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Fiscal Sustainability and Its Implication for Fiscal Policy in Korea*

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A sharp rise in government debt in Korea has followed over years the Asian financial crisis. This paper aims to assess the fiscal performance and test whether the current level of government debt is sustainable for a severely attacked country, namely, Korea. Under the intertemporal budget constraint model, the study tests for fiscal sustainability and examines whether there was any discernible change in the behaviour of government debt following the crisis. It applies the well-known test procedure by Hamilton and Flavin and Trehan and Walsh to the Korean case under study. In a different context, the study also applies the procedure of Campbell and Shiller to the tests of intertemporal budget balance. Their method also allows us to assess whether there was any discernible change in the behavior of government debt following the 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 Korea in which only a yearly data are readily available. Empirical analysis indicates that the levels of government debt are not sustainable in Korea. It also shows that the crisis contributes significantly to push the government debt in excess of its sustainable level. This draws a particular policy attention for fiscal consolidation.

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1. INTRODUCTION

A sharp rise in 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 financial crisis have renewed interest in the problem of public debt for Korea. 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 Korea, 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 public debt problems of a severely attacked country, namely, Korea. A key issue is whether the recent level of its public debt is 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. The study applies the well-known test procedure by Hamilton and Flavin and Trehan and Walsh to the Korean case under study.

In a different context, Campbell and Shiller (1987) propose a method to assess the present value model of stock and bond prices. The study also applies 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 Korea in which only a yearly data are readily available.

The remainder of this paper is organized as follows. Section 2 provides an overview of the fiscal policy and budget structure in Korea under study. Section 3 explains the current fiscal stance for Korea in regard to budget deficit and public debt. Section 4 assesses the fiscal performance in the aftermath of the financial crisis. Section 5 summarizes the general analytical background in relation to the present-value borrowing constraint and tests of sustainability and presents empirical results along with some policy implications for fiscal consolidation. Section 6 concludes the paper.

2. FISCAL POLICY AND BUDGET STRUCTURE

Fiscal policy played a supporting role in the Korean industrialization process by contributing to the overall savings rate and by minimizing tax disincentives of investment. Though the focus of fiscal policy in Korea changed sharply over time, its major characteristics for the last four decades have included a relatively small public sector, comparatively low taxes, liberal use of tax incentives for saving and investment, heavy reliance on indirect tax, increased public savings, and relatively little emphasis on spending for redistributive social services. Korean fiscal planners applied the logic of supply-side economics much earlier than their counterparts in the USA and the UK.

Table 1 provides four indicators of the capacity of the government to influence the economy: share of the budgetary expenditures (general account)

Table 1 Fiscal Indicators, 1995-2006

(unit: %)

	As a percentage of GDP			
	Budget Expenditure	Total Tax	Government Consumption	Government Saving
1995	-	6.2	8.8	-2.4
1996	17.1	10.3	14.5	-2.1
1997	11.6	8.6	9.3	1.7
1998	16.0	14.4	9.8	7.0
1999	14.9	14.9	11.2	3.2
1980	16.7	17.0	12.4	5.4
1985	14.8	16.1	11.2	6.1
1990	14.7	17.8	11.8	7.9
1995	13.0	18.1	11.2	9.1
1996	12.9	18.4	11.6	9.6
1997	13.8	18.0	11.6	9.9
1998	14.5	17.5	12.8	8.9
1999	15.1	17.8	12.3	9.1
2000	14.9	19.6	12.1	11.8
2001	15.9	19.7	12.9	11.0
2002	15.9	19.8	12.9	11.7
2003	16.2	20.4	13.3	11.6
2004	17.1	21.1	14.8	13.1
2005	17.8	21.3	15.1	13.4
2006	18.3	21.6	15.3	14.1

Source: National Bureau of Statistics, Major Statistics of the Korean Economy, 2007.

of the central government in GDP, the total tax burden, measured as a ratio of total (national and local) tax revenue to GDP, the government final consumption as a proportion of GDP, and the government saving rate.

Despite the heavy and active involvement by the government in activities of the private sector, the size of government, whether measured as budgetary expenditure as a percentage of GDP or the overall tax burden, is still somewhat low compared with that of other countries, developed and

developing.

The total budgetary spending of the central government has fluctuated widely since 1960, without showing any consistent trend. The share of government final consumption in GDP has fluctuated less than that of general account budgetary expenditures in GDP. Due to the concerted effort by the government to raise revenue, the share of total (national and local) tax revenue as a percentage of GDP, or the tax burden, increased from 6.2% in 1995 to 21.6% in 2006. There has been an almost uninterrupted increase in government savings when the government sector moved from a position of net dissaver to one of net savers.

Government expenditures have been basically restrained, with the ratio of the central government budget to GDP remaining at less than 24% throughout the 1960 to 2006 period.

The central government budget for 1990 inclusive of the general account and the special accounts was 31.9 trillion won equivalent to 17.9% of GDP. Its ratio to GDP has been stable between 18% and 20% until the financial crisis in 1997. However it hiked to 23.7% in 1998 and thereafter has consistently stayed over 21% (see table 2).

While the size of the general account has varied by the equivalent path to the central government budget for the same time period, the ratio of the 22 special accounts to GDP has been declining since the crisis after it reached its peak at 8.6% in 1999.

An important characteristic of the central government expenditure pattern is that Korea had big share of defense expenditures and small share of social development expenditures until early 1990s and thereafter the share of defense expenditures has declined while the social expenditure share has increased. In 1980 defense expenditures accounted for 35.6% of total government outlays and 6.3% of GDP. The shares of defense expenditures in government outlays have continuously declined to 15.9% in 2006. Social development expenditures remained smaller than defense expenditures and economic development expenditure though the social development expenditure has increased gradually to 14.1% in 2006.

Table 2 Central Government Budget and Its Components

(unit: hundred million won, %)

Year	Central Government		General Account		Special Accounts	
	Amount	Percent of GDP	Amount	Percent of GDP	Amount	Percent of GDP
1970	9,897	35.8	4,462	16.1	5,435	19.7
1975	33,289	32.1	15,869	15.3	17,420	16.8
1980	152,808	39.4	64,667	16.7	88,141	22.7
1985	278,398	33.1	125,323	14.9	153,075	18.2
1990	319,115	17.9	274,637	16.0	44,478	1.9
1995	729,150	19.3	514,981	13.6	214,169	5.7
1996	927,052	20.0	584,808	13.9	252,244	6.1
1997	924,642	20.4	639,621	14.1	285,021	6.3
1998	1,054,505	23.7	732,260	16.4	322,245	7.3
1999	1,145,482	23.7	732,260	15.1	413,222	8.6
2000	1,239,155	21.4	805,099	13.9	434,056	7.5
2001	1,374,808	22.1	986,685	15.8	388,123	6.3
2002	1,452,499	21.2	1,089,183	15.9	363,316	5.3
2003	1,586,479	22.0	1,172,229	16.2	414,250	5.8
2004	1,831,944	24.3	1,182,362	16.1	649,582	8.2
2005	1,923,998	24.7	1,342,076	17.4	581,922	7.3
2006	2,008,786	25.1	1,448,360	18.1	560,426	7.0

Note: Data prior to 1990 include both central and local government budget.

Source: Ministry of Planning and Finance.

There was a conspicuous change in the composition of the General Account expenditures in the aftermath of the financial crisis so as to stimulate the economy as well as to carry out restructuring policies; economic development (30.3%), education (16.6%), defense (19.3%), social development (9.8%) and transfers to local governments (9.6%) in 1998. In 2006, the composition is seen in a traditional manner besides more emphasis

Table 3 Composition of General Account Expenditures

(unit: %)

Year	National Defense	Education	Social Development	Economic Development	General Administration	Grants to Local Gov't	Repayment of Debt & Others	Total
1972	27.0	17.1	7.6	23.4	22.5	2.5		100.0
1975	27.1	13.1	7.3	30.3	20.0	2.2		100.0
1980	30.6	14.6	9.9	26.0	8.5	10.4		100.0
1985	26.6	16.6	12.4	21.9	9.4	13.2		100.0
1990	24.3	18.5	19.5	16.3	9.7	11.8		100.0
1995	22.1	18.8	8.1	22.3	10.6	10.6	7.1	100.0
1996	22.1	18.9	8.6	22.4	10.7	10.9	6.4	100.0
1997	21.3	18.9	9.2	25.1	10.7	10.7	3.8	100.0
1998	19.3	16.6	9.8	30.3	10.0	9.6	4.4	100.0
1999	17.3	14.2	11.1	29.2	9.7	8.3	9.9	100.0
2000	17.7	14.5	13.1	27.3	9.3	9.5	9.6	100.0
2001	16.4	18.1	13.8	25.8	9.3	12.5	4.1	100.0
2002	16.0	17.2	12.7	29.4	9.3	11.3	4.2	100.0
2003	15.8	17.7	13.1	27.7	10.8	12.6	2.3	100.0
2004	16.5	18.5	13.7	25.2	9.5	12.0	4.6	100.0
2005	16.2	20.1	13.0	20.9	10.9	14.5	4.1	100.0
2006	15.9	20.3	14.1	19.3	10.8	15.8	3.8	100.0

Note: Data for 2006 are budget amounts and the rest, actual.

Source: Ministry of Planning and Finance, Bank of Korea.

on grants to local governments and education; economic development (19.3%), education (20.3%), defense (15.9%), social development (14.1%) and transfers to local governments (15.8%) (see table 3).

3. BUDGET DEFICIT AND PUBLIC DEBT

3.1. Consolidated Fiscal Balance

Korea recorded a consolidated budget deficit of 18.8 trillion won in 1998, the biggest annual shortfall since the Republic's foundation in 1948, and 13 trillion won in the following year. Accordingly, the ratio of overall deficit inclusive of interest payments to gross domestic product (GDP) rose to 4.2% and 2.7%, respectively (see table 4). However, the consolidated budget balance started to be positive ever since and peaked at 22.7 trillion won, 3.3% in 2002. This is over-stated due to the surpluses in the National Pension Fund (NPF). To better assess the financial soundness of the government, it is desirable to exclude the NPF from the consolidated balance. There are two more factors to consider in addition to the NPF in this regard. One is the net lending and the other is the repayment of restructuring bonds by the government.¹⁾

Meanwhile, the government's consolidated fiscal balance posted a surplus of 5.6 trillion won in 2004, down 26.3% from 7.6 trillion won a year ago, as it spent more to boost the economy. The figure is equivalent to 0.7 percentage point of the nation's GDP, compared with 1.1% in 2003.

The sharp fall reflects expansionary policies and the adoption of a 4.5 trillion won supplementary budget. Total revenue in the government's consolidated budget reached 178.8 trillion won in 2004, up 7.8 trillion won from 2003, while total expenditures came to 173.2 trillion won, up 8.8 trillion won from a year ago.

The public fund, including pension funds and other social security funds, registered a 1.9 trillion won deficit in 2004, compared with a 2.8 trillion won loss a year earlier. When the operation of social security-related funds is excluded, the consolidated fiscal balance swung into the red, with a deficit of 3.6 trillion won. The balance of social security funds posted a surplus of 21.2 trillion won in 2004.

¹⁾ See Koh (2005) for further discussion.

Table 4 Balance of the Central Government

(unit: billion won, %)

Year	Revenue	Expenditure	Balance of the Consolidated Budget	
			Amount	Percent of GDP
1980	7,281	8,455	-1,174	-3.1
1981	9,247	11,358	-2,111	-4.4
1982	10,074	12,296	-2,222	-4.1
1983	11,596	12,546	-951	-1.5
1984	13,040	13,963	-923	-1.3
1985	14,505	15,218	-713	-0.9
1986	15,856	15,921	-65	-0.1
1987	18,882	18,622	260	0.2
1988	23,101	21,458	1,643	1.2
1989	26,187	26,206	-19	0.0
1990	32,457	34,035	-1,578	-0.9
1991	37,486	41,508	-4,022	-1.9
1992	43,767	45,470	-1,703	-0.7
1993	51,548	50,735	813	0.3
1994	61,741	60,357	1,384	0.4
1995	72,820	71,579	1,241	0.3
1996	85,528	84,429	1,099	0.3
1997	93,368	100,327	-6,959	-1.5
1998	96,673	115,430	-18,757	-4.2
1999	107,923	120,988	-13,065	-2.7
2000	135,811	129,284	6,527	1.3
2001	144,033	136,765	7,268	1.3
2002	158,712	136,047	22,665	3.3
2003	171,945	164,303	7,642	1.1
2004	178,784	173,180	5,595	0.7

Source: Ministry of Planning and Finance.

3.2. Snowballing Public Debt

Persistently rising financial costs on the public funds used for financial sector restructuring in the aftermath of the crisis in 1997 were a main factor raising the budget deficit. This dramatically raised the nation's net government debt by 41.7% to 71.4 trillion won in 1998 from 50.4 trillion won in 1997.

Table 5 Central Government Debt and Its Components

(unit: million won, %)

Year	Net Government Debt		Gross Government Debt	
	Amount	Percent of GDP	Amount	Percent of GDP
1985	14,275,967	18.0	21,523,343	27.1
1986	15,027,593	16.2	22,802,425	24.5
1987	18,888,188	17.2	25,670,232	23.4
1988	18,927,086	11.1	25,179,030	19.2
1989	21,093,069	14.3	27,321,020	18.5
1990	24,545,165	13.8	31,733,273	17.8
1991	27,681,094	12.9	37,523,999	17.5
1992	30,974,113	13.0	44,661,890	18.7
1993	32,846,324	11.8	44,612,097	16.1
1994	34,431,893	10.6	47,756,087	14.8
1995	35,626,029	9.1	50,654,930	12.7
1996	36,827,642	8.8	44,439,726	9.9
1997	50,453,913	11.1	63,492,825	12.9
1998	71,437,309	11.8	143,390,657	29.6
1999	89,714,617	16.9	171,219,212	32.3
2000	100,941,585	17.1	175,506,957	30.3
2001	113,115,691	18.2	219,885,250	35.3
2002	126,629,739	18.5	229,101,094	33.6
2003	158,824,711	22.0	239,414,938	33.2

Note: Net government debt is the difference between gross government debt and state-guaranteed liabilities.

Source: Ministry of Planning and Finance.

The surge was attributed to the issuance of a huge sum instate bonds and borrowings from international funding agencies in order to raise badly-needed funds for corporate and financial restructuring. When state-guaranteed liabilities are included, the government debt snowballed by 125.8% to 143.4 trillion won in 1998 from 63.5 trillion won in 1997.

The skyrocketing amount of government debt is expected to pose a serious threat to the nation's economic development. Korea is worried that a dramatic rise in the government debt will derail the sound economic growth as has been seen in other countries, including the U.S., Britain, Germany and Japan. Korea's debt ratio to the GDP is still lower than that of some advanced economies, most of which vary from 50% to 70%. However, government debt, once it begins to accumulate, tends to surge continuously due to snowballing interest payment burdens (see table 5).

4. FISCAL POLICY IN THE AFTERMATH OF THE FINANCIAL CRISIS

4.1. Fiscal Response to the Financial Crisis

4.1.1. Public Funding for Financial Restructuring

Following the financial crisis in 1997 and in its aftermath, a number of big businesses collapsed in chain insolvencies as well as the undercapitalized banks, securities companies, and some financial institutions were thrust to the brink due to a shortage of liquidity. This was attributed to interest rate hike and a credit crunch. Hence the financial market became extremely unstable and even the financial system itself faced a risk of collapse.

The Korean government proceeded to clean up the troublesome financial institutions by suspension of operation, purchase and assumption (P&A), mergers, etc. It has injected 167.6 trillion won of public funds into financial institutions through capital subscriptions, purchase of bad loans and payments of deposits of failed financial institutions (see table 6). The public

Table 6 Public Funds Injected for Financial Restructuring

(unit: trillion won)

Year	Bond Issued	Injection of Recovered Public Funds	Fiscal Funds	Others	Total
1998	38.8	–	15.7	1.1	55.6
1999	25.2	5.7	4.6	–	35.5
2000	8.9	20.0	0.8	7.4	37.1
2001	29.2	5.1	–0.2	–7.0	27.1
2002	–	1.9	–	1.8	3.7
2003	–	1.6	–0.5	1.0	2.1
2004	–	4.0	–0.1	–	3.9
2005 ¹⁾	–	2.6	–0.05	–	2.5
Total	102.1	40.9	20.2	4.3	167.6

Note: Figures are for the first five months of the year.

Source: Korea Public Fund Oversight Committee.

funds were mainly raised by issuing of Deposit Insurance Fund Bonds and Non-performing Assets Resolution Fund Bonds, whose repayment were guaranteed by the government. The government also extended interest-free loans to the Deposit Insurance Corporation and the Assets Management Corporation for interest payments on the bonds. The total outstanding stock of restructuring bonds stood at 102.1 trillion won (21% of 1998 GDP).

4.1.2. Expanding Social Safety Nets

A series of business bankruptcies and corporate restructuring resulted in a depression and a record high rate of unemployment rate. Creating more temporary jobs thru public assistance and additional beneficiaries by extending the scope of social insurance helped coping with soaring economy and jobless workers.

As a mandatory membership of unemployment compensation was extended to cover small business workers and self-employed were given

subsidies representing some part of the contributions to encourage them to join the National Pension Scheme, the number of beneficiaries of social insurance increased substantially. For stabilizing the livelihood of low-income families, the scale of benefit was increased and the range of beneficiaries was also extended.

Accordingly, a budget increase by 32% per annum during 1998-2001 was followed for expanding social safety nets. Fiscal subsidy for medical insurance covered almost 40% of loss incurred by regional health insurance authorities as well. Along with strengthening the social safety nets, the health and social security budget was markedly stretched. The share of the general account budget rose from 6.2% in 1997 to 10.8% in 2001 and its ratio to GDP hiked from 0.9% to 2.0% for the same period.

4.1.3. Deficit Budget to Encounter the Crisis

The economic recession since the outbreak of the financial crisis continued for 29 months while the average duration of previous recessions was 16.8 months. This painful and prolonged economic hard-landing in 1998 brought about budget deficit of 18.8 trillion won or 4.2% of the nominal GDP in the consolidated central government balance. The magnitude of the deficit was not unusually large, but it was large enough to threaten the sustainability of the fiscal policy.

The real GDP growth rate recorded 10.9% in 1999, a remarkable 17.6%p improvement from -6.7% in the previous year. Such a sudden and abrupt recovery from recession is unprecedented one. The economic recovery was spectacular indeed, but the overall adjustment process can be characterized as an adjustment at the cost of growth.

Such a rapid economic recovery was obviously the basis for the consequent success in fiscal consolidation. In 1999, the consolidated central government's budget deficit reduced to 2.72% of the nominal GDP. In the following year, the budget balance turned to a surplus of 1.3% of the nominal GDP. Significant changes in the composition of both expenditure and revenue also supported the improvement in the budget balance. (Park, 2002)

4.2. Assessment of Fiscal Performance in the Aftermath of the Crisis

Under IMF-supported programs, Korea did in fact allow public finances to exert a stimulating impact on its economy. This has been true for Korea in 1998. This can be shown by the evolution of budget balances in Korea from the year immediately preceding the crisis to the year immediately following it.

It is correct that the IMF advised Korea to limit the buildup of public debt in the aftermath of financial crisis in order to help restore confidence, and reduce the very high interest rates in such a situation. Nonetheless, this advice was tailored to Korea's special circumstances and the size of debt burden. Of course, it is impossible to predict accurately the consequences of a crisis. The budget deficits in Korea were allowed to grow rapidly in the face of deeper-than-expected economic downturns. From all this, it is clear that government budgets in Korea's situation have played a stabilizing role.

It also needs to be taken into account the way that IMF-supported programs in Korea have been adjusted to respond to the needs of the most exposed segments of society, especially the poor. In Korea, social safety nets have been expanded to provide unemployment compensation, targeted public subsidies and other support. In several cases, government budgets also helped finance a needed restructuring of the financial sector. At the same time, the programs allowed for significant shortfalls in budget revenues as tax proceeds declined with the recession.

Fiscal restructuring also sought to reduce unproductive and wasteful public expenditures to help finance priority spending. Many of the specific elements of government budgets thus provided support for the economy while a few elements were contractionary when seen in isolation. Overall, the overall contribution of government budgets was supportive.

5. SUSTAINABILITY TEST OF PUBLIC DEBT

5.1. 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, $B_{t-1} = -E\left[\sum_{j=0}^{\infty} \beta^{j+1} D_{t+j}\right]$

$+E[\lim_{j \rightarrow \infty} \beta^{j+1} D_{t+j}]$, $\lim \beta^{j+1} B_{t+j} < 0$, 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

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

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

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

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

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

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 , 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 except for an innovation. Because sustainable fiscal policy must satisfy the present value budget constraint, significant deviations of B_t from \tilde{B}_t 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

$$g'[1 - \varpi A] = -h'\varpi A. \quad (10)$$

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 $\delta_{1,k} = \delta_{2,k} = \dots = 0$ for all $k > 0$.

5.2. Empirical Results

Empirical analysis outlined above is undertaken using annual data over the period 1974 to 2006. Data on public debt and deficit are in real terms deflated by the CPI. All data were obtained from the Ministry of Planning and Finance and the Bank of Korea. First, we test for the presence of a unit root in each series. Table 7 reports the results of augmented Dickey-Fuller (ADF) tests for the null hypothesis of a unit root. To have a crosscheck, the study also reports 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 Korea. These results imply that from equation (3), the level of public debt in Korea must be stationary for fiscal sustainability.

For public debt, however, the KPSS test shows that the null hypothesis of stationarity, either with or without trend, is rejected. These findings are consistent with those of the ADF test, as they could not reject the null hypothesis of a unit root. Consequently, the level of public debt may be regarded as unsustainable for Korea.

The study now examines a present value model of public debt 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.

Table 7 Unit Root Tests

Debt			Deficit		
ADF	KPSS		ADF	KPSS	
	No Trend	Trend		No Trend	Trend
-2.33	0.91*	0.23*	-3.43*	0.07	0.06

Note: Both ADF and KPSS tests assume the lag length of two which minimizes AIC (Akaike Information Criterion). 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.

Table 8 Tests on the Present Value Model of Government Debt

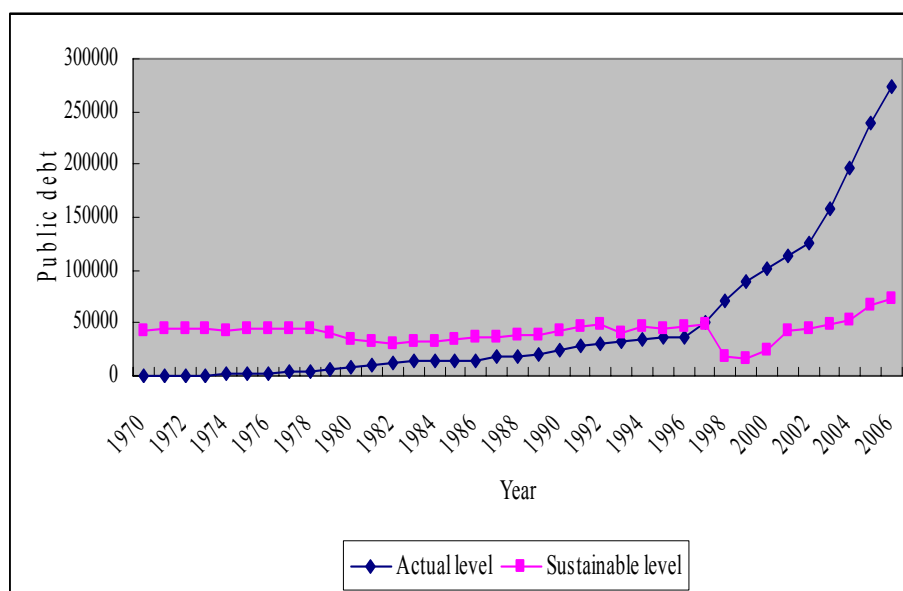
Wald Test	19.28
<i>p</i> -value	0.01

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

Data on the real interest rate are constructed using nominal money market rates and the CPI from the Bank of Korea. Its simple average over the full sample is used to derive the dependent variable, $B_t - D_t - (1+r)B_{t-1}$. Table 8 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 with the marginal significance levels being less than 1%. Accordingly, the level of public debt fails 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.

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 public debt. Figure 1 depicts actual and optimal public debt 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 8.

In fact, figure 1 leads us to draw several interesting conclusions. Actual public debt of Korea was smaller than the sustainable level prior to the crisis. While the level of public debt was not in an optimal path, they should not have posed 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 public debt far above the level of sustainability. Figure 1 offers one explanation why the unit root test may fail to capture the debt

Figure 1 Sustainable Level of Public Debt

problem after the crisis. This also corroborates the usefulness of Campbell and Shiller's method for the test of fiscal sustainability. Reflecting partly on this, the sustainable level fell subsequently to observe the intertemporal budget balance.

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 the study, as figure 1 shows. Skyrocketing fiscal deficit since the crisis should have pushed public debt 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 public debt ratio since the crisis. 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 acts to overshadow this somewhat optimistic view (see figure 1). 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 1 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 Korea 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 Korea has accumulated the level of public debt that appears 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 crisis. It is necessary, therefore, to ensure that Korea uses its current economic expansion to initiate tax reform to substantially raise government revenues and streamline and cut wasteful government expenditures to reduce fiscal deficits or, at least, generate primary surplus. 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.

6. CONCLUSION

For Korea, 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 public debt and fiscal consolidation. This paper has set out to assess fiscal sustainability for a severely attacked country, namely, Korea. At work is the model of intertemporal budget balance. The study tests for implied intertemporal balance conditions for fiscal sustainability. It also examines whether there was any discernible change in the behaviour of public debt following the crisis.

Empirical analysis indicates that the level of public debt is not sustainable

in Korea. It posed little concern on the soundness of public debt prior to the crisis. After the crisis, however, a rapid surge in fiscal deficit pushes public debt far above the level of sustainability. The results suggest that policy makers need to draw their attention to consolidate the fiscal stance and to retain the sustainability of public 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. Several alternative measures for the sustainability have been developed, but they also have their own shortcomings such as lack of economic grounds. Second, the study has used annual data over the sample period 1974 to 2006 because quarterly data and a longer sample span were not available. 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, the study 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.

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