

Debt Sustainability in East Asia after the Financial Crisis*

Hyeon-seung Huh** · Raghendra Jha*** · Chung Mo Koo****

For the East Asian countries, the total amount of government debt has risen sharply over the following several years in the wake of the Asian financial crisis. The purpose of this paper is to assess whether the current levels of government debt are sustainable for those severely attacked countries, namely, Korea, Malaysia, Indonesia, the Philippines, and Thailand. Under the intertemporal budget constraint model, we test for fiscal sustainability and examine whether there was any discernible change in the behaviour of government debt following the Asian crisis. Empirical analysis indicates that the levels of government debt are not sustainable in all counties under study. It also shows that the crisis contributes significantly to push the government debt in excess of its sustainable level. This urges policy attention for fiscal consolidation.

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** Author for correspondence, Department of Economics, Yonsei University, 134, Shinchon-dong Seodamoon-gu, Seoul 120-749, Korea, Tel: 02-2123-5499, Fax: 02-393-1158, E-mail: hshuh@yonsei.ac.kr

*** Australian National University, Australia

**** Kangwon National University, Korea

1. INTRODUCTION

Rapid accumulation of public debt can lead to severe macroeconomic problems and can impede control of the fiscal deficit itself. This is particularly relevant for developing countries where the need for public expenditure is high and where tax systems and public regulation and accountability are weak. The recent experiences of the Asian Crisis have renewed interest in the problem of public debt for the East Asian countries. The total amount of government debt has risen sharply over the following several years in the wake of the financial crisis. This is mainly as a result of huge and persistent fiscal stimulus to speed up the recovery process from the crisis. For these countries, however, high public debt had more immediate consequences for economic performance such as debt crises and the resulting painful periods of economic adjustment.

The purpose of this paper is to examine the budget deficit and government debt problems of those severely attacked countries, namely, Korea, Malaysia, Indonesia, the Philippines, and Thailand. A key issue is whether the recent levels of their government debts are sustainable. Fiscal sustainability is essentially an intertemporal question. In this vein, several studies have devised and implemented tests of the intertemporal budget constraint: Hamilton and Flavin (1976), Trehan and Walsh (1991), Bohn (1991 and 1998), Jha and Sharma (2004), to name a few. These methods typically examine the presence of fiscal sustainability by testing the time-series properties of government debt and fiscal deficits implied by the present value model, such as unit roots or cointegration relationships. Most of the subsequent studies have followed suit. We apply the well-known test procedure by Hamilton and Flavin and Trehan and Walsh to five East Asian countries under study.

In a different context, Campbell and Shiller (1987) propose a method to assess the present value model of stock and bond prices. We also apply this procedure to the tests of intertemporal budget balance. Their procedure makes full use of the model's structure and derives testable hypotheses. For

example, one may test the restriction that the actual path of government debt is equal to the theoretical one implied by the present value model at every horizon. Presumably, the Campbell and Shiller model offers a more stringent test for fiscal sustainability than other methods mentioned above do. Their method also allows us to assess whether there was any discernible change in the behavior of government debt following the Asian Crisis. This task may not be accomplished with the use of unit roots or cointegration tests because there is only a short sample span since the Crisis. The situation is particularly acute for those Asian countries in which only a yearly data are readily available.

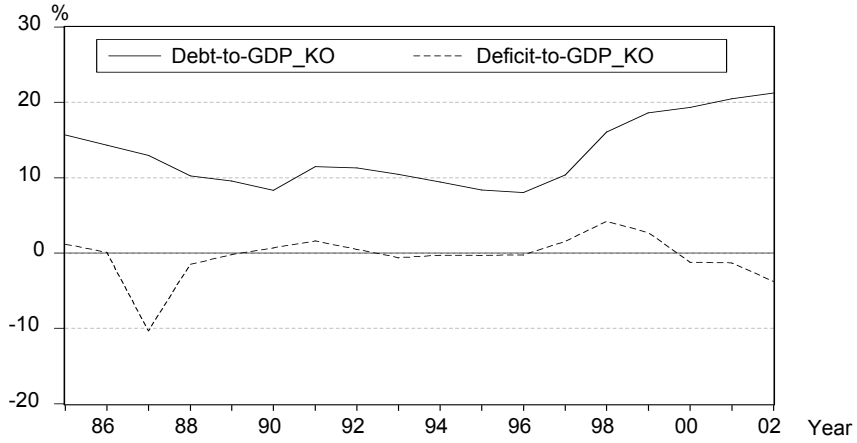
The remainder of this paper is organized as followed. Section 2 provides a brief overview of the fiscal stance for the countries under study. Section 3 summarizes the general analytical background in relation to the present-value borrowing constraint and tests of sustainability. In section 4, empirical results are presented along with some policy implications for fiscal consolidation. Section 5 concludes the paper.

2. FISCAL PERFORMANCE AFTERMATH OF THE FINANCIAL CRISIS

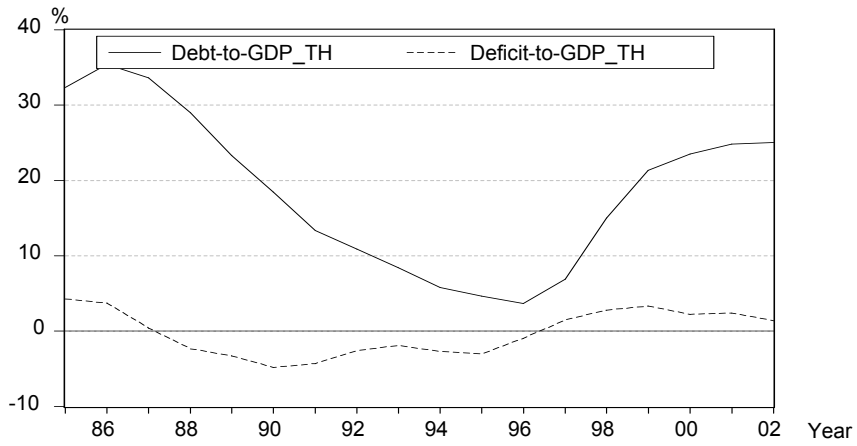
When the economy was experiencing robust growth with private sector playing the major role prior to the Asian financial crisis, the fiscal stance was tight in the East Asian countries with pegged exchange rates and all of them registered fiscal surpluses during the mid-1990s; Korea, from 1993 to 1996, Thailand, from 1988 to 1996, Malaysia, from 1993 to 1997, Indonesia, from 1994 to 1997, and the Philippines, from 1994 to 1997, respectively (see figure 1a through figure 1e). However, in the years immediately after the Asian crisis, which plunged the East Asian countries into their deepest recession, the respective government embarked on an expansionary fiscal policy to provide counter-cyclical measures to compensate for the financially strapped private sector.

Figure 1 Budget Deficits and Government Debt

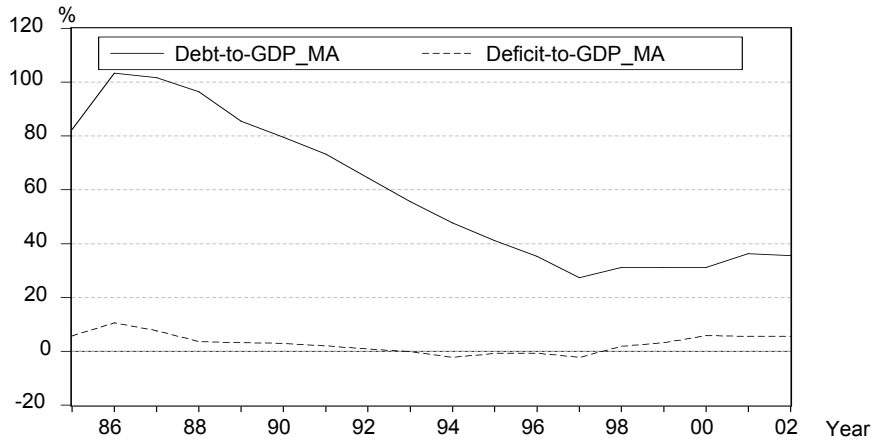
<Figure 1a> Budget Deficits and Government Debt - Korea



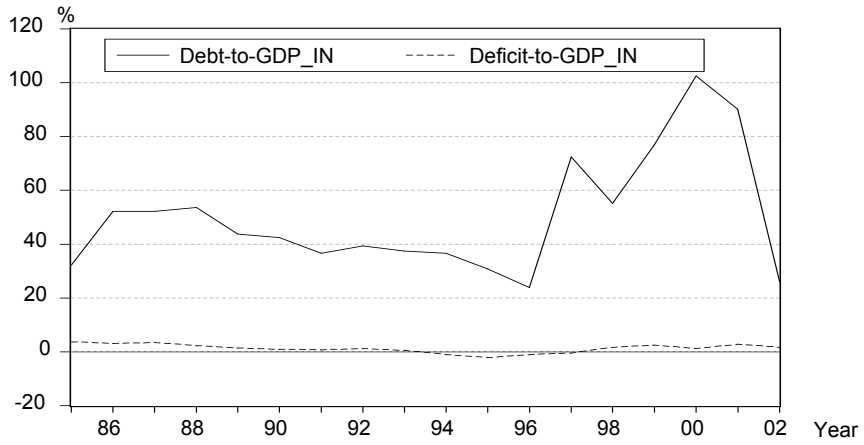
<Figure 1b> Budget Deficits and Government Debt - Thailand

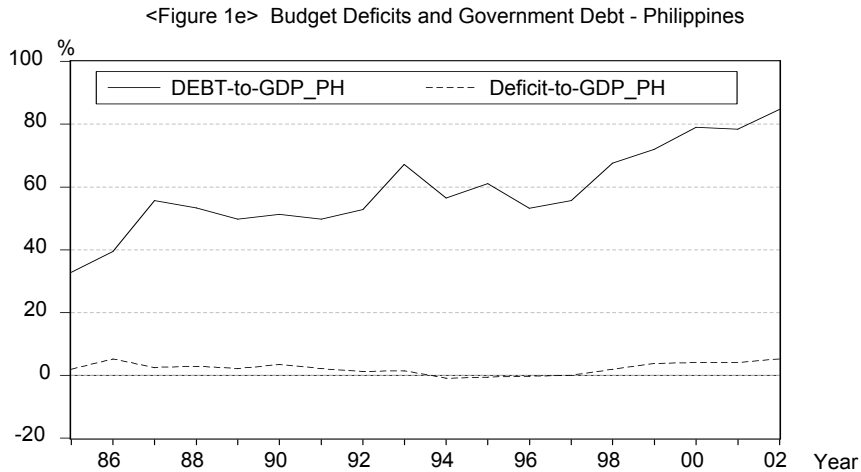


<Figure 1c> Budget Deficits and Government Debt - Malaysia



<Figure 1d> Budget Deficits and Government Debt - Indonesia





From an initial austerity drive based on fiscal tightening stance, the respective governments reversed the decision to implement fiscal stimulus measures to resuscitate the economy. In line with the strategy to spur economic recovery, these governments allocated more funds for restructuring of the financial and corporate sectors as well as for socio-economic projects to cushion the impact of the crisis on the more vulnerable segments of their societies. The expansionary budget policy has been effective in stimulating output and economic activity. Together with a considerable increase in exports, each economy bounced back from a negative growth rate in 1998.

The East Asian economy again faced difficult challenges when the world economy began slowing down towards the end of 2000. In order to mitigate the effects of slower world growth, each government implemented fiscal stimulus packages for the development and infrastructure projects. The objective was also to stimulate private sector investment and enhance competitiveness, particularly through making funds more accessible at reasonable costs to the private sector. As a result, the contribution of public sector expenditure to recovery and GDP growth was significant in East Asian countries, particularly in Thailand, Malaysia, and the Philippines in 2002.

As expected, persistent fiscal stimulus in the East Asian countries after the financial crisis became a main factor raising the budget deficit. This dramatically raised these countries' net debt ratio to GDP from 10.4% to 21.2% in Korea, from 6.9% to 25.0% in Thailand, from 27.3% to 35.6% in Malaysia, from 72.5% to 102.4% in Indonesia, from 55.7% to 84.7% in the Philippines, respectively for the years of 1997 and 2002 (see also figure 1a through figure 1e).

The surge was attributed to the issuance of a huge sum in state bonds and borrowings from international funding agencies in order to raise badly-needed funds for corporate and financial restructuring as well as to stimulate the sluggish economy. The skyrocketing amount of government debt is expected to pose a serious threat to the prospects for continued economic development in these countries. Each of the East Asian countries is concerned about a dramatic rise in the government debt since that would derail the sound economic growth experienced prior to the Asian crisis.

3. INTERTEMPORAL BUDGET CONSTRAINTS

In this section, we set out a simple intertemporal budget relationship and derive the restrictions that must be satisfied for sustainability. Consider the general budget identity

$$B_t = (1 + r_{t-1})B_{t-1} + D_t, \quad (1)$$

where B_t is the real market value of outstanding government debt at period t , r_{t-1} is the real interest rate for debt instruments held from $t-1$ to t , and D_t is the primary fiscal deficit, excluding interest payments. Under the assumption of a constant real interest rate (i.e., $r_t = r$ for all t), solving equation (1) forward yields the intertemporal budget constraint

$$B_{t-1} = -E\left[\sum_{j=0}^{\infty} \beta^{j+1} D_{t+j}\right] + E\left[\lim_{j \rightarrow \infty} \beta^{j+1} B_{t+j}\right], \quad (2)$$

where $\beta = 1/(1+r)$ is the discount factor. From equation (2), sustainability requires that the present value of future primary surpluses must exceed the present value of primary deficits by a sufficient amount to cover the difference between the initial debt stock and the present value of the terminal debt stock.

If the present value of the terminal debt stock is positive, equation (2) can be satisfied even if a government rolls over its debt in full every period by borrowing to cover both principal and interest payments. However, Chalk and Hemming (2000) demonstrates that a government attempting to run a Ponzi game will find that no rational individual is willing to hold its liabilities, and it cannot therefore roll over its debt in full in every period. Thus, no-Ponzi game restriction is typically regarded as synonymous with sustainability, which implies that the transversality condition, $\lim \beta^{j+1} B_{t+j} < 0$, has to hold. In fact, this condition will hold as an equality since individual investors cannot end up being indebted to the government, and as a consequence sustainable fiscal policy has to satisfy the present-value borrowing constraint. Thus, sustainability requires that an excess of future primary surpluses over primary deficits match the current stock of government debt in present value terms as in

$$B_{t-1} = -E\left[\sum_{j=0}^{\infty} \beta^{j+1} D_{t+j}\right]. \quad (3)$$

As Trehan and Walsh (1991) have shown, equation (3) offers a simple test of intertemporal budget constraints in the case where the (expected) rate of real interest is constant. If D_t is a stationary stochastic process, budget balance is satisfied if and only if B_t is also stationary. If D_t is nonstationary, B_t must be nonstationary and there must exist a linear combination of D_t and B_t that is stationary, i.e. cointegration. Hamilton and Flavin (1986) is a special case as they find D_t to be stationary, and therefore argue that stationarity of B_t implies that budget balance holds. With a few exceptions, most previous studies based their tests of sustainability on the tests of a unit

root or a cointegrating relationship linking government deficits and the outstanding stock of debt (Trehan and Walsh, 1988; Hakkio and Rush, 1991; Bohn, 1998).

Alternatively, the present value model of Campbell and Shiller (1987) can be employed to test the intertemporal budget constraint. One benefit is that their model enables us to derive the optimal path implied by the present value model of public debt in an unrestricted vector autoregression (VAR) framework. To see this, consider a VAR model for D_t and B_t of the form

$$\begin{bmatrix} D_t \\ B_t \end{bmatrix} = \begin{bmatrix} a(L) & b(L) \\ c(L) & d(L) \end{bmatrix} \begin{bmatrix} D_{t-1} \\ B_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}, \quad (4)$$

where the polynomials in the lag operators $a(L)$, $b(L)$, $c(L)$, and $d(L)$ are all of order p . Equation (4) can be represented in companion form as

$$\begin{bmatrix} D_t \\ M \\ D_{t-p+1} \\ B_t \\ M \\ B_{t-p+1} \end{bmatrix} = \begin{bmatrix} a_1 & L & a_p & b_1 & L & b_p \\ 1 & O & & & & \\ & 1 & O & & & \\ c_1 & L & c_p & d_1 & L & d_p \\ & & & 1 & O & \\ & & & & 1 & O \end{bmatrix} \begin{bmatrix} D_{t-1} \\ M \\ D_{t-p} \\ B_{t-1} \\ M \\ B_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ 0 \\ M \\ \varepsilon_{2t} \\ 0 \\ M \end{bmatrix}, \quad (5)$$

or in a more compact notation

$$Z_t = AZ_{t-1} + \varepsilon_t.$$

For all i , note that

$$E(Z_{t+i} | I_t) = A^i Z_t,$$

which is the forecast of Z_{t+i} conditional on the information at time t , I_t ,

containing current and lagged values of D_t and B_t . Projecting equation (3) onto the information set I_t gives

$$E(B_t | I_t) = -\sum_{i=1}^{\infty} (1/(1+r))^i E(D_{t+i} | I_t). \quad (6)$$

Using equation (5), the following set of restrictions on the VAR companion matrix A can be obtained

$$g' = -\sum_{i=1}^{\infty} (1/(1+r))^{-i} h' A^i, \quad (7)$$

where g and h are column vectors of $2p$ elements, all of which are zero saving the $p+1$ element of g and the first element of h are unity (i.e., $B_t = g'Z_t$ and $D_t = h'Z_t$). Since B_t and D_t are stationary variables, the right-hand-side of (7) converges to

$$g' = -h' \varpi A (I - \varpi A)^{-1}, \quad (8)$$

where $\varpi = 1/(1+r)$. Using equations (3) and (7) with $B_t = g'Z_t$ and $D_t = h'Z_t$, it is possible to compute

$$\tilde{B}_t^c = -\sum_{i=1}^{\infty} \varpi^i h' A^i Z_t \quad \text{or} \quad \tilde{B}_t^c = -h' \varpi A [I - \varpi A]^{-1} Z_t, \quad (9)$$

which is a VAR forecast of the present value of future changes in D_t based on the estimated coefficients from the unrestricted VAR as in equation (4). This public debt variable, \tilde{B}_t^c , then reflects the optimal current deficit implied by the theory. If the present-value model of public debts is adequate then B_t should equal \tilde{B}_t^c except for an innovation. Because sustainable fiscal policy must satisfy the present value budget constraint, significant deviations of B_t from \tilde{B}_t^c may be regarded as evidence against fiscal sustainability.

A formal test can be constructed to check the statistical validity of intertemporal budget constraints for the public debt. To see this, post-multiply both sides of equation (8) to yield

$$g'[I - \varpi A] = -h' \varpi A. \quad (10)$$

By writing out the restrictions on individual coefficients of the companion matrix, A , the restrictions implied by equation (9) state that $B_{t+1} - D_{t+1} - (1+r)B_t$ should be unpredictable given lagged B_t and D_t . This orthogonality restriction can be statistically examined by running a linear regression of the form

$$B_t - D_t - (1+r)B_{t-1} = \alpha + \sum_{k=1}^p \delta_{1,k} B_{t-k} + \sum_{k=1}^p \delta_{2,k} D_{t-k} + v_t, \quad (11)$$

and testing the null hypothesis $\delta_{1,k} = \delta_{2,k} = L = 0$ for all $k > 0$.

4. EMPIRICAL RESULTS

Empirical analysis outlined above is undertaken using annual data over the period 1974 to 2002. Data on government debt and deficit are in real terms deflated by the CPI. All data were obtained from the *Asian Development Bank Key Indicators* (www.adb.org/statistics). First, we test for the presence of a unit root in each series. Table 1 reports the results of augmented Dickey-Fuller (ADF) tests for the null hypothesis of a unit root. To have a crosscheck, we also report the results of Kwiatkowski *et al.* (KPSS, 1992) tests, which assumes the null hypothesis that the series is stationary with or without a trend. Both tests suggest that budget deficits are stationary in all countries. These results imply that from equation (3), the levels of government debt in these countries must be stationary for fiscal sustainability.

Table 1 Unit Root Tests

	Debt			Deficit		
	ADF	KPSS		ADF	KPSS	
		No trend	Trend		No trend	Trend
Korea	-2.16	0.89*	0.21*	-3.19*	0.08	0.05
Thailand	-2.13	0.53*	0.09	-4.55*	0.11	0.11
Malaysia	-1.56	0.76*	0.23*	-3.71*	0.11	0.12
Indonesia	-3.02*	0.83*	0.14	-4.26*	0.09	0.09
Philippines	-1.83	1.06*	0.20*	-2.99*	0.29	0.10

Notes: Both ADF and KPSS tests assume the lag length of two. Critical values for the ADF and KPSS tests are drawn from Fuller (1976) and Kwiatkowski *et al.* (1992), respectively. An * indicates significance at the 5% level.

For government debt, however, the KPSS test shows that the null hypothesis of stationarity, either with or without trend, is rejected in all countries except Indonesia. These findings are consistent with those of the ADF test, as they could not reject the null hypothesis of a unit root. Consequently, the levels of government debt may be regarded as unsustainable for Korea, Thailand, Malaysia and Philippines. For Indonesia, both tests indicate that the level of debt is better characterized as being stationary (possibly with a trend). This may be taken as a supporting evidence for fiscal sustainability. Apparently, Indonesia among the five is shown to be the only country where the levels of public debt have been sustainable over the last thirty years.

We now examine a present value model of public debts by applying the procedure of Campbell and Shiller (1987). For this, equation (11) is estimated with $p=2$ to warrant no serial correlation in the residual series. Data on the real interest rate are constructed using nominal money market rates and the CPI from the *International Financial Statistics*. Its simple average over the full sample is used to derive the dependent variable,

Table 2 Tests on the Present Value Model of Government Debt

	Korea	Malaysia	Indonesia	Philippines	Thailand
Wald test	19.11	22.00	47.93	14.55	54.46
<i>p</i> -value	0.01	0.00	0.00	0.04	0.00

Note: The Wald test statistic is distributed as $\chi^2(4)$.

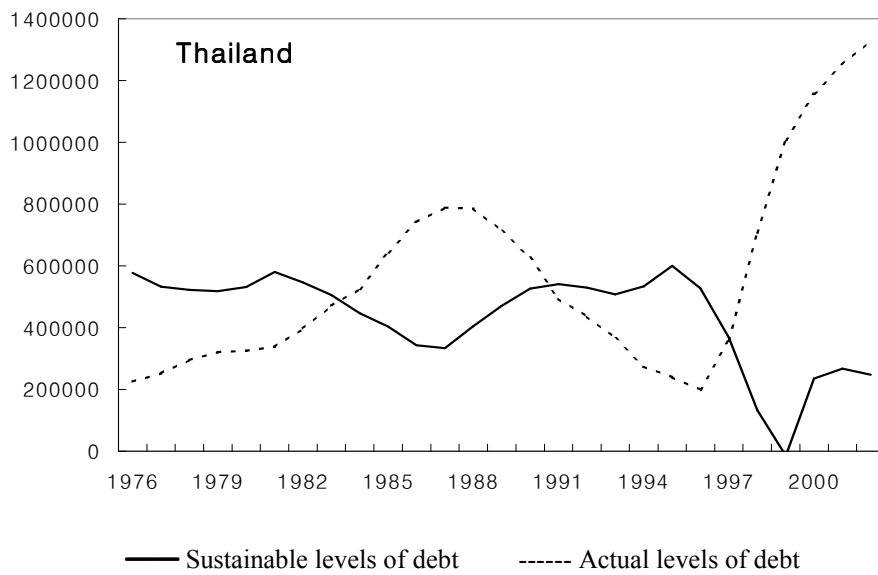
($B_t - D_t - (1+r)B_{t-1}$). Table 2 reports the results of the Wald test for the null hypothesis that the restrictions implied by the present value model are coherent with the data. This null hypothesis is rejected strongly in all countries with the marginal significance levels being less than 1% (for Philippines at 5%). Accordingly, the levels of public debt fail to satisfy the intertemporal budget constraint. This may be regarded as evidence against the sustainability of public debt as sustainable fiscal policy must satisfy the present value budget constraint. Indonesia is not an exception this time.

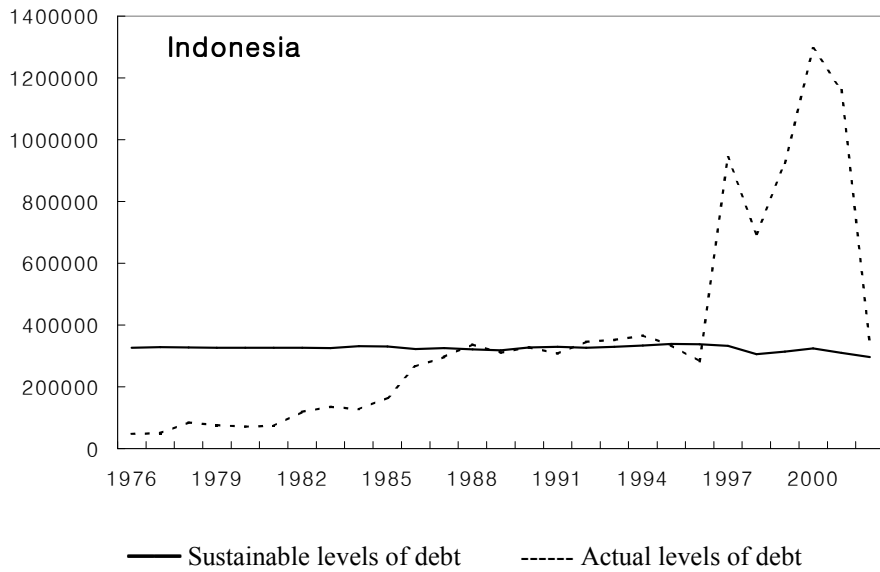
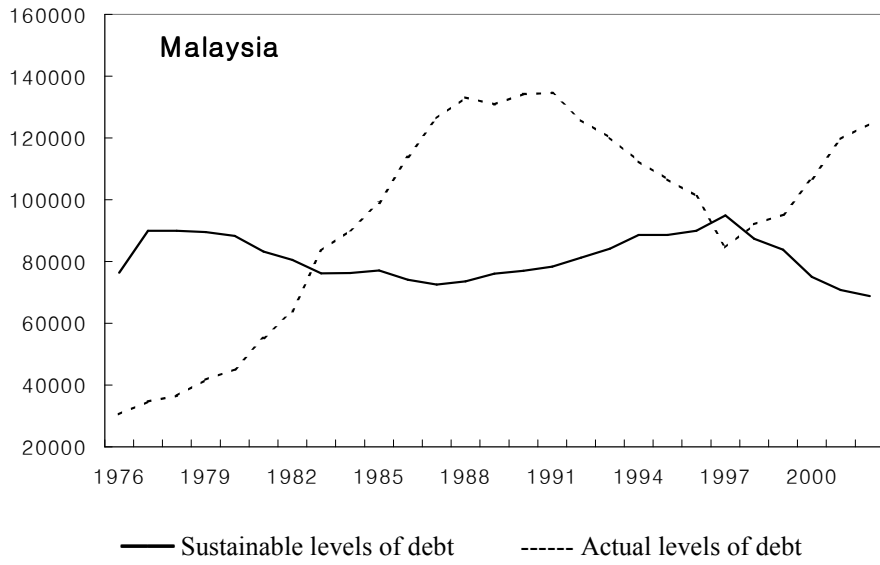
Campbell and Shiller point out that equation (11) may be rejected because of economically unimportant deviations from the null hypothesis, such as data imperfections, which are nevertheless statistically important. They also suggest a more intuitive and less econometrically stringent test that compares the predicted path of the optimal government debt under the theory with that of the actual government debt. Figure 2 depicts actual and optimal government debts based on the estimation of VAR (2) model in equation (4). There are significant differences between the two, confirming the rejection of intertemporal budget constraints as in table 2. The effects are particularly evident in Malaysia. The levels of government debt are excessive over the implied sustainable levels for the most of the periods since 1982.

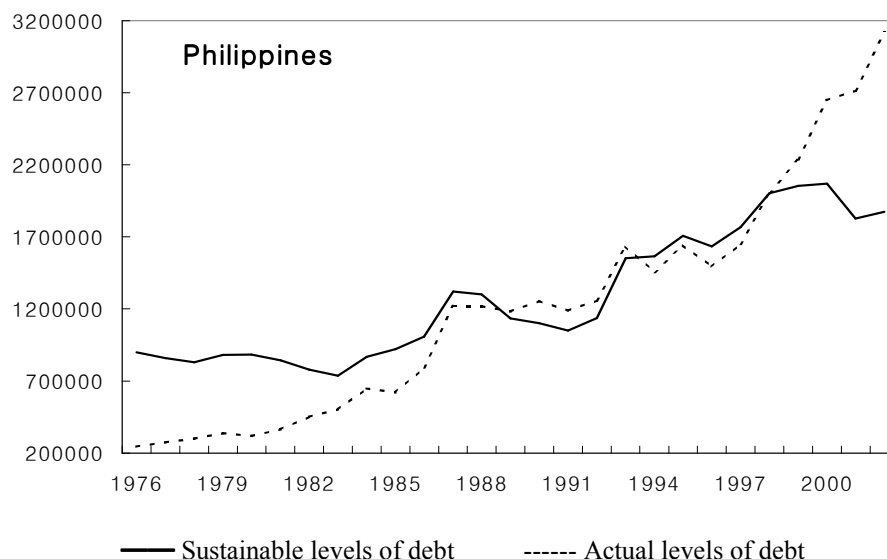
In fact, figure 2 leads us to draw several interesting conclusions. Actual government debts of Korea, Indonesia and to a lesser extent, Philippines were smaller than the sustainable levels prior to the Crisis. While the levels

of government debt were not in an optimal path, they should not have posed

Figure 2 Sustainable Levels of Government Debt







a major concern to the healthiness of the economy as a result. After the crisis, however, the situation reverses as a rapid surge in the fiscal deficit pushes government debts far above the levels of sustainability. It is interesting to recall that for Indonesia, the unit root test in table 1 provided empirical evidence in favor of the fiscal sustainability. Figure 2 offers one explanation why the unit root test may fail to capture the debt problem after the Crisis. This also corroborates the usefulness of Campbell and Shiller's method for the test of fiscal sustainability. For the other two countries, Malaysia and to a lesser extent, Thailand had excessive levels of government debt even before the crisis. Reflecting partly on this, their sustainable levels fell subsequently to observe the intertemporal budget balance. Both countries again experienced a considerable rise in the government debt since the crisis, which widens the gaps between the actual and sustainable levels.

Previously, Croce and Juan-Ramón (2003) examined the fiscal sustainability using the IFS algorithm for 12 countries including Indonesia, Korea, and Thailand. They found that their IFS indicators for three Asian countries switched from the sustainable to the unsustainable region in the aftermath of the Financial Crisis. This finding is well consistent with ours, as

figure 2 shows. Skyrocketing fiscal deficits since the Crisis should have pushed government debts far above the levels of sustainability. For Korea, however, Kim (2001) and Bank of Korea (2002) report that fiscal unsustainability may not be a concern despite the jump in the public debt ratio since the Crisis. The underlying idea is that given low initial level of Korea's debt ratio, this ratio was still "outside the danger zone." These studies used data up to either 1999 or 2000. Continued accumulation of fiscal deficits throughout the early 2000's (see figure 2) acts to overshadow this somewhat optimistic view. It will be prudent to wait for more observations before we decide with some certainty whether the current fiscal stance is sustainable or not. Nevertheless, given the results in figure 2 together with those from Croce and Juan-Ramón, it is our opinion that it may not be a good practice to ignore debt growth until it causes a real problem.

Fiscal expansion has been used in the countries studied in this paper to get out of two recessions – one occasioned by the East Asian crisis and the second by the downturn in the global economy since late 2000. However, during this process these countries have accumulated levels of public debt that appear unsustainable, risking sustained high rates of economic growth. If left unchecked this excessive accumulation of public debt might risk adverse expectations and subsequent recession just as the accumulation of excessive private debt triggered the Asian crisis. It is necessary, therefore, to ensure that these countries use their current economic expansion to initiate tax reforms to substantially raise government revenues and streamline and cut wasteful government expenditures to reduce fiscal deficits or, at least, generate primary surpluses. At the same time a carefully tailored program of privatization of government enterprises with the revenue being used to directly reduce the debt should be pursued.

5. CONCLUSION

For the East Asia countries, the total amount of government debt has risen

sharply over the following several years in the wake of the financial crisis. This raises concern about the sustainability of government debts and fiscal consolidation. This paper has set out to assess fiscal sustainability for those severely attacked countries, namely, Korea, Malaysia, Indonesia, the Philippines, and Thailand. At work is the model of intertemporal budget balance. We test for implied intertemporal balance conditions for fiscal sustainability. We also examine whether there was any discernible change in the behaviour of government debt following the crisis.

Empirical analysis indicates that the levels of government debt are not sustainable in all five countries. Among them, Korea, Indonesia and to a lesser extent, Philippines posed little concern on the soundness of government debt prior to the crisis. After the crisis, however, a rapid surge in fiscal deficits pushes government debts far above the levels of sustainability. For Malaysia and Thailand, they had excessive levels of government debt even before the crisis and another considerable rise since the crisis has deteriorated their fiscal sustainability further. In any case, our results suggest that policy makers need to draw their attention to consolidate the fiscal stance and to retain the sustainability of government debt.

Some caveats are in order before concluding the paper. First, the present value balance approach has limitations in serving an indicator to gauge fiscal sustainability. Some fiscal policies that appear unsustainable can satisfy implied constraints, while other policies appear sustainable but do not satisfy them (McCallum, 1984; Kremer, 1989). Several alternative measures for the sustainability have been developed, but they also have their own shortcomings such as lack of economic grounds (see Horne, 1991) and IMF (2002) for a comprehensive survey. Second, the study has used annual data over the sample period 1974 to 2002 because quarterly data and a longer sample span were not available for those Asian countries. Such a small sample may be unavoidable for this kind of studies. Nevertheless, the well-known problems in use of small samples (i.e., small sample biases, size and power distortions in unit root tests) are likely to undermine the strength of the findings in the paper. Finally, we could not address a possibility of structural

breaks in connection to the Asian financial crisis. This topic would be interesting, but has to be left until more observations after the crisis are available.

REFERENCES

- Bank of Korea, *Monthly Bulletin*, December 2002, pp. 24-45 (in Korean).
- Bohn, H., "The Sustainability of Budget Deficits with Lump-Sum and with Income-Based Taxation," *Journal of Money, Credit, and Banking*, 23, 1991, pp. 580-604.
- _____, "The Behavior of U.S. Public Debt and Deficits," *Quarterly Journal of Economics*, 113, 1998, pp. 949-963.
- Campbell, J. and R. Shiller, "Cointegration and Tests of Present Value Models," *Journal of Political Economy*, 95, 1987, pp. 1062-1088.
- Chalk, N. and R. Hemming, "Assessing Fiscal Sustainability in Theory and Practice," IMF Working Paper No. 00/81, International Monetary Fund, 2000.
- Croce, E. and H. Juan-Ramón, "Assessing Fiscal Sustainability: A Cross-Country Comparison," IMF Working Paper No. 03/145, International Monetary Fund, 2003.
- Fuller, W., *Introduction to Statistical Time Series*, John Wiley & Sons, 1976.
- Hakkio, C. S. and M. Rush, "Is the Budget Deficit Too Large?," *Economic Inquiry*, 29, 1991, pp. 429-445.
- Hamilton, J. and M. Flavin, "On the Limitations of Government Borrowing: A Framework for Empirical Testing," *American Economic Review*, 76, 1986, pp. 809-819.
- Horne, J., "Indicators of Fiscal Sustainability," International Monetary Fund, Working Paper No. 91/5, 1991.
- International Monetary Fund, "Assessing Sustainability," Prepared by the Policy Development and Review Department, 2002.
- Jha, R. and A. Sharma, "Structural Breaks, Unit Roots and Cointegration: A

- Further Test of the Sustainability of the Indian Fiscal Deficit,” *Public Finance Review*, 32, 2004, pp. 196-219.
- Kim, S., “Fiscal Deficits Effects and the Sustainability,” *Korean Journal of Public Finance*, 15, 2001, pp. 3-32 (in Korean).
- Kwiatkowski, D., P. Phillips, P. Schmidt, and Y. Shin, “Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root,” *Journal of Econometrics*, 54, 1992, pp. 159-178.
- Kremer, J., “U.S. Federal Indebtedness and the Conduct of Fiscal Policy,” *Journal of Monetary Economics*, 23, 1989, pp. 219-238.
- McCallum, B., “Are Bond-Financed Deficits Inflationary? A Ricardian Analysis,” *Journal of Political Economy*, 92, 1984, pp. 123-135.
- Trehan, B. and C. Walsh, “Common Trends, The Government’s Budget Constraint, and Revenue Smoothing,” *Journal of Economic Dynamics and Control*, 12, 1988, pp. 425-444.
- _____, “Testing Intertemporal Budget Constraints: Theory and Applications to U.S. Federal Budget and Current Account Deficits,” *Journal of Money, Credit, and Banking*, 23, 1991, pp. 206-223.