REGIME CHANGES AND THE SUSTAINABILITY OF FISCAL IMBALANCE IN EAST ASIAN COUNTRIES

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Abstract

In the aftermath of the 1997 Asian financial crisis, fiscal policy is playing a bigger role in smoothing the business cycle and getting the crisis-affected countries back on their growth paths. The main purpose of this paper is to assess empirically the fiscal policy regimes in five Asian countries using a formal framework based on the government's intertemporal budget constraints (GIBC). For this purpose, we relied on an array of time-series methods and quarterly frequency data of nearly three decades that ended in 2003:Q2. Our conclusions are; **first**, the evidence indicates that the fiscal stance in Thailand and Korea are on their sustainable path while the Philippines and Malaysia satisfy only the necessary condition for sustainability. **Second**, we found that revenues are growing at a rate faster than government spending for Singapore, a country that have recorded large surpluses for most of the sample period. **Third**, the results show a one-way causation from expenditure to revenue for Korea, Singapore and Thailand. This finding indicates that reducing the size of government spending may improve fiscal budget deficits without having to undergo changes in the overall strategy. **Fourth**, we observed a long-run feedback causality in the revenue-expenditure nexus for the case of Malaysia and the Philippines, which may require fiscal synchronization instrument policies to moderate the post-crisis fiscal imbalances. Together, these results demonstrate the diverse fiscal patterns but they should be useful as a means of understanding the complexities of economic integration in the region.

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1. Introduction

The importance of maintaining a sustainable fiscal budget deficit has received increasing attention from economists and decision makers, alike. From a fiscal perspective, maintaining a stable long-term relationship between expenditures and revenues is one of the key requirements for a stable macroeconomic environment and a sustainable economy. The World Bank and the International Monetary Fund have developed a wide-ranging plan for studying government expenditure and financing decisions in order to assess fiscal sustainability among their member countries. The purpose is to find out whether the fiscal imbalances in the developing world need to be curtailed before they become economically unsustainable[1]. Under the present condition of the world economy, huge internal (or external) imbalances might lead to a hard landing for countries that appear to be insolvent. In fact, one of the central themes for the European Monetary Union (EMU) membership is maintaining the sustainable fiscal deficit agreed upon according to the convergence criteria set in the Maastricht treaty. The treaty among others, requires that governments runs a budget deficit of not more than 3 percent and the amount of government borrowing should not exceed 60 percent of national income (GDP). The East Asian countries are also working towards an economic and monetary cooperation within the region after the 1997 financial shock. This is to ensure a greater degree of economic integration among the member countries. In moving towards these objectives, the fiscal policies of all member countries need to be coordinated and their deficits must be kept under control.

[1] Authors like Chalk and Hemming (2000), Edwards (2002), Croce and Juan-Ramon (2003) and Fedelino and Kudina (2003) emphasize on monitoring and assessing the effectiveness of fiscal sustainability among the member countries. Most of these studies, however focus on the debt relief program for the Highly Indebted Poor Countries (HIPC).

Fiscal sustainability is the criterion that is usually utilized to evaluate whether or not fiscal policy is out of control[2]. Sustainable fiscal policies are those conditions that can be continued indefinitely without any modification in the policy stance. In other words, the fiscal policy is sustainable if the intertemporal government budget constraint holds in the present value terms. Conversely, if the budget is out of control, economic policies at both macro and microeconomic levels will quickly become unsupportable and require changes to be made. If such a phenomenon occurs, then the fiscal imbalances would imply a need for larger and more painful adjustments for the economy. Given the detrimental impact of persistent deficit finance practices on debt accumulation, inflation rates, interest rates and economic growth, evaluating and monitoring the sustainability fiscal policies are extremely important as it may be accompanied by adverse macroeconomic developments.

There has been a substantial volume of empirical studies focusing on the sustainability of the government's fiscal strategy in the US and European countries (see Hamilton and Flavin, 1986; Hakkio and Rush, 1991; MacDonald, 1992; Makrydakis *et al*., 1999; Papadopoulos and Sidiropoulos, 1999; Feve and Henin, 2000; Martin, 2000; Olekalns, 2000; Bravo and Silvestre, 2002; Hatemi-J, 2002). Empirical investigations on the government's intertemporal fiscal solvency constraints in the Asian region are becoming increasingly available in the literature (see for example, Wu, 1998; Chung, 2002; Cashin *et al*., 2003). From the time series analysis, both Wu (1998) and Chung (2002) found sustainable fiscal policies for Taiwan and Korea while Pakistan is on the unsustainable path (see, Cashin *et al*.,

[2] Analysis on sustainability had been focused on both the univariate properties on debt (e.g. Hamilton and Flavin, 1986) and the long run relationship between revenues and expenditures (see Hakkio and Rush, 1991).

2003). These series of studies were undertaken following concerns on budget deficits and the associated build-up of debts observed in the post-Asian financial crisis period. The recession (economic slowdown) in the late 1990s led to weak private investment activities and this in turn necessitated a bigger role for expansionary fiscal policies[3]. As the size of the deficits mounted, fiscal policy has posed some formidable problems in recent years. Hence, the question is does the size of government's deficit imply that the GIBC is being violated? We consider this issue of utmost important and the present paper throws some light on this question.

The main purpose of this paper is to investigate and draw some policy lessons on the sustainability of fiscal balances in five Asian neighboring countries namely, Malaysia, Thailand, Singapore, Korea and Thailand. Besides answering this important policy question, we are also interested in ascertaining the causal direction between government spending and tax revenues. The causal direction between the two variables provides useful insights into how these economies can manage their deficits in the future (by instruments such as fiscal tightening). In an advancement of previous work, we based our empirical analysis on recent developments in time-series econometrics methods and our sample period is extended to include the post crisis period that ended in 2003:Q2. We addressed the effect of a potential break in the data generating process to find out if it coincided with the major macroeconomic events that took place in the region. Specifically, the issue here is to identify the events in the

[3] In the wake of the financial crisis, most of the Asian countries in the area (including Singapore, Malaysia, Thailand and Indonesia) have emphasized on expansionary policies as a means of recovery via stimulating domestic demand. The discretionary fiscal policy adopted in these countries so far has been successful in smoothing the business cycle.

past two decades that may have altered the dynamic path of government's revenues and expenditures (if any) in the countries under investigation.

All in all, we are able to reject the hypothesis that the recent budget deficits have been "too large", that is the GIBC holds for these countries and the revenues-expenditure nexus has been affected by the events of the late 1980s. This finding is reasonable since the build-up of deficits in the recent years is partly due to a fall in tax revenue associated with the economic slowdown and as the economy recovers, the government revenues are expected to increase and satisfy the GIBC.

This study offers several policy perspectives. First, the empirical investigation would unleash the long run financial performances of the governments in these five Asian countries. This information is crucial for evaluating the feasibility of these countries in moving towards economic and monetary cooperation. Second, based on the causality results, one may know whether control over one variable, tax or government expenditure can lead to control over the other variable or not. The direction of the causality between the two variables would assist policy makers to identify the source of fiscal imbalances that might exist. This in turn would facilitate efforts to develop a suitable fiscal strategy for these countries. From a methodology perspective, we combined several time series techniques in order to arrive at a more robust and conclusive finding.

The remainder of the paper is structured as follows. Section 2 briefly describes the theoretical framework based on the government's intertemporal budget constraint. Section 3 outlines the empirical methodology for testing the government's

intertemporal budget constraint. The description of the data and empirical results are reported in Section 4. Finally, Section 5 concludes the paper and provides some policy lessons.

2. Theoretical Framework of Government's Intertemporal Budget Constraint

The most straightforward way to assess the fiscal sustainability situation is to start from the government's intertemporal budget constraint. The budget constraint looks at the long-run relationship between government revenue and expenditure (that covers the total government spending on goods and services, transfer payments and interest on debts).

The model starts by defining the budget constraint faced by a government at period *t*

$$G_t + (1 + r_t) B_{t-1} = RR_t + B_t \qquad (1)$$

where G_t is the value of government purchase of goods and services and transfer payments; RR_t is the government revenue; B_t is government debt; and r_t is the (one period) interest rate. At this point in the discussion it is worth noting that the variables in (1) can be nominal, real or "deflated" by population or real GDP[4].

[4] The interpretation of the interest rate in Equation (1) depends on how total government expenditures and revenues are measured. When the variables are nominal, r_t is the nominal interest rate; when the variables are real, r_t is the real interest rate; when the variables are real per real GDP, r_t is the real interest rate minus the rate of growth in real GDP; and when the variables are real per capita, r_t is the real interest rate minus the rate of population growth (Hakkio and Rush, 1991).

The budget constraint expressed in (1) pertains to period *t*; there is similar constraint for periods *t*+1, *t*+2, *t*+3,…, and recursively solving the equation via forward substitutions leads to the following government intertemporal budget constraint

$$B_0 = \sum_{t=1}^{\infty} \delta_t [RR_t - G_T] + \lim_{n \to \infty} \delta_n B_n \qquad (2)$$

In Equation (2) $\delta_t = \prod_{s=1}^{t} \beta_s$ where $\beta_s = 1/(1+i_s)$, and δ_t is the discount factor. The equation simply says that the current value of government debt B_0 is equal to the expected present value of all future primary surpluses $\sum_{t=1}^{\infty} \delta_t [RR_t - G_t]$, plus a limiting term representing the asymptotic expected present value of the government's debt. The crucial element in (2) is the last term *lim* $\delta_n B_n$, where the limit is taken as $n \to \infty$. When the limit term is zero $\lim_{n \to \infty} \delta_n B_n = 0$ (transversality condition), this implies that in the long run we rule out a Ponzi scheme, that is the government is not 'bubble' financing its expenditure by issuing new debts to finance the deficits. Therefore, a fiscal policy will be sustainable if the limiting term in Equation (2) is zero[5].

The above model is not an appropriate equation for testing the sustainability of fiscal deficit. Following the literature, we assumed that the interest rate is stationary around a mean r or expressed as the real interest rate. In order to transform the equation into some testable implication and after further manipulation, (2) may also be written as

$$RG_t - RR_t = \sum_{s=0}^{\infty} \frac{\Delta RR_{t+s} - \Delta RG_{t+s} + r\Delta B_{t-1+s}}{(1+r)^{s-1}} + \lim_{s \to \infty} \frac{B_{t+s}}{(1+r)^{s+1}} \qquad (3)$$

[5] This is equivalent to saying that the deficit is sustainable if and only if the stock of debt held by the public is expected to grow no faster than the mean real rate of interest which is viewed as a proxy for the growth rate of the economy.

where RG_t represent the total government spending on goods and services, transfer payments and interest on debts or $RG_t = G_t + rB_{t-1}$. Hakkio and Rush (1991), assume that the RR_t and $G_t + (1+r)B_{t-1}$ are both nonstationary variables of $RR_t = \alpha_1 + RR_{t-1} + \varepsilon_{1t}$ and $RG_t = \alpha_2 + RG_{t-1} + \varepsilon_{2t}$. Consequently, expression (3) can be conveniently rewritten as

$$RG_t = \alpha + RR_t + \lim_{s\to\infty} \frac{B_{t+s}}{(1+r)^{s+1}} + \varepsilon_t \tag{4}$$

where $\alpha = \frac{1+r}{r}(\alpha_1 - \alpha_2)$ and $\varepsilon_t \sum_{s=0}^{\infty} \frac{(\varepsilon_{1t} - \varepsilon_{2t})}{(1+r)^{s-1}}$.

Equation (4) forms the basis for testing the hypothesis of sustainable fiscal deficit. If the transversality condition for the budget constraint holds and the limit term in (4) is zero, we obtain

$$RR_t = a + bRG_t + \mu_t \tag{5}$$

along with the null hypothesis of $b = 1$ and μ_t is a stationary process (see Trehan and Walsh, 1988; Quintos, 1995). Equation (5) has been widely used as the basis to assess the sustainability of government's intertemporal budget constraint in the literature[6]. In line with the existing literature, we examined four possible scenarios for the sustainability conditions and they are as follows (see, Quintos, 1995 and Martin, 2000):

(a) The deficit is 'strongly' sustainable if and only if the *I(1)* processes of RR and RG are cointegrated with cointegrating vector [1,-1]or with $b = 1$. It means

[6] In short, the two variables are said to be cointegrated with each other if by itself the variables are not stationary, but there is a linear combination of the two variables which is stationary and a value a may exist for a and b such that $RR_t - bRG_t - a = \mu_t$ is stationary. If the two variables are cointegrated, they cannot deviate from the cointegrating relationship beyond constant fluctuation bands, since μ_t has a constant variance.

that the government's budget constraint intertemporally holds and at the same time, the undiscounted debt process B_t is *I(1)*.

(b) The deficit is only 'weakly' sustainable if RR and RG are cointegrated with $0 < b < 1$[7].

(c) The deficit is unsustainable if $b \leq 0$. An unsustainable deficit is one which implies that B_t is exploding at the rate equal to or in excess of the growth rate in the economy, such that the limiting term in GIBC of Equation (2) is violated.

(d) The condition of $b > 1$ is not consistent with a deficit. It implies that government revenue are growing at a faster rate than government expenditure (see also Martin, 2000).

3. Estimation Procedure

The model outlined in the previous section provides the basis for the empirical analysis and in accordance with the current tradition, we relied on an array of unit root and cointegration tests to analyze the deficit process in the Asian countries. We considered the robust dynamic OLS (DOLS) procedure endorsed from Stock and Watson (1993) to estimate the parameters of the model. Additionally, to addressed the causal interrelationship between government revenues and government expenditures, we adopted the modified WALD (MWALD) test proposed by Toda and Yamamoto (1995). A brief description of each the tests proposed is outlined below. However, for

[7] Hakkio and Rush (1991) demonstrate that $0 < b < 1$ is a sufficient criterion for the deficit to be sustainable. However, the condition of $b < 1$ implies that the government expenditure will always be larger than revenue. In this limit, the undiscounted stock of debts will reach infinity and make the value of debt unbounded which provides incentives for government to default on its debt. Therefore, this outcome is a less desirable scenario (see also Quintos, 1995).

more detail of the procedure, interested readers may refer to the original article and the empirical literature on the relevant techniques.

3.1 Single Equation-based Unit root tests

In carrying out the cointegration analysis, the first step is to implement the unit root tests. In this article, we deployed the Said and Dickey (1984, ADF), Elliott *et al.* (1996, DFGLS) and the Kwiatkowski *et al.* (1992, KPSS) testing principles. The ADF and the DFGLS testing principles share the same null hypothesis characterized by a unit root. Their difference however centers 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 demeaning and/or detrending a series prior to the implementation of the usual auxiliary ADF regression. The use of the DFGLS test statistics is likely to minimize the danger of erroneous inferences emerging when the series under investigation has a mean and/or linear trend in its DGP. The DFGLS mean (μ) and trend (τ) stationarity under a local alternative will be denoted by τ_{μ} and τ_{τ} respectively.

In contrast, the KPSS procedure tests for level (η_{μ}) or trend stationarity (η_{τ}) against the alternative of a unit root. In this sense, the KPSS principles involve different maintained hypothesis from the ADF and DFGLS unit root tests. The adoption of the three versions of the unit root tests should enable us to mitigate a clear-cut conclusion on the requirement of the order of integration when applying time series data.

3.2 Multivariate Cointegration test

The determination of the number of cointegrating vectors based on the Johansen and Juselius (1990) (Johansen procedure) multivariate procedure depends on the use of two likelihood ratios (LR) test statistics: the trace test and the maximum eigenvalue test. This procedure is well known in the empirical analysis of time series data and the detailed explanations are not presented here. Two types of tests, i.e. the trace and maximum eigenvalue tests are conducted based on critical values tabulated in Osterwald-Lenum (1992).

The importance of applying a degree-of-freedom correction for the Johansen procedure in small samples is well known. The correction factor is necessary in order to reduce the excessive tendency of the test to falsely reject the null hypothesis of no cointegration often associated with data of a relatively short span. Cheung and Lai (1993) provided the correction factor for small sample sizes of the Johansen likelihood ratio tests while Reinsel and Ahn (1992) suggested an adjustment to the estimated trace and maximum eigenvalue statistics. The degree-of-freedom correction suggested by Reinsel and Ahn (1992) is to multiply the test statistic by $(T-pk)/T$, where T is the sample size, p is the number of variables, and k is the lag length of the estimated VAR system. In the analysis that follows, we relied on the latter suggestion to check for the significance and the robustness of the cointegration tests.

3.3 Gregory and Hansen Cointegration Method

The cointegration framework of Johansen has its limitations especially when dealing with a long data span such as ours as the DGP may be affected by major economic events. In fact, several studies have documented the sensitivity of the outcome of the

tests to structural breaks; see Wu, 1998 and Lau and Baharumshah, 2003, among others)[8]. Given that such breaks are likely to exist in estimating a cointegrating relationship, we also applied the Gregory and Hansen (1996, GH) cointegration tests to account for an endogenously determined break at some unknown point in time. Briefly, in this procedure, a dummy variable is included to account for a shift in the cointegrating regression. The advantage of this test is the ability to treat the issue of a break (which can be determined endogenously) and cointegration altogether. The procedure offers four different models corresponding to the four different assumptions concerning the nature of the shift in the cointegrating vector[9]. As such, the Gregory and Hansen (1996) procedure allows us to determine the break point endogenously from the data set instead of selecting the break point based on *a priori* information. Hence, the problem of data mining can be avoided by employing this procedure.

3.4 Estimation of Long run Equilibria

The Johansen procedure may be used to extract the long-run parameters of the model. However, a more robust method proposed by Stock and Watson (1993) that also corrects for possible simultaneity bias among the regressors is considered in this paper[10]. The method involves estimation of the long-run equilibrium relationship

[8] Authors like Quintos (1995), Papadopoulos and Sidiropoulos (1999) and Martin (2000) also documented the importance of the unusual exogenous events that may alter the conduct of fiscal policy in a country and they stressed the need for allowing the structural break in examining the sustainability of fiscal policy.

[9] Model 1 = standard cointegration, Model 2 = level shift (C), Model 3 = level shift with trend (C/T) and Model 4 = regime shift (C/S). The estimation of the relevant regression is performed sequentially in each breakpoint and calculated using the range of $\hbar = [0.15,\ \ 0.85]$ interval. The breakpoint is identified as the one where the GH test statistic is maximized in absolute value at which the structural break occurred.

[10] They offer a parametric approach for estimating long-run equilibria in systems that involve variables integrated of different orders but still cointegrated. The possibility of simultaneity bias and small-sample bias among the regressors is dealt with by the inclusion of lagged and lead values of the first difference in the regressors.

using the dynamic OLS (DOLS) method. In this study, we relied on the technique devised by Stock and Watson (1993) that allows for the (dynamic) estimation of cointegrating vectors for systems involving deterministic components.

3.5 Granger Causality Tests

Toda and Yamamoto (1995) have proposed the modified WALD (MWALD) test for testing *Granger non-causality* as it allows causal inference to be conducted in the level VARs that may contain integrated and (non) cointegrated processes[11]. This procedure imposes (non-) linear restrictions on the parameters of the VAR models without having to pretest for unit root and cointegrating rank. Rambaldi and Doran (1996) has shown that Seemingly Unrelated Regression (SUR) could easily compute the MWALD test. Thus, causal ordering among the variables can be established without *prior* restrictions of exogeneity.

Following Toda and Yamamoto's (1995) Granger non-causality test, these variables can be causally linked in a two-dimensional VAR system (assuming p=3):

$$\begin{bmatrix} RR_t \\ RG_t \end{bmatrix} = \mathrm{A}_0 + \mathrm{A}_1 \begin{bmatrix} RR_{t-1} \\ RG_{t-1} \end{bmatrix} + \mathrm{A}_2 \begin{bmatrix} RR_{t-2} \\ RG_{t-2} \end{bmatrix} + \mathrm{A}_3 \begin{bmatrix} RR_{t-3} \\ RG_{t-3} \end{bmatrix} + \begin{bmatrix} \varepsilon_{RR} \\ \varepsilon_{RG} \end{bmatrix} \qquad (6)$$

where A_0 acts as an identity matrix. To test whether RG does not Granger cause movement in RR (if k=2 and d_{max}=1), the null hypothesis H_0: $\beta_{12}^{(1)} = \beta_{12}^{(2)} = 0$ where $\beta_{12}^{(i)}$ are the coefficients of RG_{t-i}, i=1,2,…, in the first equation of the system. The existence of the causality from RG to RR can be established through rejecting the

[11] They have 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.

above null hypothesis, which requires finding the significance of the MWALD statistics for RG_{t-1} and RG_{t-2} identified above while RG_{t-3} is left unrestricted as a long run correction mechanism. These restrictions imply a long run causal inference since, unlike ordinary first difference VAR, this formulation involves only variables appearing in their levels. Similar analogous restrictions and testing procedure can be applied in testing the hypothesis that RR does not Granger cause movement in RG, i.e. to test H_0: $\beta_{21}^{(1)} = \beta_{21}^{(2)} = 0$ where $\beta_{21}^{(i)}$ are the coefficients of RR_{t-i}, i=1,2,…, of the second equation of the system (Equation 6). This procedure can be easily generalized for a larger number of lags in the VAR system.

As exposed in the literature, there are four main hypotheses with regard to the causal nexus of government expenditures and government revenues.

1. One way causation from expenditures to revenues (spend and tax hypothesis). This suggests that the government adjust revenues to the level of the planned expenditures (see Barro, 1979 and Peacock and Wiseman, 1979).
2. One way causation from revenues to expenditures (tax and spend hypothesis). Following this hypothesis, the authorities adjust their expenditures to the level of the revenues so that control over revenues leads to limiting growth in the public sector (Friedman, 1978).
3. Bidirectional causality (fiscal synchronization). This hypothesis is based on the equivalence of marginal cost and marginal revenue that the utility-maximizing supplier and demanders of the public services make. In other words, the fiscal authorities made simultaneous decisions on expenditures and revenues. Hence, the two macro-variables mutually reinforce each other This is the classical view of public finance (see Musgrave, 1966).

4. No causality. The authorities can set the level of expenditures and revenues by rule of thumb. This phenomenon reflects the institutional separation of allocation and taxation functions of the government (Hoover and Sheffrin, 1992). This view is also consistent with no cointegration and a sustainability problem.

It is worth noting that causality per se had implications only for the dynamics of the fiscal adjustments process and not for the sustainability condition. The latter depends on the existence of the condition outlined earlier. Since the causality tests do give estimates of the authorities reactions to the past fiscal imbalances, they also provide a useful indicator of how the authorities may respond to the imbalances in the future.

4. Data Descriptions and Empirical Investigation

4.1 Data Description

The empirical estimation period begins in 1975Q1 and ends in 2003Q2. Quarterly observations of the total government revenues and government expenditures (inclusive of the transfer payments and interest on the debt) and gross domestic product (GDP) are sourced from the International Monetary Fund's *International Financial Statistics* (IFS)[12]. The total government revenues and expenditures are converted into real terms by using the consumer price index (CPI 1995=100) and dividing it by real GDP in order to account for the economy's growth[13]. The real

[12] Quarterly observations of GDP were extrapolated from the annual series employing the Gandolfo (1981) approach.

[13] The assumption of stationary interest rate rules out nominal magnitudes of the data since the nominal interest rate is the nonstationary variable (Hakkio and Rush, 1991).

budget balances (BD) is constructed using BD = RR – RG. All the variables used in the analysis are expressed in domestic currency[14].

4.2 Univariate Unit Root Tests Results

We adopted the recursive *t*-statistic procedure by Ng and Perron (1995) with an upper bound of k_{max} = 12 for the lag length selection criterion in the univariate setting. If the last included lag is significant, we would choose $k = k_{max}$. If not, we would reduce k by one until the last lag becomes significant. If no lags are significant then k is set to zero (k=0). The 5 percent value of the asymptotic normal distribution, 1.96 is used to assess the significance of the last lag. The lag length is reported in parenthesis in Table 1.

Table 1 displays the empirical results of the univariate tests performed on RR, RG and BD. Overwhelmingly, all the testing procedures suggest the existence of unit root in level or *I(1)* series for all the countries. The finding that all the variables has the same order of integration allows us to proceed with the Johansen multivariate cointegration analysis. Interestingly, the variable BD appears to be nonstationary for all the countries under investigation suggesting that the fiscal policies in the Asian countries are on an unsustainable path for the sample period (Trehan and Walsh, 1988).

[Insert Table 1]

[14] The analysis is based on full sample and it is interesting to find out how the crisis has affected the long run relationship by looking at the sub samples 1997-2003. However this leaves too few degrees of freedom.

4.3 Johansen Cointegration Results

After assessing the stationarity of the series, we proceeded with the Johansen multivariate cointegration tests that would allow us to test for long-run equilibrium between the revenues and the expenditures. To implement this procedure, an appropriate lag length in the VAR system had to be determined. The purpose was to allow for some dynamics and to eliminate serial correlation in the model. To this end, Akaike's Information Criteria (*AIC*) was used to determine the optimal lag length. This criteria yielded VAR(3) for Korea and Thailand while VAR(5) was shown as more appropriate for Malaysia and the Philippines and VAR(4) for Singapore. Despite the short lag length employed in the analysis, the residuals for each equation in the system did not exhibit any form of serial correlation or autoregressive conditional heteroskedasticity (ARCH) effects.

Table 2 presents the country by country Johansen cointegration test results. In general, the null hypothesis of no cointegrating vector (r=0) is rejected in favor of at least one cointegrating vector at 5 percent significance level for all the countries. Rejecting the null hypothesis of no cointegration between the $I(1)$ variables appearing in Equation (5) implies that the two variables do not drift apart in the long-run.

[Insert Table 2]

4.4 Structural Break Results

The results of the GH cointegration with the endogenous break conducted for these countries are summarized in Table 3. Figures tabulated in the brackets indicate the break points detected from each of the particular model. The minimum ADF statistic

endogenously determines the break point and is compared to critical values supplied by Gregory and Hansen (1996). The first model (mean model) reveals that cointegration is present with a break only for Korea (1988:Q2) and Thailand (1988:Q3), implying that the data supports cointegration with one change in the intercept.

The second model (level shift and trend model) failed to detect any significant presence of cointegration with a break in all the countries. Finally, the third model that took into consideration the simultaneous presence of both a mean break and a slope break (regime shift) exhibited empirical support for the case of Malaysia (1988:Q2), the Philippines (1988:Q2) and Thailand (1989:Q2). Taken together, the GH test supports a cointegrating relationship between the two variables with a possible shift in mean and/or regime shift in all countries, with the exception of Singapore for the sample period. This evidence shows the important changes in the fiscal stance of the Asian countries in response to major external disturbances. It also suggests that the behavior of the budget deficit for different countries may differ as indicated by the structural break.

[Insert Table 3]

The break points detected in the late 1980s by the test coincide with some major international events. First, the collapse of commodity prices due to the world recession (Plaza Accord and its aftermath) in the mid-1980s. The impact of such economic phenomena contributes to the significant break detected in the countries in the region. Second, the introduction of the Brady Plan in the late 1980s that

articulated new principles for addressing the LDC debt crisis focusing on Latin America[15]. We moved to the next section, by testing the necessary and sufficient condition (strong form) of the sustainability hypothesis that would mitigate a clear conclusion on the subject matter[16].

4.5 Estimation of Long run Equilibria

Given that revenues and expenditures are cointegrated in the post-crisis period for all the countries under investigation (Thailand in both sub-periods), we then estimated the DOLS proposed by Stock and Watson (1993). We also tested whether the cointegration coefficient $b = 1$ (strong form of sustainability condition) is insignificantly different from 1. The results of the DOLS appear in Table 4 and the findings may be summarized as follows:

First, we found that the null hypothesis of $b = 1$ is decisively rejected at conventional significance levels for Malaysia (Panel B) and the Philippines (Panel C). The empirical evidence however, supports the weak form of sustainability. Second, the DOLS results provide evidence satisfying the solvency of the government intertemporal budget constraint (strong form of sustainability) for Korea (Panel A), Singapore (Panel D) and Thailand (Panel E). This later finding implies that the undiscounted value of the public debt goes to zero (i.e. transversality condition holds).

[15] For a brief summary of the history of the debt strategies, see Cline (1995) and Krugman (1988). The Philippines is the only country under the treatment of the Brady Plan. Although the other countries were not in the Brady Plan, they were also exposed to the growing of internal imbalances.

[16] It worth noting that the yen depreciated 66% during the period 1985 (August) – 1987 (August) compared to only 20% during the period of the Asian financial crisis. The depreciation of the yen especially during the earlier period caused difficulties in this region due to the large debts denominated largely in Japanese yen.

Our result is in line with Wu (1998) and Chung (2002) that fiscal policy in Taiwan and Korea is on a sustainable path. In addition, the coefficient of b is greater than 1 (1.185 with χ^2 of 2.403) for Singapore and this is inconsistent with the deficit criterion. We note that this result suggests that the government revenues are growing at a faster rate than expenditures. For example, for every Singapore dollar increase in expenditure, the revenue rises by \$1.185. The total government revenues generated from the efficient tax collection and other resources are more than able to cover the expenditures by the Singapore authorities. This evidence also implies the strong performance of government financial accounts for Singapore. Thus, fiscal sustainability is not a problem for the case of Singapore.

Third, the estimated model that appears in Table 4 seems to be robust to various departures from the standard regression assumptions in terms of serial correlation of the residuals, autoregressive conditional heteroskedasticity (ARCH) effects, misspecification of functional form (RESET test), non-normality (Jarque-Bera test) and heteroskedasticity of residuals (White test). Furthermore, the CUSUM squares stability test was conducted for each estimated model. If the plot of the CUSUM squares sample path moves outside of the critical region (5 percent significant level), the null hypothesis of stability over time for the intercept and slope parameters is rejected (assuming the model is correctly specified)[17].

[17] All in all, the graphical illustrations from the CUSUM squares tests indicated that over the estimated period, the models are indeed stable and well specified. Due to space constraints, the results are not reported here but are made available upon request from the author.

4.6 Toda and Yamamoto Causality Analysis

Next, we move to the discussion of the Granger causality based on Equation 6. Clearly from Panels A, D, and E of Table 5, the null hypotheses that the RG (government expenditures) does not cause the RR (government revenues) are easily rejected at the conventional significance levels. This suggests an existence of causality runs one-way from RG to RR (spend and tax hypothesis) in Korea, Singapore and Thailand. This is consistent with the view that the fiscal authorities of the countries are capable of generating the revenues required to finance the planned expenditures, which supports the empirical evidences in Table 4. That shows that the authorities kept fiscal budget under control.

For the remaining Asian countries (Malaysia and the Philippines) we are able to reject the hypothesis of bi-directional causality. This provides an empirical basis for the notion that expenditures changes simultaneously with changes in revenues (fiscal synchronization). This in turn upholds the assumption of equivalency between the marginal costs and marginal revenues that the utility-maximization suppliers and demanders of the public services make. In other words, the government would compare the marginal costs and revenues when formulating a decision in terms of the appropriate levels of government expenditures and revenues. Thus, the governments of Malaysia and the Philippines may not strictly stick to one rule in implementing its fiscal policy.

5. Conclusion and Policy Lessons

In this paper, we are concerned with the empirical investigation of the long run sustainability of the fiscal policy in five Asian countries. We tested the sustainability

hypothesis by checking whether it is consistent with GIBC using time series econometrics. Based on formal statistical tests, we arrived at several important results. First, it was observed that with the exception of Malaysia and the Philippines, all other countries are on a sustainable path (in strong form). In other words, the discounted value of the debt tends to converge to zero over time. There is no indication that the government of Korea, Singapore and Thailand will default on their debts, at least in the near future. Thus, the government of these countries have been generally successful in smoothing the business cycle using a discretionary fiscal policy. These countries have scope to continue with the fiscal stimulus policies to boost the economy.

For Malaysia and the Philippines, the data supports the weak form of the hypothesis; cointegration is detected but $b \neq 1$. As pointed by Martin (2000), although this result is consistent with sustainability, it may have some implications for the ability of the government to market its debt and it is generally perceived as the less desirable scenario. In response to the economic slowdown due to the crisis, both of these countries implemented a fiscal expansionary policy. Malaysia's fiscal stimulus, for instances was RM 7 million (2.5% of GDP) resulting in an average fiscal deficit of 4%of GDP during 1998-2002. We believe that it is important that these two countries adhere to the principle of expenditure within revenue in order to correct the fiscal imbalances.

Second, the Granger causality analysis yields two sets of conflicting empirical evidences. While Korea's, Singapore's and Thailand's fiscal policy appears to be expenditure-led, Malaysia and the Philippines support the conduct of fiscal

synchronization instruments. Again the results reflect a less homogenous pattern in government expenditures and revenues. The conduct of the expenditure-led policy in Korea, Singapore and Thailand reflects the revenue adjustment to ensure that the planned expenditures can be financed within the framework of the sustainable budget position. This in turn supports the strong form of sustainability condition in these countries. However, the adjustment policy to the taxation system of the country must be exercised and maintained to ensure the smoothness of the overall policy. In the case of Malaysia and the Philippines, the expenditures and the revenues drive each other where fiscal synchronization instruments are working hand in hand with the government policies. The implementations of the fiscal policy are subject to the marginal costs and revenues in order to determine the appropriate levels of government expenditures and revenues for these countries.

Third, a notable implication of our findings is that the fiscal problems vary across countries in the region. Despite the differences, the needs for fiscal consolidation and prudent fiscal policies is essential for reducing public debt, improving the operating of monetary and exchange rate policies and facilitating private sector-led growth. Consolidation in fiscal policy assists long term growth prospects since countries with low deficits (debt) levels can exercise more options over expenditure priorities and allocate more resources to the productive sectors. Therefore, assessing, monitoring, maintaining and sustaining a stable internal imbalances is a prerequisite condition for the macroeconomic stability and sustainability of an economy. These would bridge the road towards the broader desire for economic, monetary and financial cooperation in the East Asian region.

In interpreting the results of this study, however, the shortness of our samples (twenty-eight years) should be borne in mind. It is well known that the short data span makes it more difficult to reject nonstationarity if mean reversion adjustment process is manifested over long periods. However, the data is able to reject the null hypothesis of GIBC in 3 out of 5 of the countries considered in the article. To end this paper, we would like to also caution the reader regarding the issues of multiple breaks as well as nonlinearities in the budgetary process. This may bias the results of the analysis. Of course this is beyond the scope of the present study and we have left this for future research.

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Table 1: Unit Root and Stationary Tests

	Test Statistics					
	t_μ	t_τ	η_μ	η_τ	τ_μ	τ_τ
A: Level						
Korea						
RR	-1.935(1)	-0.432(1)	1.985(4)*	0.554(4)*	-1.659(2)	-0.577(2)
RG	-0.126(4)	-2.001(4)	1.972(4)*	0.535(4)*	-0.407(4)	-1.461(4)
BD	-1.773(2)	-1.548(2)	0.327(1)*	0.219(1)*	-0.498(4)	-1.180(4)
Malaysia						
RR	-1.417(4)	-1.148(4)	2.148(4)*	0.512(4)*	-1.013(2)	-1.855(2)
RG	-0.570(2)	-3.150(2)	1.953(4)*	0.470(4)*	-0.811(1)	-1.189(3)
BD	-1.243(4)	-0.533(4)	0.618(4)*	0.296(4)*	-1.422(4)	-0.455(4)
Philippines						
RR	-2.289(4)	-0.498(4)	2.024(4)*	0.592(4)*	-0.952(1)	-0.815(1)
RG	-1.178(2)	-0.316(2)	1.884(4)*	0.549(4)*	-1.576(4)	-0.613(4)
BD	-0.052(4)	-0.931(4)	1.099(4)*	0.362(4)*	-0.188(4)	-0.991(4)
Singapore						
RR	-1.112(4)	-0.731(4)	1.943(4)*	0.199(4)*	-0.432(4)	-1.089(4)
RG	-1.270(2)	-2.055(2)	2.138(3)*	0.392(3)*	-1.492(3)	-1.364(3)
BD	-1.924(4)	-2.039(4)	1.148(4)*	0.155(4)*	-1.738(4)	-2.084(4)
Thailand						
RR	-1.538(4)	-1.402(4)	2.233(4)*	0.478(4)*	-0.973(6)	-1.560(6)
RG	-1.599(4)	-1.429(4)	2.130(4)*	0.900(4)*	-1.705(3)	-1.205(3)
BD	-1.568(3)	-1.551(3)	0.499(2)*	0.389(2)*	-1.566(3)	-1.554(3)
B: First Differences						
Korea						
RR	-10.943(1)*	-11.954(1)*	0.179(4)	0.080(4)	-8.870(2)*	-10.927(2)*
RG	-5.211(4)*	-6.269(4)*	0.152(4)	0.034(4)	-5.087(3)*	-3.112(3)*
BD	-12.072(2)*	-12.412(2)*	0.089(1)	0.040(1)	-8.080(2)*	-10.804(2)*
Malaysia						
RR	-4.368(4)*	-4.779(4)*	0.141(4)	0.019(4)	-12.505(2)*	-5.630(2)*
RG	-7.344(3)*	-9.116(3)*	0.108(4)	0.025(4)	-11.924(1)*	-17.751(2)*
BD	-7.206(4)*	-7.642(4)*	0.063(4)	0.032(4)	-7.157(4)*	-7.031(4)*
Philippines						
RR	-4.266(3)*	-4.584*(3)	0.097(4)	0.053(4)	-6.338(1)*	-9.337(1)*
RG	-5.914(2)*	-8.928(2)*	0.167(4)	0.088(4)	-3.420(4)*	-3.628(4)*
BD	-6.379(4)*	-7.098(4)*	0.063(4)	0.047(4)	-3.475(4)*	-3.158(4)*
Singapore						
RR	-4.910(4)*	-4.972(4)*	0.060(4)	0.056(4)	-4.622(4)*	-4.816(4)*
RG	-8.982(3)*	-8.998(3)*	0.032(4)	0.033(4)	-4.493(3)*	-3.763(3)*
BD	-6.569(4)*	-6.579(4)*	0.024(4)	0.022(4)	-4.936(3)*	-3.209(3)*
Thailand						
RR	-4.144(4)*	-4.734(4)*	0.330(4)	0.043(4)	-3.852(2)*	-7.840(2)*
RG	-4.401(4)*	-4.889(4)*	0.348(4)	0.035(4)	-11.754(3)*	-9.311(3)*
BD	-15.046(2)*	-15.117(4)*	0.051(2)	0.042(2)	-4.268(4)*	-3.399(4)*

Notes: The t, η and τ statistics are for ADF, KPSS and DFGLS respectively. The subscript μ in the model allows a drift term while τ allows for a drift and deterministic trend. Please refer to the main text for the notations. Asterisk (*) show significance at 5 percent level. Figures in parentheses are the lag lengths. The asymptotic and finite sample critical values for ADF is obtained from MacKinnon (1996) while the KPSS test critical values is obtained from Kwiatkowski *et al*. (1992, Table 1, pp. 166). The DFGLS for the drift term (μ) follows the MacKinnon (1996) critical values while the asymptotic distributions for the drift and deterministic trend (τ) is 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.

Table 2:Cointegration Test Results

A: Korea							
Null	Alternative	k=3 r=1					
			λ-max			Trace	
		Unadjusted	Adjusted	95% C.V.	Unadjusted	Adjusted	95% C.V.
r = 0	r = 1	23.931*	22.671*	15.870	26.512*	25.117	15.870
r<= 1	r = 2	2.580	2.442	9.160	2.580	2.442	9.160
B: Malaysia							
Null	Alternative	k=5 r=1					
			λ-max			Trace	
		Unadjusted	Adjusted	95% C.V.	Unadjusted	Adjusted	95% C.V.
r = 0	r = 1	26.039*	23.754*	15.870	26.083*	23.795*	20.180
r<= 1	r = 2	0.044	0.040	9.160	0.044	0.040	9.160
C: Philippines							
Null	Alternative	k=5 r=1					
			λ-max			Trace	
		Unadjusted	Adjusted	95% C.V.	Unadjusted	Adjusted	95% C.V.
r = 0	r = 1	29.338*	26.764*	15.870	32.460*	29.612*	20.180
r<= 1	r = 2	3.121	2.847	9.160	3.121	2.847	9.160
D: Singapore							
Null	Alternative	k= 4 r=1					
			λ-max			Trace	
		Unadjusted	Adjusted	95% C.V.	Unadjusted	Adjusted	95% C.V.
r = 0	r = 1	17.344*	16.127*	11.030	19.180*	17.834*	12.360
r<= 1	r = 2	1.837	1.708	4.160	1.837	1.708	4.160
E: Thailand							
Null	Alternative	k=3 r=1					
			λ-max			Trace	
		Unadjusted	Adjusted	95% C.V.	Unadjusted	Adjusted	95% C.V.
r = 0	r = 1	30.319*	28.723*	15.870	34.793*	32.962*	20.180
r<= 1	r = 2	4.474	4.239	9.160	4.474	4.239	9.160

Notes: Asterisk (*) denote statistically significant at 5 percent level. The 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 Reinsel and Ahn (1992) methodology. Their finite sample correction multiplies the Johansen test statistic by the scale factor of $(T\text{-}pk)/T$, where T is the sample size, p is the number of variables, and k is the lag length for the VAR model.

Table 3: Gregory-Hansen Cointegration Tests

Country	C	C/T	C/S
Korea	-5.059*	-4.149	-4.304
	[1988:2]	[1994:4]	[1988:2]
Malaysia	-2.018	-4.069	-5.936*
	[1997:2]	[1988:2]	[1988:2]
Philippines	-2.184	-4.212	-5.262*
	[1989:1]	[1989:1]	[1988:2]
Singapore	-3.745	-1.610	-2.593
	[1999:4]	[1999:4]	[1999:4]
Thailand	-6.312*	-4.022	-7.307*
	[1988:3]	[1988:2]	[1989:2]

Notes: Asterisk (*) denote statistical significance at the 5 percent level. The critical values for models C [-4.61], C/T [-4.99] and C/S [-4.95] are obtained from Gregory and Hansen (1996 Table 1 pp.109). Figures in [ ] refers to the breaking date.

Table 4: Dynamic OLS Estimation (DOLS)

Country	b	H_0: b = 1	AR(5)	ARCH (4)	RESET(4)	J-B	White
A: Korea							
Model C	0.961	2.823	1.555	2.718	0.333	3.712	0.746
B: Malaysia							
Model C/S	0.778	36.777*	1.503	1.730	1.895	1.973	0.682
C: Philippines							
Model C/S	0.789	29.033*	2.324	2.201	0.265	0.741	0.849
D: Singapore							
Model JJ	1.185	2.403	0.212	0.369	1.450	3.453	1.408
E: Thailand							
Model C/S	0.959	1.102	0.783	0.051	0.575	1.903	0.364

Notes: The distributional properties of diagnostics are: LM (5) is a test of 5^{th} order serial correlation. ARCH (m) is an m-order test for autoregressive conditional heteroskedasticity. Ramsey's RESET (Regression Specification Test) test uses the square of the fitted values. J-B (Jarque-Bera) is the test of the normality of the residuals. The White general heteroskedasticity test is based on the regression of squared residuals on squared fitted values. Asterisks (*) denote significance at percent level. The break point selected for the DOLS estimation is based on the Gregory and Hansen results from Table 3 except for Singapore where the estimation is conducted based on results in Table 2 (Johansen and Juselius, 1990).

Table 5: Test for Granger non-causality

Null Hypothesis	Test Statistics		Conclusion
A: Korea (k=3 d=1)	**MWALD**	**p-value**	
Government Expenditures does not *Granger cause* Government Revenues	27.230	0.000	Reject Ho
Government Revenues does not *Granger cause* Government Expenditures	3.364	0.498	Do not reject Ho
B: Malaysia (k=5 d=1)			
Government Expenditures does not *Granger cause* Government Revenues	24.042	0.000	Reject Ho
Government Revenues does not *Granger cause* Government Expenditures	15.246	0.001	Reject Ho
C: Philippines (k=5 d=1)			
Government Expenditures does not *Granger cause* Government Revenues	20.404	0.001	Reject Ho
Government Revenues does not *Granger cause* Government Expenditures	42.238	0.000	Reject Ho
D: Singapore (k=4 d=1)			
Government Expenditures does not *Granger cause* Government Revenues	57.043	0.000	Reject Ho
Government Revenues does not *Granger cause* Government Expenditures	7.348	0.119	Do not reject Ho
E: Thailand (k=3 d=1)			
Government Expenditures does not *Granger cause* Government Revenues	37.373	0.000	Reject Ho
Government Revenues does not *Granger cause* Government Expenditures	4.723	0.193	Do not reject Ho

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