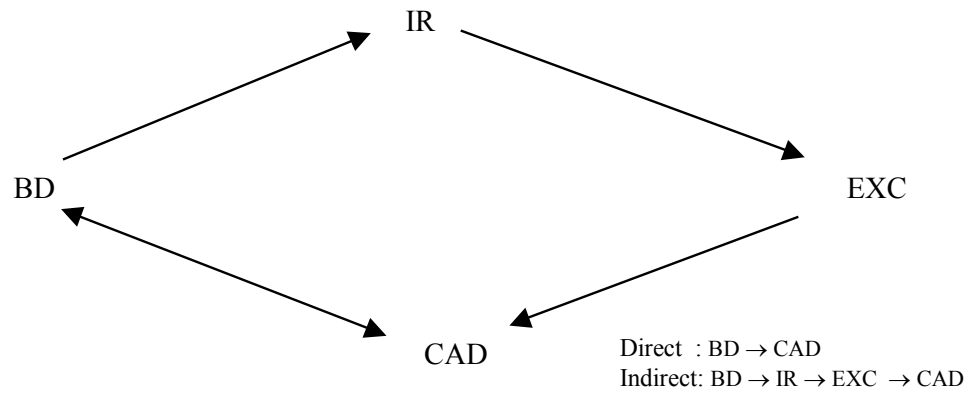
Dependent Variable	Δ CAD	Δ BD	Δ IR	Δ EX
	WALD (χ^2 -statistics)			
CAD	-	129.464 (0.000)	4.409 (0.632)	13.245 (0.064)
BD	35.819 (0.000)	-	6.071 (0.432)	8.831 (0.265)
IR	4.962 (0.421)	26.492 (0.000)	-	4.606 (0.595)
EXC	3.132 (0.679)	7.437 (0.384)	26.028 (0.001)	-

Note: Parenthesized values are the probability of rejection of Granger non-causality. Estimations are based on the pooled data for 1980-2001 from 6 countries (N=6, T=22) with three lead and three lags of first differenced explanatory variables.

Figure 1: The Transmission Mechanism of the Four Testable Hypotheses

Notes: BD → CAD implies transmission mechanism from budget to current account deficits while BD ↔ CA indicate a bi-directional transmission mechanism relationship. A dashed line (---) indicates absence of linkage among the variables or consistency with REH.

Figure 2: Direction of Causal Relationship Summarized from Tables 3 and 5



Note: $BD \rightarrow CAD$ implies one-way causality while $BD \leftrightarrow CA$ indicates the bi-directional causality relationship.

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