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Working Paper No. 527 March 2005 ISSN 1473-0278

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January 2005*

ABSTRACT

This paper develops empirical methods of assessing the sustainability and feasibility of public debt using the No Ponzi Game criterion, using the Philippines as the testing case. Both historical data and forecasts generated by a quarterly macro-econometric model are used in the assessment. Stochastic simulations are carried out to mimic future uncertainty. The test results show that, up to the end of the present administration in 2010, the Philippine government debt is not sustainable but weakly feasible, that the feasibility is vulnerable to major adverse shocks, and that simple budgetary deficit control policy is inadequate for achieving debt sustainability or strengthening feasibility.

Key words: Government debt, Ponzi Game, rollover bond portfolio
JEL: H62, H63, E62, F34, C53

* Thanks are due to W. Bikales, X-L. Liu, R. S. Ondrik and our other ADB colleagues for their valuable comments on an earlier draft.

I. Introduction

Empirical tests of government debt sustainability are mostly carried out on checking the No Ponzi Game (NPG) condition using historical time-series data. Theoretically, the NPG condition is derived within the framework of an infinite-horizon representative agent model. However, public Ponzi games are shown to be feasible, within the framework of a stochastic overlapping generations model, in a situation where the government manages its bond portfolio to a lower debt rate than the dominant market rate. This paper develops the method of empirical tests on both the sustainability and feasibility conditions in accordance with these theoretical postulates. Three aspects of improvement are proposed to make the tests more relevant to theoretical as well as policy concerns. The first is to extend the historical time-series data by utilizing forecasted series from macro-econometric model to make the test results directly forward-looking; the second is to allow for the possibility of having the government bond rate staying below the dominant market lending rate; the third is to take into consideration forecast uncertainty and possible adverse shocks by making use of stochastic simulations as well as policy simulations. The proposed new methods are applied to the Philippine case.

The rest of the paper is structured as follows: Section 2 briefly describes the fiscal and public debt situation in recent years. Section 3 outlines the testable theories of public debt sustainability and feasibility. Section 4 reports the empirical test results. The last section concludes.

II. The fiscal and government debt situation in the Philippines

The huge public debt in the Philippines has raised serious and growing concerns about the ability of the Philippine government to manage its debt obligations and the long-run sustainability of government fiscal policy. Several studies done on the Philippines have shown, by detailed analyses of the fiscal position over recent years, how the country's public debt has been fluctuating from sustainable to unsustainable levels, see e.g. Paderanga (1995; 2001) and Manasan (1997; 2004).

Chronic deficits have marked the Philippine government's fiscal position since the early years of the country's development.[1] There was brief respite in the mid-1990s when the government's fiscal position improved enough to register a surplus of less than 1% for the period 1994-1997. The occurrence of the Asian financial crisis, however, pushed the fiscal balance back to the negative plane when it fell to –1.9% of GDP in 1998, and then plummeted to –5.2% in 2002. In 2003, the deficit stood at 4.6% of GDP (see Figure 2.1).

The deterioration of the fiscal balance is mostly due to shortfalls in government revenues, especially tax revenues (which accounts for more than 85% of the total). The national government's revenue efforts have declined from a peak of 19.9% of GDP in 1994 to 14.6% of GDP in 2003 (see Figure 2.2). From its peak of about 17% in 1997, the tax effort has slid to 12.5% in 2003. Government expenditures, on the other hand, have been fairly stable, averaging about 18% of GDP for the period 1980-2003. Its growth has been kept to a minimum and has been on a downward trend since 2000. In particular, primary spending (i.e., national government spending net of interest payments) has been reined in, with its share to GDP falling from 16.3% in 1999 to 14.0% in 2003. Capital expenditures have been reduced – after reaching its peak of more than a quarter of total

[1] In the 1960s, government was in deficit 8 out of the 10 years and fiscal deficit averaged about 1% of GDP for the decade. In the 1970s it was in deficit 7 out of the 10 years and the fiscal deficit averaged about one-half of 1% of GDP. In the 1980s the government was in deficit all 10 years and fiscal deficit averaged about 2.5% of GDP.

expenditures in the early 1980s, it is down to 13.5% in 2003.[2] In contrast, the amount spent for servicing of debt escalated. From an average of 4.6% in 1975-79, it went up to about 7% in 1980-83, ballooned to almost 25% in 1984-89 and has averaged more than 24% in 2000-03 (Figure 2.3).

A major threat to the national government's fiscal position is the large stock of national government debt and the associated costs of servicing that debt. In the 1970s and 80s, large debt inflows were used to stimulate the economy and to provide a cushion against external shocks that had often plagued the economy in the early years of its development. Then in the 1990s it also became a means to service the liabilities of ailing government agencies. By this time, domestic resources have become a significant part of Philippine public debt reflecting the government's struggle to service its foreign debt while incurring fiscal deficits (Figure 2.4). From a peak of ₱95.4 billion in 1994, primary balance (i.e., total revenues less non-debt expenditures) went into deficit in 2002 (₱24.9 billion) before registering a surplus of ₱26.5 billion in 2003.

The national government's total outstanding debt stood at ₱3.36 trillion (which is 78 percent of GDP) at the end of 2003. Including contingent liabilities, this would amount to about ₱4.1 trillion (or 94.5 percent of GDP). The consolidated public sector debt is much higher at ₱5.9 trillion – a whooping 137 percent of GDP. All three are on an upward trend (Figure 2.5).

The growth of public debt has been very high, averaging above 15 percent between 1999 – 2004. NG debt has been growing at a higher rate for the same period, with the increase largely attributed to the continuing national government deficits. However, an

[2] Of note is the fact that infrastructure spending of the national government has remained repressed and has not exceeded 2% of GDP. Indeed, the brunt of fiscal adjustment has primarily been absorbed by

equally sizeable amount (about 37 percent) of the increase in debt is due to non-budgetary items and assumed liabilities of government corporations, see Figure 2.5, underscoring the continuous practice of condoning inefficiency and irresponsibility of government-owned and controlled corporations.

Warnings of the public debt problem have recently been voiced at an increasing volume by economists, institutional investors in the Philippines as well as internationally, e.g. see De Dios *et al* (2004). However, most of these are based on case analyses rather than rigorous empirical tests. This paper attempts to fill in this gap.

III. Theories of Government Debt Sustainability and Feasibility

The key consideration for any government to resort to debt is the availability and feasibility of debt financing. This consideration underlies the theoretical approach to determine the debt sustainability on the lenders' constraint, which is commonly expressed by the present value constraint (PVC).

Under the highly idealistic assumptions of an economy with one sector, in steady state and on a dynamically efficient growth path, the PVC-based theory of government debt results in the long-run condition of No Ponzi Games (NPG), e.g. see Chalk and Hemming (2000) and Bergman (2001). The theory starts from the government debt accounting identity. With respect to the Philippine case, this identity results in:

(1) $$B_{t+1} = q_{t+1}B_t + D_{t+1} + L_{t+1}$$

where B_t denotes the government debt at time t, q_t the one-period interest rate factor, e.g. $q_t = 1 + r_t$, with r_t being the equilibrium interest rate with respect to the marginal rate of

infrastructure and other development spending – expenditures developing countries like the Philippines badly need.

substitution derived from the optimization of consumers' preference function, D_t is the primary fiscal deficit, i.e. budget deficit excluding interest payment, and L_t denotes the off-budget account deficit, due mainly to the contingent liabilities of government-owned and controlled corporations.[3] Forward substitution of (1) yields:

(2) $$B_t = \sum_{j=1}^{\infty} \frac{-(D+L)_{t+j}}{\prod_{i=1}^{j} q_{t+i}} + \lim_{\tau \to \infty} \frac{B_{t+\tau}}{\prod_{j=1}^{\tau} q_{t+j}}$$

Since the first term on the right-hand side of (2) is expected to balance out in general, the lenders' constraint results in the NPG condition:

(3) $$\lim_{\tau \to \infty} \frac{B_{t+\tau}}{\prod_{j=1}^{\tau} q_{t+j}} = 0$$

The limit in (3) defines the necessary condition for the long-run debt sustainability. It implies that government debt cannot grow faster than the average interest rate in the long run.

A popular alternative is to examine the sustainability condition in terms of the debt-to-income ratio, instead of debt alone, based on the argument that all the budget variables are highly dependent on the macroeconomic situation, see for example Cuddington (1996). Let us define the debt ratio by $b_t = B_t / Y_t$, the primary deficit ratio by $d_t = D_t / Y_t$ and the off budget account deficit ratio by $l_t = L_t / Y_t$, where Y_t is the aggregate income and often represented by GDP or GNP. Equation (2) can be rewritten as:

(4) $$b_t = \sum_{j=1}^{\infty} \left(\prod_{i=1}^{j} \frac{g_{t+i}}{q_{t+i}} \right) \left(-(d+l)_{t+j} \right) + \lim_{\tau \to \infty} \prod_{j=1}^{\tau} \frac{g_{t+j}}{q_{t+j}} b_{t+\tau}$$

where g_t is the growth factor: $Y_{t+1} = g_{t+1} Y_t$. The NPG condition corresponding to (3) becomes:

[3] Notice that the term L_t is absent in the standard debt accounting identity, where only net debt is

$$(5) \qquad \lim_{\tau\to\infty}\prod_{j=1}^{\tau}\frac{g_{t+j}}{q_{t+j}}b_{t+\tau}=0$$

Equation (5) highlights the importance of the dynamic efficiency assumption, since it is necessary to have the interest rates larger than the economic growth rates for the nontrivial case of $b_{t+\tau}\neq 0$ in (5).[4]

Empirical tests of the debt sustainability conditions (3) or (5) entail knowledge of the time-series properties of the variables in these equations, since these conditions require us to infer the asymptotic properties of the limit functions from finite data samples. In particular, it is crucial to know the time-series properties of the debt or debt ratio series, as the interest rate and the economic growth rate are normally expected to be either stationary or non-trended random walk.[5] Following Bergman (2001), we assume that the government debt be generated by a first-order autoregressive, i.e. AR(1), process:[6]

$$(6) \qquad \begin{aligned} B_t &= \alpha_0+\alpha_1 B_{t-1}+\varepsilon_t \\ &= \sum_{k=0}^{t-1}\alpha_0\alpha_1^k+\alpha_1^t B_0+\sum_{k=0}^{t-1}\alpha_1^k\varepsilon_{t-k} \end{aligned}$$

where ε_t is a zero-mean stationary process. When $\alpha_1<1$, the NPG condition (3) is satisfied. When the debt series is nonstationary, i.e. $\alpha_1\geq 1$, the NPG condition (3) can be examined by combining it with (6):

$$(7) \qquad \lim_{\tau\to\infty}\frac{B_{t+\tau}}{\prod_{j=1}^{\tau}q_{t+j}}=\lim_{\tau\to\infty}\left(\frac{1}{\prod_{j=1}^{\tau}q_{t+j}}\right)\left(\sum_{k=0}^{t+\tau-1}\alpha_0\alpha_1^k+\alpha_1^{t+\tau}B_0+\sum_{k=0}^{t+\tau-1}\alpha_1^k\varepsilon_{t+\tau-k}\right)$$

considered, e.g. see Lebow (2004).

4 The assumption is embodied in the infinite-horizon representative consumer model, e.g. see Bohn (1995).

5 A number of empirical tests are built on the time-series relationship between the fiscal deficit and the debt series, see e.g. (Quinto 1995), (Bohn 1998). However, this approach is not applicable here since there is an off-budget deficit component in the Philippine government debt.

6 This is a testable assumption. The results below can be extended to an AR(*n*) process when *n>1*.

The NPG condition now becomes:

(8) $$\lim_{\tau\to\infty}\frac{\sum_{k=0}^{\tau}\alpha_0\alpha_1^k}{\prod_{j=1}^{\tau}q_{t+j}}=0,\quad \lim_{\tau\to\infty}\frac{\alpha_1^{\tau}}{\prod_{j=1}^{\tau}q_{t+j}}=0$$

Condition (8) requires that the degree of explosiveness in the roots of the debt series be no larger than what the compounding interest rates could dampen out in the long run.

The same approach applies if empirical tests are based on the debt ratio. Starting from an AR(1) process:

(9) $$b_t=\beta_0+\beta_1 b_{t-1}+\nu_t$$

where ν_t is a zero-mean stationary process, and combining it with (5):

(10) $$\lim_{\tau\to\infty}\prod_{j=1}^{\tau}\frac{g_{t+j}}{q_{t+j}}b_{t+\tau}=\lim_{\tau\to\infty}\left(\prod_{j=1}^{\tau}\frac{g_{t+j}}{q_{t+j}}\right)\left(\sum_{k=0}^{t+\tau-1}\beta_0\beta_1^k+\beta_1^{t+\tau}b_0+\sum_{k=0}^{t+\tau-1}\beta_1^k\nu_{t+\tau-k}\right),$$

we obtain the following convergence conditions:

(11) $$\lim_{\tau\to\infty}\prod_{j=1}^{\tau}\frac{g_{t+j}}{q_{t+j}}\sum_{k=0}^{\tau}\beta_0\beta_1^k=0,\quad \lim_{\tau\to\infty}\prod_{j=1}^{\tau}\frac{g_{t+j}}{q_{t+j}}\beta_1^{\tau}=0$$

It is a widely known fact that government bonds normally enjoy significantly lower interest rates than the market equilibrium rates. Moreover, many governments utilize the bond market to reduce their debt interest payments by issuing bonds of different maturities to roll over government debt, e.g. see (Bohn 1995; 1998). As a result, the aggregate interest rate of the government bond portfolio is normally lower than the growth rate of the economy, making the simple NPG scheme (5) implausible, see e.g. (Blanchard and Weil 2001). Under this situation, the issue then becomes to what extent the government can violate the present value budget constraint and make it feasible to play debt Ponzi games.

In a recent paper, Barbie *et al* (2004) investigate this issue by means of the stochastic overlapping generations model. They establish the necessary and sufficient conditions of the feasibility of government debt Ponzi games under a scenario where the government utilizes rollover bond issuance strategies.[7] Their conditions essentially boil down to the non-divergence of the ratio of the aggregate interest rate of the public bond portfolio to the economic growth rate under all kinds of stochastic shocks:

(12) $$\lim_{\tau\to\infty}\prod_{j=1}^{\tau}\frac{q^b(z)_{t+j}}{g(z)_{t+j}}<\infty$$ (necessary condition)

(13) $$\sum_{j=1}^{\infty}\left(\prod_{j=1}^{\tau}\frac{q^b(z)_{t+j}}{g(z)_{t+j}}\right)_j\leq\phi<\infty$$ (necessary and sufficient condition)

where q^b denotes aggregate interest rate factor of the government bond portfolio, z denotes the state of random shocks and ϕ a finite positive bound representing the credit constraint faced by the government. Conditions (12) and (13) show that government Ponzi games would not be possible unless the government could obtain debt finance at a lower interest rate than the average economic growth rate in the long run. Barbie *et al* (2004) refer to the ratio, q^b/g, as the real interest rate of debt payment, and to ϕ as setting a fixed upper bound for the debt ratio. The latter is not difficult to see if we assume (5) converges to a positive number instead of zero when the interest rate is the lower-than market bond rate, i.e.:

(14) $$\lim_{\tau\to\infty}\prod_{j=1}^{\tau}\frac{g_{t+j}}{q^b_{t+j}}b_{t+\tau}=\lambda>0\quad\Rightarrow\quad\lim_{\tau\to\infty}b_{t+\tau}=\lambda\lim_{\tau\to\infty}\prod_{j=1}^{\tau}\frac{q^b_{t+j}}{g_{t+j}},$$

provided that $\lim_{\tau\to\infty}\prod_{j=1}^{\tau}\frac{g_{t+j}}{q^b_{t+j}}\neq 0$.

[7] Notice that the condition for feasibility is weaker than that for sustainability, see Barbie *et al* (2001).

IV. Empirical Tests of Government Debt Sustainability and Feasibility

In this section, empirical tests are conducted on the Philippine national government (NG) debt. Ideally, the tests should be conducted on the consolidated public debt. But this series is available only at annual frequency. As the consolidated public debt is roughly 1.7 times the NG debt (see the footnote in Figure 2.5), the conclusions that we draw from the empirical tests on the NG debt should be also applicable to the consolidated public debt.

Almost all the empirical tests of government debt sustainability in the literature have been carried out using historical time-series data, e.g. see (Bohn 1998), (Chalk and Hemming 2000). However, a major weakness of these tests is that the past results may not be directly projected into the future, where all the PVC theories are really focused on. This can be especially worrisome considering that the dynamics of the government debt tends to be highly susceptible to the macroeconomic environment in a small and open economy like the Philippines.

Here, we conduct the tests using a quarterly time-series sample combining historical data with future data forecasted by a quarterly macro-econometric model of the Philippines built by the Asian Development Bank (we refer to this model as the ADB Philippine model thereafter). The model contains over 80 variables and is estimated using the data sample from 1990Q1 to 2004Q2, although some data series are shorter, e.g. the government fiscal account series, including the debt series to be used in our tests, start from 1993Q1, see Ducanes *et al* (2005) for more detailed description of the model. The forecast period is 2004Q3 – 2014Q4. Forecast values of some exogenous variables are partly based on forecasts from the OECD Economic Outlook and Oxford Economic Forecasting World Model; otherwise, the forecasts of an exogenous variable are extrapolated from its present time path. During the forecast period, a large number of stochastic simulations are computed using the bootstrap method for shock generation.[8] This method enables us to empirically mimic the z component of equations (12) and (13) in accordance with the random patterns of the ADB Philippine model residuals. Quantiles are calculated from the large set (400 in our experiments) of the simulation results to illustrate the distribution of the stochastic forecasts. In particular, values at 2% and 97% quantiles are used as the approximate 95% confidence band of the simulation mean values. Below, we refer to the data series of the simulation mean values as the 'mean' data series and the other two as the 'upper' and 'lower' data series respectively. Figure 4.1 shows the debt and debt ratio series with these forecasting bands.

Let us first examine the simple time-series properties of the government debt and debt/GDP ratio series respectively. As shown from the unit-root test results in Table 4.1, both series exhibit strong non-stationary properties, with the debt series showing certain explosive tendency. The test results are also reflected in the ensuing regression analysis. We start by running an AR(4) model for the debt and debt ratio series respectively in order to test the assumption of AR(1) in equations (6) and (9). As visible from Table 4.2, the assumed AR(1) process is accepted for the debt ratio series in both the full-sample and sub-sample estimations whereas the debt process is captured by an AR(3) in the full-sample estimation and by an AR(1) only in the sub-sample estimations. Moreover, the one-lag coefficient estimates for the debt ratio exhibit stronger time invariance than those for the debt series, conforming to what was expected in the previous section.

In view of the regression results, we have conducted the sustainability tests on the debt ratio only. It is discernible from the recursive $\hat{\beta}_1$ of (9) in Figure 4.2 that this

[8] The method randomly draws shocks from single equation residuals over a specified historical sample

coefficient drifts below unity in the aftermath of the Asian financial crisis and converges to unity during the forecasting period of the sample, even though the unit value is within the 95% band for the entire sample. Considering the finite-sample uncertainty in $\hat{\beta}_1$, two versions of condition (11) are tested, one using the full sample estimate $\hat{\beta}_1$ and the other the recursive $\hat{\beta}_{1,t+j}$:

(11')
$$\left\{\prod_{j=1}^{\tau}\frac{g_{t+j}}{q_{t+j}}\hat{\beta}_1^{\tau}\right\},\quad \left\{\prod_{j=1}^{\tau}\frac{g_{t+j}}{q_{t+j}}\prod_{j=1}^{\tau}\hat{\beta}_{1,t+j}\right\}$$

The condition relating to the intercept term is disregarded here because its estimates are insignificant, as shown in Table 4.2.

In the NPG theories, government bonds are assumed to bear the same rate as the equilibrium interest rate. However, this assumption seldom holds in reality. Thus, in order to examine the different effects of interest rates, we consider three rates: market lending rate, 91-day Treasury bill (TB) rate, and government debt portfolio rate derived from the government debt interest payment and the debt series. As seen from Figure 4.3, the government rates are remarkably lower than the market rate. More interestingly, the derived portfolio rate is far smoother than the TB rate, possibly reflecting government efforts in debt portfolio management to minimize and stabilize the debt cost payment. To check whether the chosen rates represent adequately the market rates for the government bonds, Figure 4.4 plots these rates together with the JP Morgan bond yield of the weighted Philippine sovereign bonds for the period of 2000Q1 – 2004Q2. Discernibly, the 91 TB rate and the portfolio rate are a bit lower than the JP Morgan bond yield while the lending rate is higher. This suggests that the test results from the three rates should provide us with a fairly good confidence region.

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period and adds them to each forecast period. For more details, see (Pierse 2001).

Three pairs of the series in (11') are calculated, each using one of the three interest rates. The results are plotted in Figure 4.5. Noticeably, the results using the full-sample coefficient estimate show significantly higher values than those using the recursive results. This is due to the fact that $\hat{\beta}_1$ exceeds its sub-sample estimates for over one third of the sample period, as shown in Figure 4.2. However, the full-sample $\hat{\beta}_1$ should be relatively reliable for out-of-sample inference based on the recursive results as it converges to a highly constant value with the sample size. Notice that the lending rate appears to provide the only case where the NPG condition is likely to be satisfied in the infinite future, as it gradually decreases with time. The series based on the portfolio rate also appears to be converging very slowly and is estimated to be approximately zero around 2020, indicating that government Ponzi game is present during the current regime.[9]

To directly assess the feasibility of the Ponzi game, we calculate the test series of (12) and (13) using the portfolio rate and the TB rate respectively, and plot them in Figure 4.5. The results show that only the necessary condition is satisfied up to 2010, not the sufficient condition. This indicates the feasibility of the debt Ponzi game played by the government to be near the borderline of becoming infeasible for the foreseeable future. Nevertheless, the sufficient condition (13) is likely to hold for the infinite future as both test series under (12) show a downward trend towards zero. Noticeably, the series for the necessary condition using the portfolio rate shows a visibly slower converging speed than that using the TB rate, suggesting that the government bond portfolio faces a tighter credit constraint than short-term bills. This suggests the increasing risk that investors attach to the government bonds of longer terms.

[9] The next election year is 2010.

Indeed, practical concerns over the future uncertainty of the debt situation is asymmetric, i.e., investors are far more watchful of those uncertain situations when the sustainability or feasibility of government debt is at risk of being violated than vice versa. The worry is warranted by a number of government debt default crises triggered by adverse shocks in small and open economies with weak governments, such as Argentina and Brazil.[10] Since the feasibility test results in Figure 4.5 indicate that the present debt situation in the Philippines is about marginally feasible, we run a model simulation to examine how much an adverse shock would worsen the government debt situation. The simulation assumes the adverse shock to be a currency crisis occurring in 2005Q4 – 2006Q4, with the peso-dollar exchange rate devaluing 40% in total (see Figure 4.6).[11]

Both the sustainability test (11') and the feasibility tests (12) and (13) are re-calculated using the simulation results for the forecasting sub-sample, see Figure 4.7. In comparison with Figure 4.5, the sustainability results (11') are now in a visibly worse state, especially with the disappearance of the downward trend in the series based on the portfolio rate and the lending rate; the test results using the portfolio rate no longer hold for either (11') or (12), illustrating that the currently feasible state of the government debt is indeed fragile and highly susceptible to adverse external shocks.

Given the severity of the government debt situation, we run another simulation to examine whether fiscal policy adjustments would help improve the situation. We set the simulation as achieving zero deficit by 2010, in accordance with the pledge by the current government. Experimenting with various schemes of curbing fiscal expenditure and

[10] Calvo *et al* (2003) demonstrate how a mismatch in the public debt composition led to a crisis in Argentina triggered by its currency devaluation shock; Razin and Sadka (2002) show how a forthcoming election in Brazil, which indicates expected regime change, could trigger a debt crisis even though the debt ratio is relatively low and the fundamentals are sound.

raising tax revenue, we find that this target is achievable by having the tax revenue increase by 11% per annum[12] together with a capped annual growth at 5% of the government expenditure net of interest payment for six years, i.e. 2004Q4 — 2010Q3. Figure 4.8 shows the dynamic path of the budget deficit under this simulation as compared with that of the default simulation (the left panel), and the impact of this simulation on GDP growth as well as interest rate (the right panel). Noticeably, the fiscal target leads to prompt deficit deterioration post the target period and a persistent slowdown of the economy during the target period, suggesting that such a severe target is highly likely to incur grave fiscal burden for the next regime while depressing the overall economy during the present regime. This kind of policy consequence is hardly surprising in view of the already undersized public sector in the Philippines, as described in Section II. What is surprising are the simulation test results, which show no chance of achieving the sustainability condition or the feasibility condition within the present regime (see Figure 4.9), in spite of the heavy policy cost. Our finding reveals the inadequacy of designing fiscal policy around controlling budget deficit alone in order to achieve debt sustainability. Much more comprehensive policies are required.

V. Conclusions

This paper develops empirical methods of assessing the sustainability and feasibility of the government debt situation, using the Philippines as the testing case. The assessment is based on the NPG criterion and mainly carried out on the debt-to-GDP

[11] The exchange rate is exogenous in the Philippine model. Since the model also assumes the world trade demand as exogenous, the simulation does not reflect the possible reactions of this variable to the devaluation shocks.

[12] Notice that increase in tax revenue does not necessarily depend on raising tax rates. In the Philippine case, improvement in taxation efficiency and promotion of faster economic growth are the paramount factors.

ratio using both its historical data and forecasts generated by a macro-econometric model of the Philippine economy.

Our assessment shows that the government debt situation is not sustainable as far as the present regime is concerned. One key reason for the existing high government debt is the fact that the government still enjoys lower bond rates than the market lending rates. In other words, the Philippine government bonds are still perceived as having relatively low default risk. Our assessment also shows that the Philippine government is playing a weakly feasible debt Ponzi game. The debt strategy satisfies the necessary condition but fails the sufficiency condition for feasibility up to 2014, although it might satisfy both conditions for the infinitely remote future. These results indicate the vulnerability of the debt situation.

The vulnerability is further confirmed by our experiment of a shock simulation using the Philippine model. We find that the government debt no longer satisfies the debt feasibility condition under a hypothetical exchange rate crisis. This result shows that the government is facing a high risk of running into a debt crisis in the event of a major adverse shock to the economy.

Our findings provide strong support to the warnings about the critical government debt situation and highlight the difficulty and the urgency of improving the government's fiscal position in the present Philippine economy. Indeed, our model simulation shows that the simple fiscal policy of medium-term budget deficit control alone is inadequate for reversing the unsustainable debt situation. This underscores the importance of studying the dynamic interaction between proposed corrective policies to control public debt and the underlying macroeconomic variables. Any policy aimed at addressing the debt sustainability problem must take into account not just its effect on debt but also its effect on other economic variables, such as interest rates and the overall economic growth, which are themselves factors that determine debt sustainability. What is highly needed are more comprehensive and well-coordinated policies aimed at promoting sustained economic growth, increasing resilience to exogenous shocks as well as improving debt management.

The results further point at the non-evadable responsibility that public debt creditors and donors should take in helping the heavily debt-burdened country to avoid a debt crisis. In particular, large institutional creditors must review lending policies to ensure that their loans and accompanying provisions are carefully based on the debt sustainability of the country concerned as derived from its macroeconomic framework. If loan provisions are not based on market perceived risk or if debt service can largely be covered by grants, aid, or debt relief, then the government will have little incentive to pursue sound macroeconomic policies and increase its capacity to pay (see IMF and IDA, 2004).

What would therefore be the optimal policy strategy to attain debt and fiscal sustainability for the current regime? The solution is beyond the scope of the present study, but the results, hopefully, would help policy making towards the right direction.

Appendix: Data Description and Sources

Data series	Description	Source[1]
91-day Treasury Bill Rate (%)	Weighted averages per annum	CEIC Data Company Ltd., BSP, ADB Philippine Model
Bond Yield	JP Morgan Asia Bond Weighted Yield of Philippine Sovereign Bonds	Datastream
Capital Outlays	In billion pesos	DBM
Consolidated Public Sector Debt	In million pesos	CEIC Data Company Ltd., Btr
Expenditure	In million pesos	CEIC Data Company Ltd., Btr
Fiscal Deficit	Revenue less expenditure	BTr
Gross Domestic Product	Current price (in million pesos)	CEIC Data Company Ltd., ADB Philippine Model
Interest Payments	Current price (in million pesos)	CEIC Data Company Ltd., BTr, ADB Philippine Model
Lending Rate (%)	Weighted averages per annum. Annual rates are averages of monthly rates. Monthly rates are annual percentage equivalent of all commercial banks' actual monthly interest income on their peso-denominated loans to the total outstanding levels of their peso-denominated loans, bills discounted, mortgage contract receivables and restructured loans.	CEIC Data Company Ltd., BSP, ADB Philippine Model
MOOE	In billion pesos	DBM
National Government Debt	In million pesos	CEIC Data Company Ltd., Btr
National Government Outstanding Debt	Outstanding Domestic Debt + Outstanding Foreign Debt, Current price (in million pesos)	CEIC Data Company Ltd., BTr, ADB Philippine Model
Personal Services	In billion pesos	DBM
Portfolio rate (%)	Interest payments/National government outstanding debt	CEIC Data Company Ltd., Btr, ADB Philippine Model
Primary Deficit	Revenue less primary spending	BTr
Primary Spending	Expenditure less interest payments	BTr
Revenue	In million pesos	CEIC Data Company Ltd., Btr

[1]Actual data are sourced from CEIC and/or official sources. Forecast data are sourced from the ADB Philippine Model. Bureau of Treasury is abbreviated as BTr. Department of Budget and Management is abbreviated as DBM.

References

Bergman, Michael (2001) Testing government solvency and the No Ponzi Game condition, *Applied Economics Letters*, **8**, 27-29.

Barbie, M., Hagedorn, M. and Kaul, A. (2001) Government debt as insurance against macroeconomic risk, *IZA Discussion Papers*, no. 481.

Barbie, M., Hagedorn, M. and Kaul, A. (2004) On the feasibility of debt Ponzi schemes – A bond portfolio approach: Theory and some evidence, Discussion paper

Blanchard, O.-J. and Weil, P. (2001) Dynamic efficiency, the riskless rate, and debt Ponzi games under uncertainty, *The B. E. Journal in Macroeconomics*, **1**, no. 2, article 3.

Bohn, Henning (1995) The sustainability of budget deficits in a stochastic economy, *Journal of Money, Credit, and Banking*, 27, 257-71.

Bohn, Henning (1998) The behavior of U.S. public debt and deficits, *Quarterly Journal of Economics*, **113**, 949-63.

Calvo, G. A., Izquierdo, A. and Talvi, E. (2003) Sudden stops, the real exchange rate and fiscal sustainability: Argentina's lessons, *NBER Working Paper*, no. 9828.

Chalk, N. and Hemming, R. (2000) Assessing fiscal sustainability in theory and practice, *IMF Working Paper*, no. WP/00/81.

Cuddington, J. T. (1996) Analyzing the Sustainability of Fiscal Deficits in Developing Countries, *Georgetown University Working Paper*, no. 97-01.

De Dios, E. S., Diokno, B. E., Esguerra, E. F., Fabella, R. V., Gochoco-Bautista, Ma. S., Medalla, F. M., Monsod, S. C., Pernia, E. M., Reside, Jr., R. E., Sicat, G. P. and Tan, E. A. (2004) The deepening crisis: the real score on deficits and the public debt, *Discussion Paper DP2004-09, School of Economics, University of Philippines*.

Ducanes, G., Cagas, M. A., Qin, D., Quising, P. F. and Magtibay-Ramos, N. (2005) A econometric model of the Philippines economy, *ERD Working Papers No. 60, Asian Development Bank*.

Hakkio, C. S. and Rush, M. (1991) Is the budget deficit too large? *Economic Inquiry*, **29**, 429-45.

IMF and International Development Association (2004) *Debt Sustainability in Low-Income Countries - Proposal for an Operational Framework and Policy Implications*. At: http://www.imf.org/external/np/pdr/sustain/2004/020304.htm

Lebow, D. E. (2004) Recent fiscal policy in selected industrial countries, *BIS Working Papers 162*.

Manasan, R. G. (1997) Fiscal adjustment in the context of growth and equity, 1986-1997, *Discussion Paper Series 1998-11*, Philippine Institute for Development Studies.

Manasan, R. G. (2004) Fiscal reform agenda: getting ready for the bumpy ride ahead, *Discussion Paper Series 2004-24*, Philippine Institute for Development Studies.

Paderanga, Jr. C. (1995) Debt management in the Philippines, in Fabella, R. V. and H. Sakai eds. *Towards Sustained Growth*, Tokyo: Institute of Developing Economies.

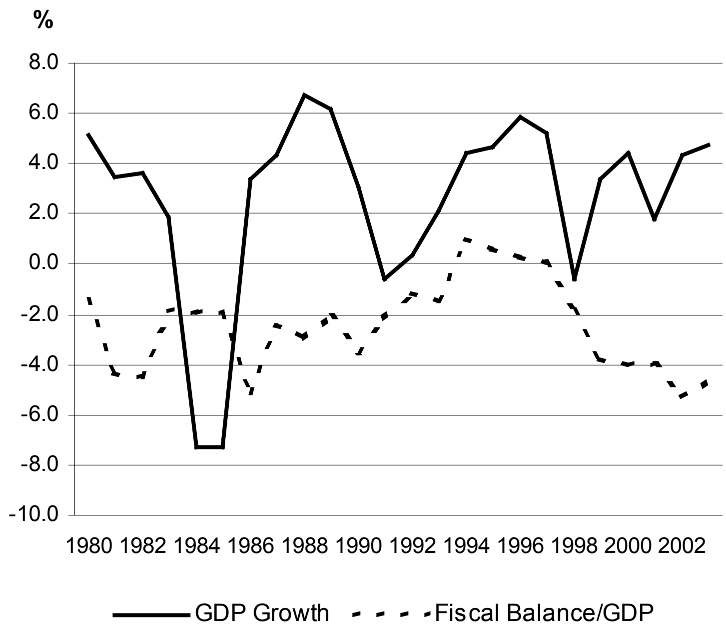
Paderanga, Jr. C. (2001) Recent fiscal developments in the Philippines, *School of Economics, University of Philippines*.

Pierse, R., 2001. *Winsolve Manual*, Department of Economics, University of Surrey, UK.

Quintos, C. E. (1995) Sustainability of the deficit process with structural shifts, *Journal of Business and Economic Statistics*, **13**, 409-17.

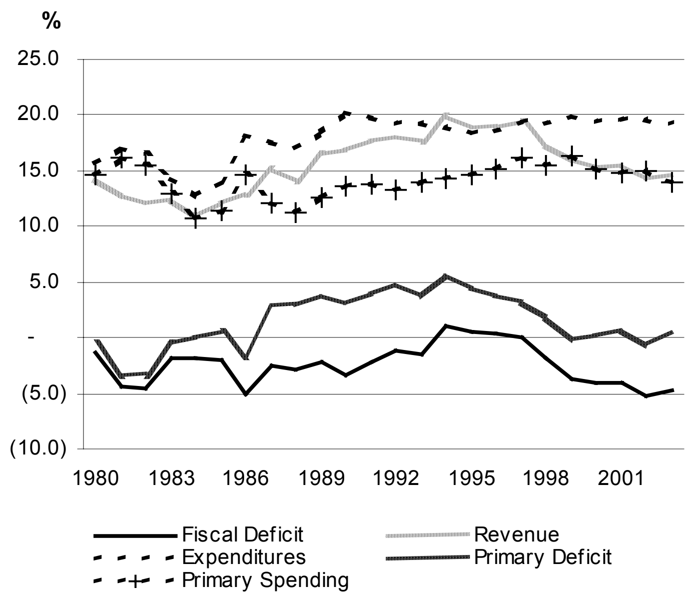
Razin, Assaf and Sadka, Efraim (2002) A Brazilian debt-crises model, *NBER Working Paper*, no. 9211.

Figure 2.1 Growth of GDP and Ratio of Fiscal Balance to GDP



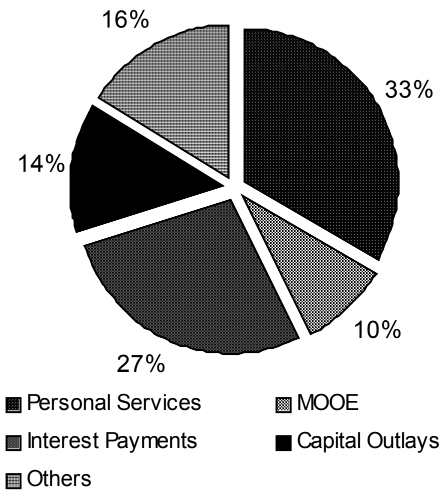
Source: National Statistical Coordination Board; Bureau of Treasury.

Figure 2.2 Fiscal Aggregates



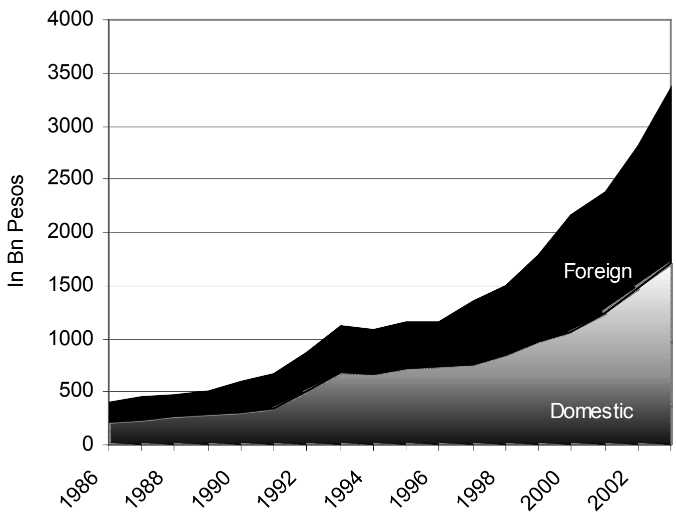
Source: Bureau of Treasury.

Figure 2.3 National government (NG) expenditures 2003



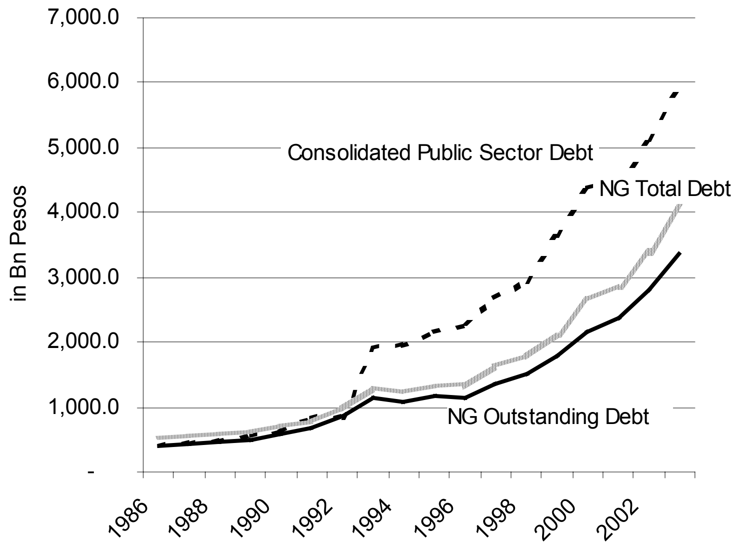
Source: Department of Budget and Management.

Figure 2.4 National government outstanding debt



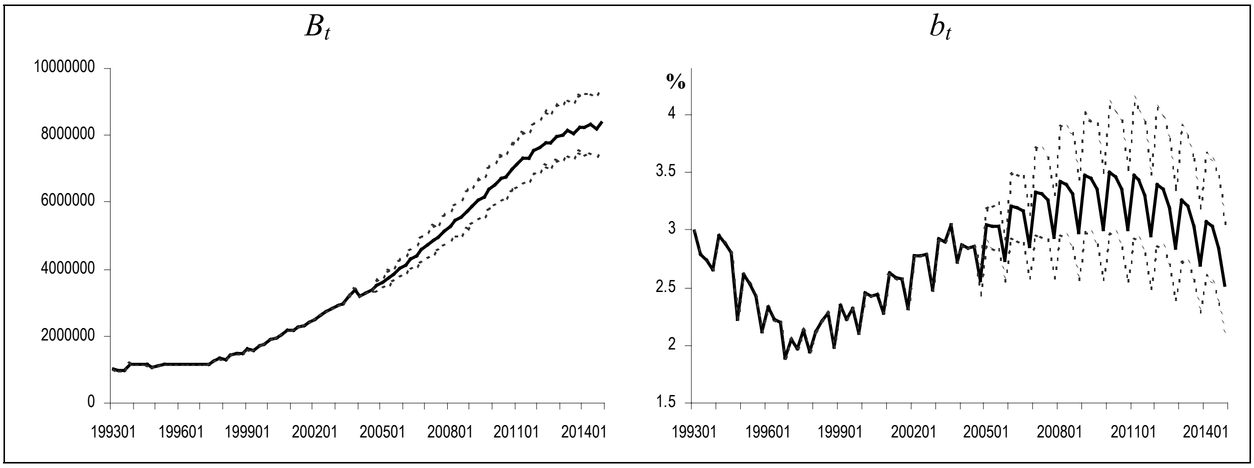
Source: Bureau of Treasury.

Figure 2.5 Consolidate public sector debt and NG debt



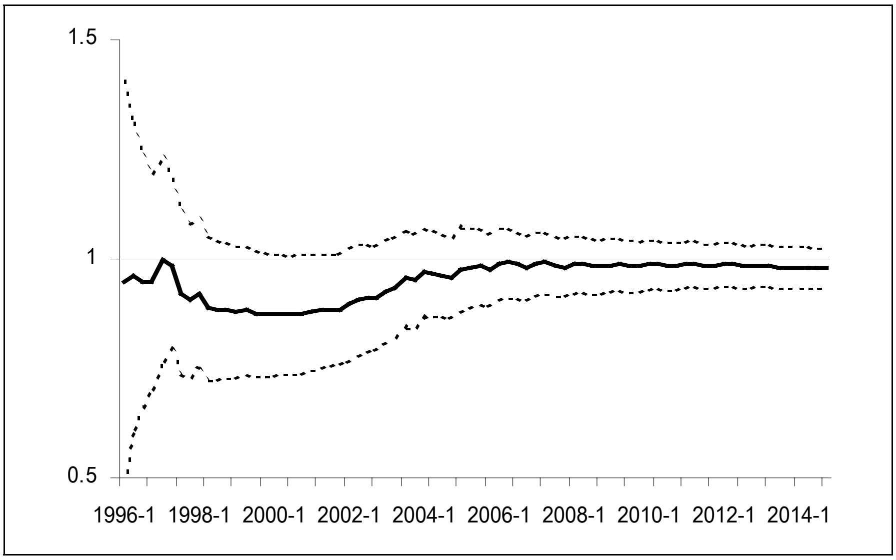
Source: CEIC Data Company Ltd., Bureau of Treasury. Simple regression of the consolidated public debt on the NG outstanding debt using data from 1993 onwards shows a relatively constant relationship between the two, with the slope coefficient estimate of 1.7.

Figure 4.1 Debt, B_t, and debt/GDP ratio, b_t: Historical data plus forecasts by stochastic simulations



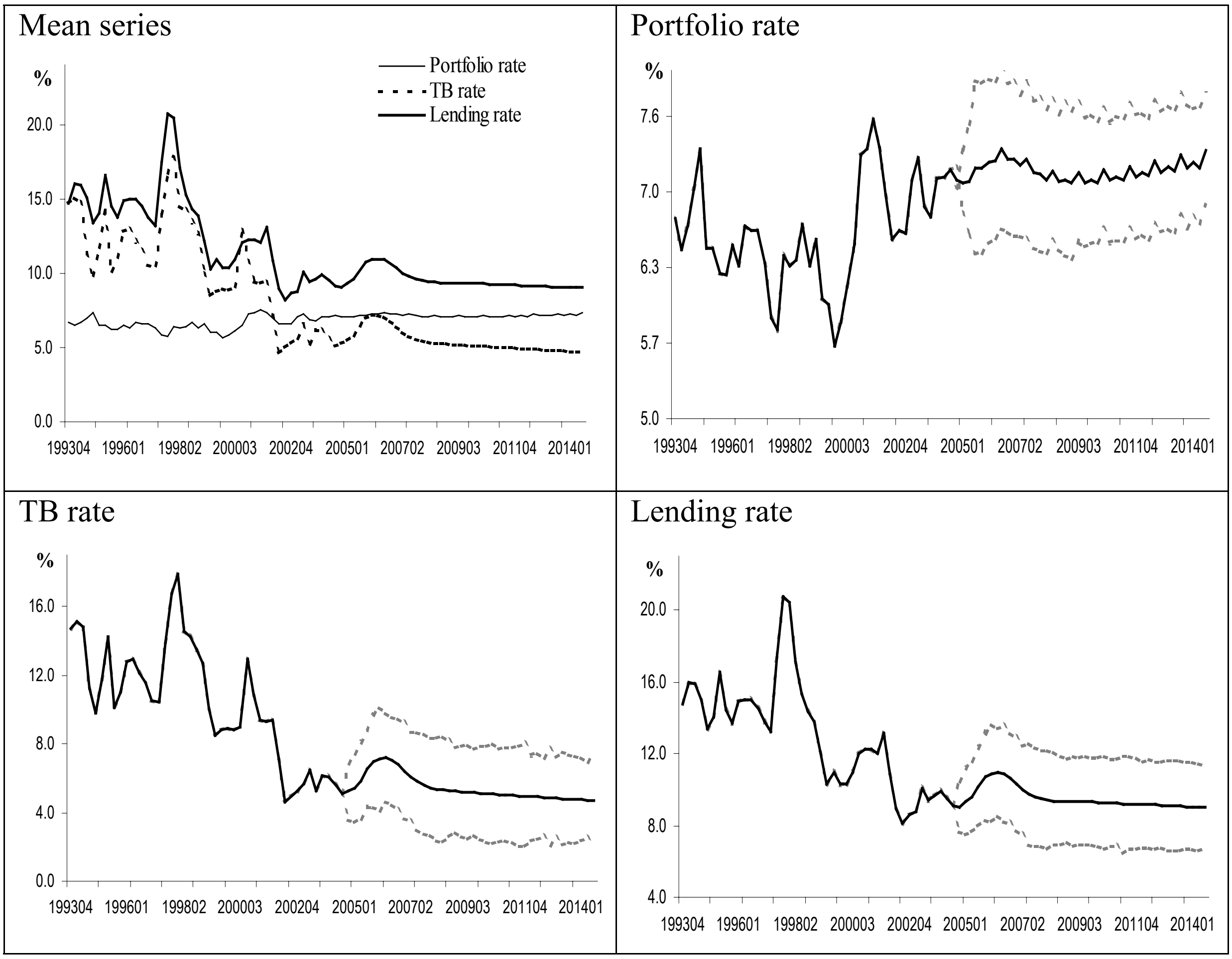
Note: The solid lines are the mean data series; the dotted lines are the upper and the lower series forming approximately 95% confidence interval.

Figure 4.2 Recursive estimates of $\hat{\beta}_1$ in Equation (9)



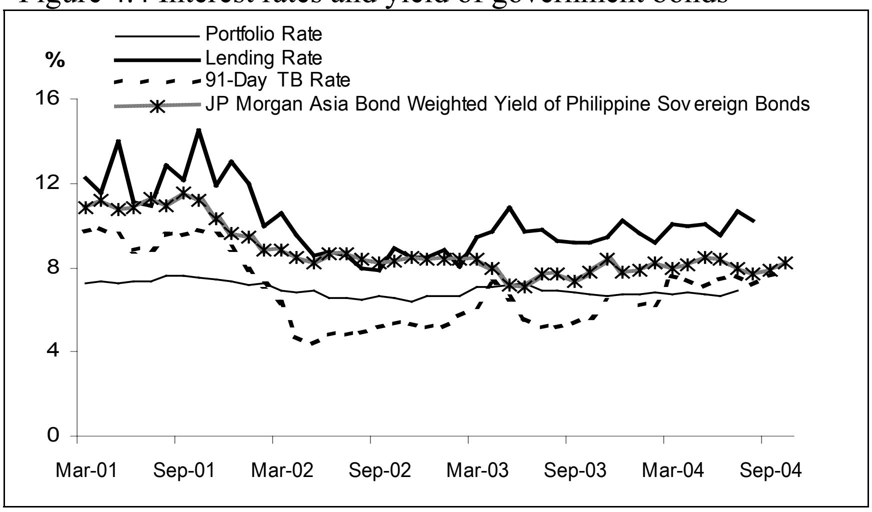
Note: the dotted lines are 95% confidence intervals.

Figure 4.3 Interest rates



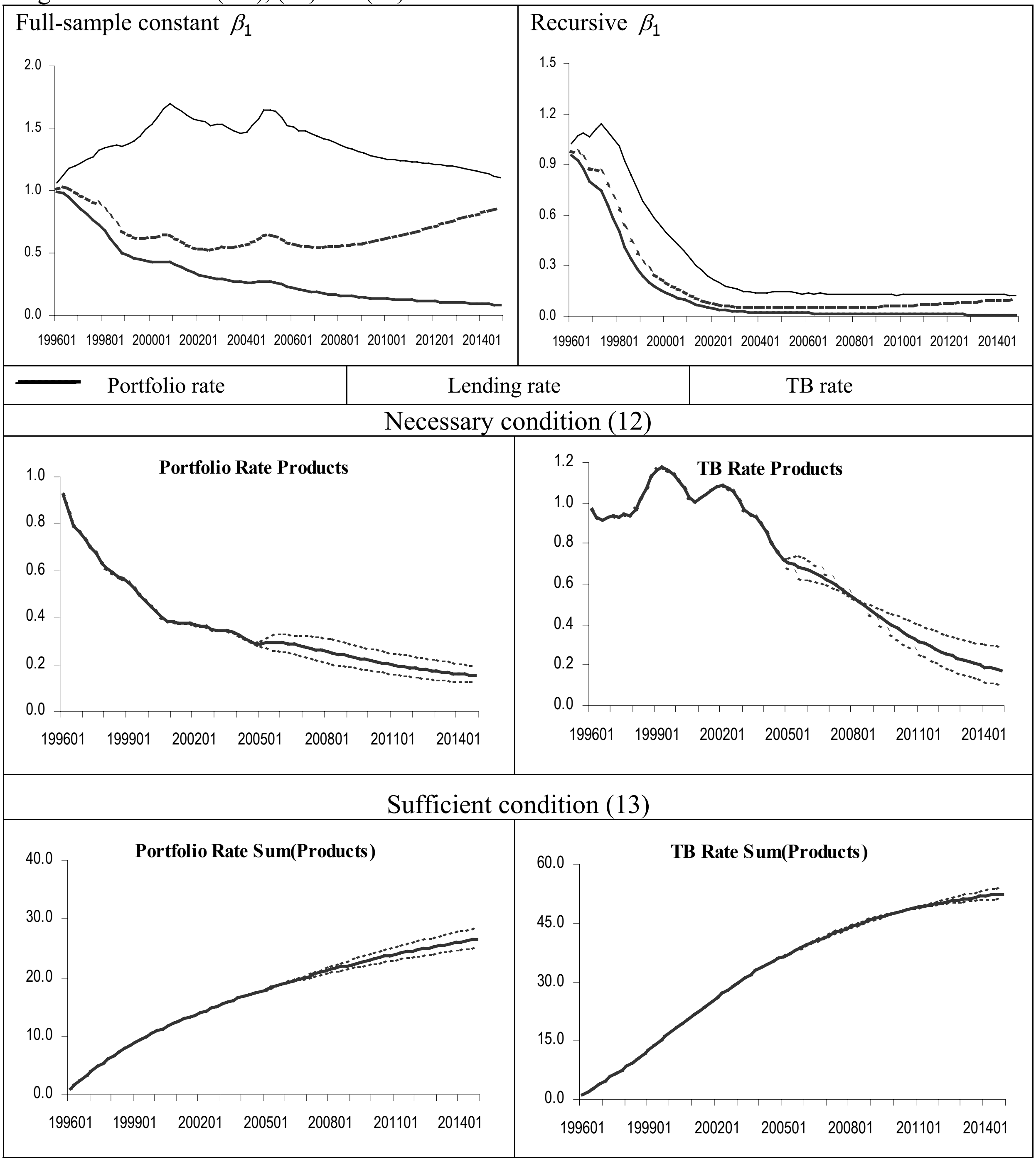
Note: TB rate denotes 91-days treasury bill rate. The solid lines are the mean data series; the dotted lines are the upper and the lower series forming approximately 95% confidence interval.

Figure 4.4 Interest rates and yield of government bonds



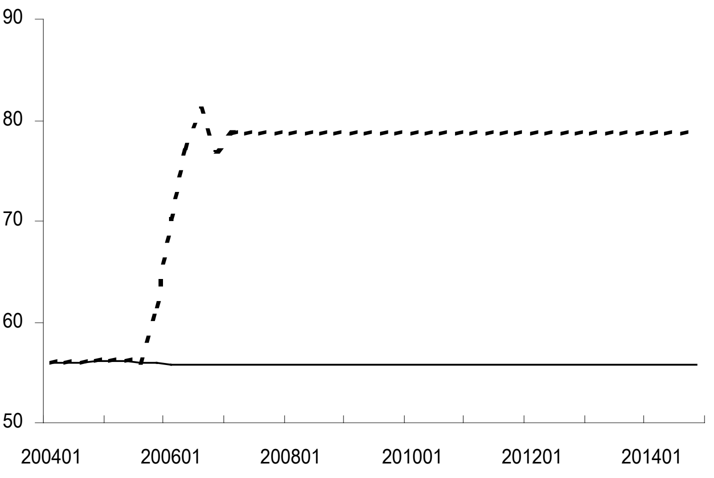
Note: JP Morgan Asia Bond Weighted Yield of Philippine Sovereign Bonds comes from Datastream.

Figure 4.5 Tests of (11’), (12) and (13)



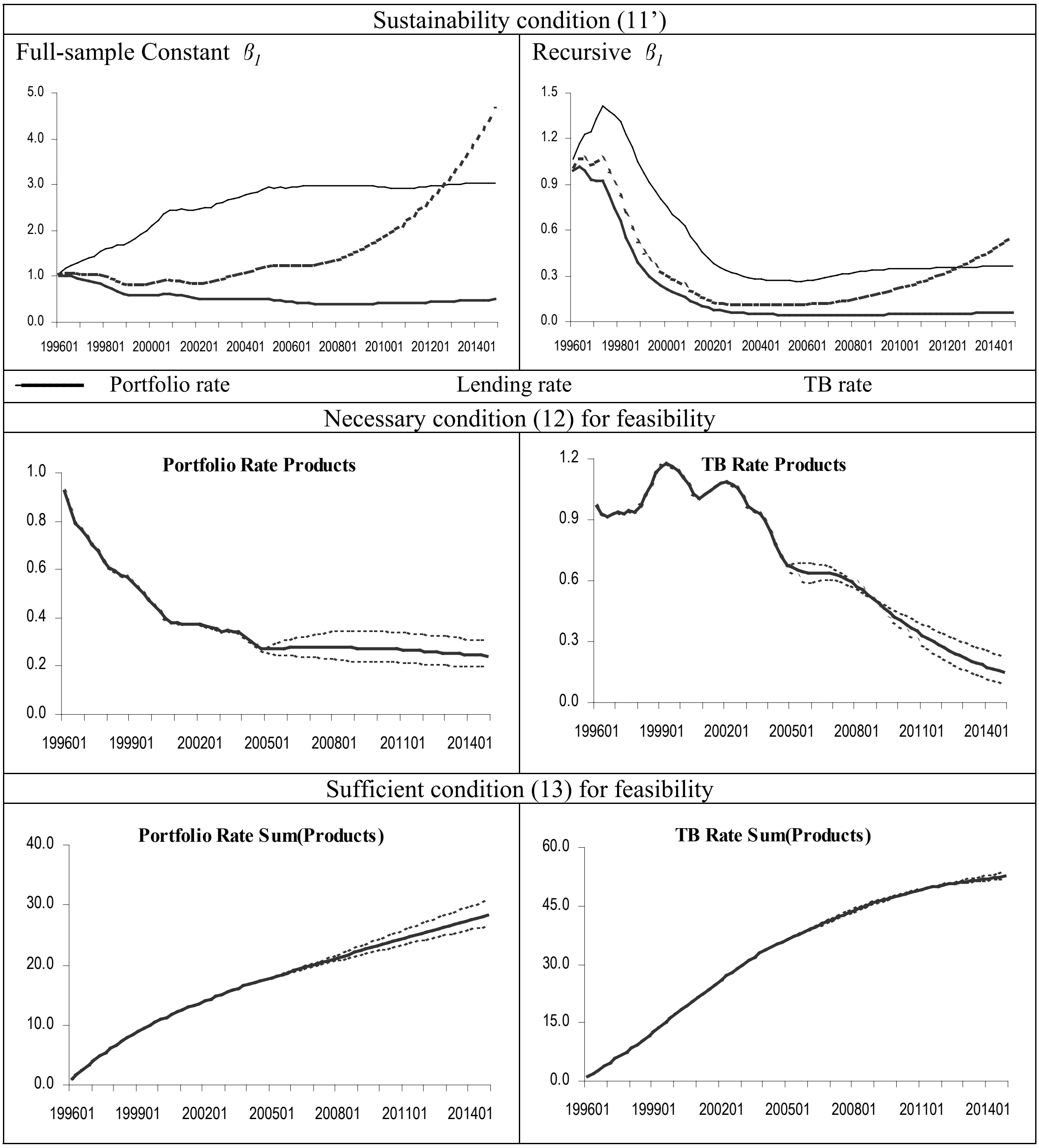
Note: It takes about 6 further years for the portfolio rate series in (11’) to converge to zero. The solid curves in (12) and (13) are mean series and the dotted lines are the lower and upper series forming a 95% confidence interval. The portfolio series in (12) would take about 4 further years to converge to zero.

Figure 4.6 Assumed exchange rate devaluation (peso/US$)



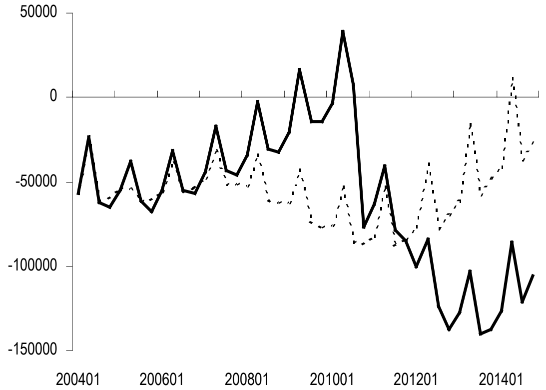
Solid line: default values; dotted line: assumed shock values

Figure 4.7. Tests of (11'), (12) and (13) under exchange rate shock simulation



Note: In this simulation, the exchange rate devalues by 11%, 14%, 10% and 5% for the consecutive four quarters starting from 2005Q4, recovers by 5% in 2006Q4 and drops by 2% in 2007Q1, and stays constant afterwards. Convergence to zero is unachievable for the portfolio rate series in (11') and (12).

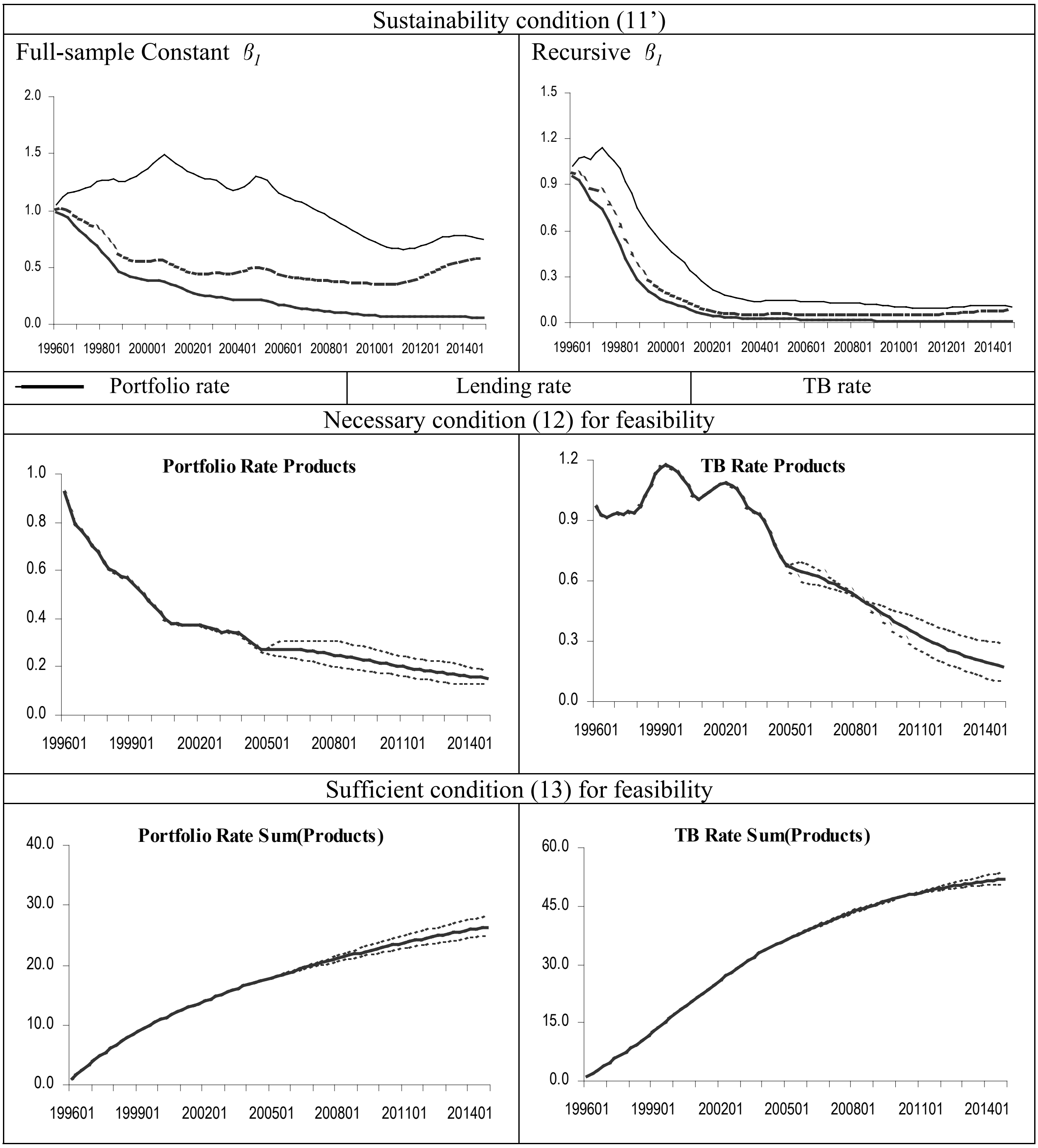
Figure 4.8 Fiscal simulation impact: Budget deficit and GDP growth



Budget deficit: Solid line: fiscal simulation; dotted line: default values.

Differences between fiscal simulation and default: Solid line: GDP growth rate; dotted line lending rate.

Figure 4.9 Tests of (11’), (12) and (13) under fiscal simulation



Note: In the model simulation, tax revenue is assumed to increase by 11% annually and government non-interest expenditure growth is controlled to not exceed 5% annually during 2005-2010. It takes about 2 further years for the portfolio rate series to converge to zero in (11’). It takes over 5 further years for it to converge to zero in (12).

Table 4.1 Unit root tests by augmented Dicky-Fuller (ADF) test

Augmented lags	ADF-test	β for Y_{t-1}	t-value of longest lag	Significance level of longest lag
Debt series				
3	2.03	1.01	-0.52	0.60
2	2.00	1.01	4.49	0.00
1	4.78	1.02	-1.55	0.12
0	4.52	1.01		
Debt ratio series				
3	-0.74	0.98	0.91	0.37
2	-0.66	0.99	-1.83	0.07
1	-0.86	0.98	-0.06	0.95
0	-0.88	0.98		

Note: The null hypothesis is $\beta = 0$. The critical values of ADF tests are: -2.90 at 5% and -3.51 at 1%. The sample covers 1994Q1 – 2014Q4. Seasonal dummies are added in the debt ratio test, as the series exhibits significant seasonal feature inherent from GDP.

Table 4.2. AR(4) Estimations for the median series of debt and debt ratio

Coefficient	Lag 1	Lag 2	Lag 3	Lag 4	Intercept
Full Sample: 1994Q1 to 2014Q4					
Debt	0.9410	0.5521	-0.5482	0.0630	26180
	(0.1087)*	(0.1485)*	(0.1516)*	0.1209	13810
Debt Ratio	0.9950	-0.2063	0.2951	-0.1004	0.0474
	(0.1102)*	0.1511	0.1514	0.1102	0.0632
Sub-sample: 1994Q1 to 2009Q4					
Debt	1.0037	0.2291	-0.1526	-0.0629	8866
	(0.1243)*	0.1783	0.1807	0.1274	13270
Debt Ratio	0.9875	-0.0895	0.1760	-0.0874	0.0401
	(0.1274)*	0.1745	0.1749	0.1271	0.0776
Historical data: 1994Q1 to 2004Q2					
Debt	0.9432	0.0138	0.0968	0.0117	-47302
	(0.1544)*	0.2053	0.2064	0.1624	25420
Debt Ratio	1.0462	-0.0173	0.1146	-0.1995	0.1385
	(0.157)*	0.225	0.2272	0.1582	0.1339

Note: The statistics in brackets are standard errors. Those marked by * are significant at 5%. Seasonal dummies are added in the AR(4) model for the debt ratio.

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