Analyzing Debt Sustainability: An Application of SimSIP Debt for Paraguay

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CHAPTER 6

Analyzing Debt Sustainability

An Application of SimSIP Debt for Paraguay

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One of the most difficult tasks in preparing a poverty reduction strategy consists in setting priorities for public action, taking into account the cost of social programs and the capacity of the government to pay that cost. The ability to pay for social programs essentially is determined by the resources available to the government through taxation and/or loans. Thus, the issues of debt and fiscal sustainability are key. In this study, we used SimSIP Debt, a user-friendly, Excel-based tool for analyzing debt and fiscal sustainability issues. Our objective was not to suggest policy options for Paraguay, but to explain how SimSIP Debt can be used to illustrate various scenarios. The simulator was developed by Gunter et al. (2002) and it has two modules.[1]

The Debt Projection Module enables the user to simulate the evolution of a country's debt over a 15-year horizon, based on initial conditions and projections for government expenditures, government revenues, and other parameters. Reflecting the fact that, for many countries, debt sustainability cannot be determined by only one specific indicator, this module adopts a flexible approach to the analysis of debt sustainability. Given that Paraguay's concessional debt is a small portion of the country's total debt, this study looks at the levels and trends of a variety of nominal debt sustainability indicators rather than so-called net present value indicators.

(We will explain later the distinction between an analysis in nominal terms and in net present value terms.)

The Deficit-Debt Consistency Module presents a variety of matrices to determine the consistency of a country's budget deficits with a desired level of short-term or long-term indebtedness and a variety of gross domestic product (GDP) growth rates. In the case of Paraguay, we look at such matrices for the nominal debt-to-GDP ratio, the nominal debt-to-exports ratio, and the nominal debt-to-revenue ratio. Each matrix shows how various levels of budget deficit relative to GDP ratios are consistent with both a range of real GDP growth rates and a range of debt targets. This type of analysis essentially enables the user to assess what level of budget deficit can be sustained without increasing debt ratios too much.

Before explaining our approach for analyzing debt sustainability, it is worth describing briefly the evolution of the debt situation in Paraguay. In 1989, the country's public external debt amounted to about 50 percent of GDP. Subsequently, the debt dropped significantly as the government purchased at a discount a sizable amount of delinquent commercial debt in the secondary market and rescheduled all remaining commercial debt arrears. In 1992, the government also paid 100 percent of any remaining official debt arrears to France, Germany, Spain, and the United States. As a result, in the mid-1990s the ratio of external public debt reached a minimum of about 15 percent. Since then, however, debt levels have been rising again, reaching nearly 30 percent in 2000 (see the annex for the trend in Paraguay's debt).[2]

Several factors explain the increase in the country's debt since the mid-1990s. The persistent recession observed since 1995 has put pressure on the amount of revenues collected by the government. Furthermore, between 1990 and 2000, although revenues increased from 9.5 percent to 11.5 percent of GDP, they remained based primarily on consumption taxes and royalties from hydroelectric power generation. Together with the prolonged recession, the limited tax base and instruments available for taxation have made it difficult for the government to raise revenues, at least in the short run.

At the same time, public spending has increased substantially, especially in the social sector. Social spending for education, health care, and social assistance tripled in per capita terms in the 1990s. It also increased from one fourth to 40 percent of total spending, and from less than 3 percent to 7 percent of GDP. Expenditures per capita in education more

than tripled. The increase was largest for primary and secondary education, but all levels of schooling benefited. Real expenditures for health also were increased substantially. In both education and health, most of the increase took place in the first half of the 1990s, but the effects on the budget have persisted since that time because the country entered a prolonged recession. Expenditures on social security and social assistance also increased in real terms and as a percentage of GDP, but they decreased as a share of total spending. Spending for housing, water, and sanitation decreased.

It is important to mention that, although Paraguay's percentage of increase in social spending through the 1990s was larger than in the rest of Latin America, the levels of social spending-to-GDP remained lower than those of other countries. Specifically, estimates from the Comisión Económica para América Latina y el Caribe (CEPAL 2002) suggested that the increase in public social spending per capita over the 1990s was larger in Paraguay (136 percent increase) than in Latin America as a whole (50 percent increase). Despite Paraguay's greater increase in spending, the level of spending remained four times smaller than in other Latin American countries ($132 per person in Paraguay in 1998–99 versus $540 in Latin America). As a share of GDP as well, the level of spending in Paraguay remained comparatively low.[3]

Still, from a debt sustainability perspective, as a result of the stagnation in revenues and the increase in spending, the central government went from a surplus of 2.5 percent of GDP during 1990–94 to a deficit of 5.5 percent in 2000. Because public sector wages use up most of the state's revenues, capital spending has been curtailed and financed with external funds. As a result, overall, the government has little room to maneuver—for example, to spend more on productive activities or on poverty reduction programs. In the first half of 2001, a better control of public expenditures was achieved and plans were discussed to increase revenues (that is, plans for extensions of the value-added tax, higher taxes on tobacco and alcohol, and import duty and annual "patent" on cars). That, however, had no dramatic effect on the current public spending constraint—and that is problematic, given the desire to fund new initiatives to reduce poverty as part of the national poverty reduction strategy proposed by the Ministry of Social Action.

At the time we wrote this report (in 2003), there were contrasting views on Paraguay's long-term debt sustainability (as was true for many

other developing countries), partly because of differences of opinion on what constitutes debt sustainability and partly because of differences in macroeconomic assumptions. The government of Paraguay's investment promotion Web site states that Paraguay's debt "does not represent a burden that threatens economic stability" and that "the country's abundant foreign reserves guarantee the normal servicing of the debt." At the same time, the Economist Intelligence Unit's country risk summary of October 2002 concluded that "[r]enewed weakness in the guaraní could compromise debt-servicing before long. A weak policymaking environment, poor economic performance, and recent external shocks could all complicate the picture. The Economist Intelligence Unit (EIU) is currently forecasting an external debt/GDP ratio of almost 70% by 2003 as US dollar GDP shrinks."[4] There also were worries that, given the impact of the recession in Argentina, fiscal deficits will continue to increase and thus lead to an unsustainable debt.

Given this controversy, the tools provided in SimSIP Debt can be useful for policy makers and analysts conducting their own analyses. But one must be careful not to overestimate what one can learn from such modeling. Indeed, the concept of sustainability is very useful—but it also can be dangerous. When making projections 10 or 15 years ahead, there are tremendous uncertainties. It may be tempting for a government to base its strategy on, say, a medium-growth case scenario while ignoring significant risks that lower-growth case scenarios may entail. This means that there are some political economy dangers inherent in using simple forecasts and one must be careful about how one treats the uncertainties resulting from them. Although we will not enter into detailed policy discussions about Paraguay in this report, we do want to emphasize that debt sustainability is an area of macroeconomic policy where governments must be especially careful.

To help readers become familiar with the simulator and its assumptions, the rest of the report is structured as follows. In the next section we briefly present a few alternative approaches, concepts, and examples for analyzing debt sustainability, and we cover the theoretical background for the two modules of the SimSIP Debt simulator.[5] The third and fourth sections provide preliminary results obtained with the two modules.[6] The report ends with some conclusions and an outlook based on the latest available data.

Alternative Approaches to Analyzing Debt Sustainability

A common definition of debt sustainability is whether a country can meet its current and future debt service obligations in full, without recourse to debt relief, rescheduling, or accumulation of arrears. To determine if a country's debt is sustainable is complex, however, and there are various analytical approaches, as presented in the first chapter of this book. From a theoretical perspective, perhaps the most appealing approach is to derive debt sustainability criteria based on discounting the net present value (NPV) of the government's debt over an infinite horizon (Buiter 1995; Cuddington 1997). The limitations of this approach, however, have led to the development of more practical debt sustainability indicators, usually based on a ratio of a debt variable to another key macroeconomic variable.[7] Still another approach is to look at the consistency of the government's budget deficit with the government's desired level of indebtedness.

To illustrate the variety of approaches used to analyze debt sustainability, we provide below a few examples of indicators used in the World Bank's *Global Development Finance* (GDF), the HIPC Initiative, the United Nations' Millennium Development Goals (MDGs), and the European Union's Maastricht Treaty.

The World Bank's GDF (formerly, World Debt Tables) classifies external indebtedness based on two ratios—the ratio of the NPV of total external debt (calculated based on all future debt service) to the three-year backward-looking average of gross national product (GNP), and the ratio of the NPV of total external debt (calculated based on all future debt service) to the three-year backward-looking average of exports of goods and services (including workers' remittances). If either ratio exceeds a critical value—80 percent for the NPV-debt-to-GNP ratio and 220 percent for the NPV-debt-to-exports ratio—the country is classified as severely indebted. If the critical value is not exceeded but either ratio is three-fifths or more of the critical value (that is, 48 percent for present value of debt service to GNP and 132 percent for present value of debt service to exports), the country is classified as moderately indebted. If both ratios are less than three-fifths of the critical value, the country is classified as less indebted.

In the framework of the HIPC Initiative, a country is considered to have a sustainable external debt if the ratio of the present value external debt

(calculated based on all future debt service) to the three-year backward-looking average of exports of goods and nonfactor services (excluding workers' remittances) is smaller than or equal to 150 percent. Although this indicator has benefits, it also may be sensitive to shocks. Suppose, for example, that there is a peak in terms of exports at some point because of an increase in some commodity prices. Heavy indebtedness may not be observed then if the last three years of exports have been strong, but the country may still be in severe trouble if export prices fall over the next several years. Given the limitations of the export criterion, especially for countries with a high export-to-GDP ratio and a sensitivity to terms-of-trade shocks, the HIPC Initiative added a fiscal criterion of debt sustainability for countries that have an export-to-GDP ratio of at least 30 percent and a government revenue-to-GDP ratio of at least 15 percent. For HIPCs satisfying both of those thresholds, the HIPC Initiative considers an additional fiscal criterion: a HIPC's external debt is sustainable if the ratio of the present value of public and publicly guaranteed external debt to government revenues is smaller than or equal to 250 percent.[8]

Within the enlarged set of MDGs, target 15 is defined to deal comprehensively with the debt problems of developing countries through national and international measures to make debt sustainable in the long term. The four indicators for this target are (1) the proportion of official bilateral HIPC debt cancelled, (2) the debt service as a percentage of goods and services exports, (3) the proportion of official development assistance provided as debt relief, and (4) the number of countries reaching HIPC decision and completion points.[9]

Finally, the European Union's Maastricht Treaty (signed in early 1992) limited the ratio of government debt to GDP to 60 percent, though it also was agreed that higher ratios are acceptable as long as the debt-to-GDP ratio is falling sufficiently over time. Indeed, the majority of European Union member-states had debt-to-GDP ratios above 60 percent for most of the 1990s, and at least three countries (Belgium, Greece, and Italy) had debt-to-GDP ratios of more than 100 percent. In any event, it should be stressed that the Maastricht Treaty's debt-to-GDP ratio ought not be interpreted as a debt sustainability indicator, but as convergence criteria set by a group of European countries that intended to adopt a single currency by the end of 2001.

We can conclude, therefore, that there are two main criteria to assess debt sustainability. The first criterion is to look at the external sustainabil-

ity of a country's debt. The second criterion is to look at the fiscal sustainability of a country's debt. Whereas the external criterion compares a country's external debt or debt service to its exports, the fiscal criterion compares a country's public and publicly guaranteed debt or debt service to government revenues. The results based on these two categories of debt sustainability criteria often yield similar results, but external sustainability is neither necessary nor sufficient for fiscal sustainability, and vice versa.[10] The three variables most commonly used as a denominator of a debt ratio or a debt service ratio are (1) a country's GDP (or GNP), (2) its exports, and (3) its government revenues.[11]

It also must be noted that excluding debt sustainability indicators that compare a country's current debt service obligations to variables such as exports, there are two alternative approaches for defining debt sustainability. The traditional approach compares the nominal stock of disbursed and outstanding debt to a given macroeconomic variable. The more sophisticated approach calculates first the NPV of all future debt service on disbursed and outstanding debt, and then compares the NPV debt to some macroeconomic variable (such as GDP, exports, and/or government revenues). The NPV calculation sums up all future debt service obligations, whereby future debt service obligations are discounted depending on when the debt service is due. This is especially important if a country has a lot of concessional debt. But because the proportion of concessional debt in Paraguay is relatively low, we will use nominal debt indicators in this report.[12]

Theoretical Foundations for the Modules in SimSIP Debt

The SimSIP Debt modules include two simulation worksheets—one for debt projections and one for assessing the consistency of various debt and budget deficit scenarios. We discuss both modules in this section.

Debt Projection Module

The Debt Projection Module calculates the values for various debt indicators, based on three modeling elements: (1) the modeling of government expenditures; (2) the modeling of government revenues; and (3) the specification of the government deficit, which is financed by new borrowing after deducting grants and debt relief. Both expenditures and revenues are

influenced by the level of GDP (Y), which is determined by the previous year's level [$Y(t-1)$], the projected real growth rate for the year (g), and the inflation rate (π):

$$Y(t) = (1 + \pi(t))(1 + g(t))Y(t-1). \tag{6.1}$$

On the expenditure side, the module differentiates between interest payments on public foreign debt, interest payments on public domestic debt, principal repayments on foreign and domestic debt, and other government expenditures. The average interest rates (not the interest payments) on outstanding foreign and domestic debts are exogenously fixed for any given year by loan contracts, although the module differentiates between interest rates on public domestic and foreign debt. Given that new loans (arising from principal repayments and deficit financing) are generally a small fraction of the debt stock, interest rates on domestic and foreign debts change only slowly over time. For simplicity, principal repayments are financed by new loans, although not necessarily from the same source (domestic or foreign) and at the same interest rate and maturity. All other expenditures (all expenditures excluding interest and principal payments) are a predetermined percentage of GDP, although this percentage rate may change over time.

If we denote the interest rates on domestic and foreign debt by i_f and i_d (averages for the various loan contracts), the stocks of debt by $D_f(t\text{–}1)$ and $D_d(t\text{–}1)$, and the exchange rate by $E(t)$—this is the ratio of the value of domestic to foreign currency—we have three kinds of expenditures: interest payments on foreign government debt [$i_f(t\text{–}1) * D_f(t\text{–}1) * E(t)$], interest payments on domestic government debt [$i_d(t\text{–}1) * D_d(t\text{–}1)$], and government expenditures on social and nonsocial sectors [$G_{sec}(t)$] = $\alpha(t) * Y(t)$. Total government spending is

$$G(t) = i_f(t\text{–}1) * D_f(t\text{–}1) * E(t) + i_d(t\text{–}1) * D_d(t\text{–}1) + \alpha(t) * Y(t). \tag{6.2}$$

On the revenue side, we simplify the analysis by combining tax revenues, seigniorage, and all other nontax revenues to one variable, namely the percentage share [$\beta(t)$] of GDP. Changes over time in this percentage share reflect changes in tax rates, the efficiency of revenue collection, and money financing.[13] The simulator calculates the intermediate values based on a linear trend. Grants $N(t)$ and debt service relief $DSR(t)$ are determined exogenously by foreign donors. Like foreign borrowing, grants

and debt service relief are converted into domestic currency at the end of each period. If revenues before grants and before debt relief are denoted by $REV_{bef}(t) = \beta(t) * Y(t)$, revenues with grants and debt relief are[14]

$$REV_{aft}(t) = \beta(t) * Y(t) + E(t) * N(t) + E(t) * DSR(t). \quad (6.3)$$

Budget deficits $BD(t)$ are simply the difference between total revenues (including grants and debt relief) and total government expenditures:

$$BD(t) = G(t) - REV_{aft}(t). \quad (6.4)$$

The module assumes that the government faces no constraints in financing expenditures through new borrowing, and the user is free to choose what share of the new debt comes from domestic sources. If new domestic and foreign borrowing by the government are denoted, respectively, by $BD_d(t)$ and $BD_f(t)$, the change in debt is

$$BD(t) = E(t) * BD_f(t) + BD_d(t). \quad (6.5)$$

The simulator makes no assumptions for the impact of new borrowing on GDP growth, inflation, the exchange rate, and the level of loan concessionality.[15] Although the assumptions for GDP growth, inflation, exchange rate depreciation, and average interest rates on domestic and foreign loans are exogenous variables, the module enables us to adjust the growth rate of real GDP downward, the inflation rate and the exchange rate depreciation upward, and the interest rates on domestic and foreign loans upward the higher the average ratio of government deficit to GDP is over the projection period. For countries with sustainable poverty reduction strategies in place, these considerations are less crucial because consultations with donors would reduce the existence of excessive financing gaps. Combining equations (6.4) and (6.5) yields

$$G(t) - REV_{aft}(t) = BD(t) = E(t) * BD_f(t) + BD_d(t). \quad (6.6)$$

The model is dynamic because the current year's budget deficit is linked to the previous year's budget deficit through the current year's total government expenditures, which include interest payments on the previous year's debt stock. When the level of debt is known over time, it is easy to compute the NPV of a country's public foreign debt by using

debt-service projections based on the average interest rate and the average maturity of outstanding public foreign debt. In any case, for a country's public domestic debt and a country's private foreign debt, the NPVs are set equal to the nominal values.

Deficit-Debt Consistency Module

The Deficit-Debt Consistency Module builds on the theoretical framework of the Debt Projection Module, although it abstracts from the details of the composition of revenues and expenditures and just looks at the difference between the current year's stock of debt [$D(t)$] and the previous year's stock of debt [$D(t–1)$], which is the current year's budget deficit [$BD(t)$] after grants and after debt relief:

$$D(t) - D(t–1) = BD(t). \tag{6.7}$$

As is shown in the SimSIP Debt manual, equation (6.7) can be expressed in percentages of GDP (denoted by Y); and for a given set of parameters, we can derive a simple equation that says the difference between this year's and last year's debt-to-GDP ratios is equal to this year's deficit-to-GDP ratio minus a factor k times last year's debt-to-GDP ratio:

$$[D(t)/Y(t)] - [D(t–1)/Y(t–1)] = [BD(t)/Y(t)] - k\,[D(t–1)/Y(t–1)]. \tag{6.8}$$

Depending on whether we look at the dynamics of the domestic or the external debt stock, the factor k is defined slightly differently, as shown in equations (6.9) and (6.10). However, as long as we assume that the share of domestic and external financing remains constant over time, we can derive a combined equation that keeps the total public debt-to-GDP ratio constant.

For domestic debt dynamics:

$$k_d = (g+\pi)/(1+g+\pi+g\pi), \tag{6.9}$$

and for foreign debt dynamics:

$$k_f = (g+\pi–e)/(1+g+\pi+g\pi), \tag{6.10}$$

where g is the GDP growth rate, π is the inflation rate, and e is the rate of devaluation.

Equation (6.8) can be solved to provide the deficit-to-GDP ratio that keeps the debt-to-GDP ratios constant; that is,

$$[D(t)/Y(t)] = [D(t–1)/Y(t–1)]. \quad (6.11)$$

Inserting equation (6.11) into (6.8) yields

$$[BD(t)/Y(t)] = k[D(t–1)/Y(t–1)]. \quad (6.12)$$

As shown in the SimSIP Debt manual, equation (6.8) also can be expressed in NPV terms, which, after some simplifying assumptions and after keeping the NPV debt-to-GDP ratios constant, results in the following equation:

$$[BD(t)/Y)(t)] = (i_{old}/i_{new})\ k[D(t–1)/Y(t–1)], \quad (6.13)$$

whereby i_{old} is the average interest rate on the previous year's debt stock, and i_{new} is the average interest rate on the newly contracted loans.

Extensions of equation (6.8) also allow for the derivation of deficit-to-GDP ratios that keep the debt-to-exports and the debt-to-revenues ratios constant, in either nominal or NPV terms.[16]

Simulations for the Debt Projection Module in Paraguay

Consistent with economic theory, we include Paraguay's domestic public and publicly guaranteed debt and exclude Paraguay's private external debt for the fiscal sustainability analysis. Moreover, we exclude all domestic public debt and include Paraguay's private foreign debt for the external sustainability analysis.

External Sustainability

To analyze Paraguay's external debt sustainability, we first note that Paraguay's total external debt was estimated in the year 2000 to consist of $2.234 billion public and publicly guaranteed debt and about $500 million private (nonpublicly guaranteed) foreign debt. For our baseline scenario, we use the initial conditions and assumptions as displayed in figure 6.1. Furthermore, we need to make an assumption on the growth rate of the private foreign debt, which we assume to grow always at the same

Figure 6.1. Initial Conditions and Basic Macroeconomic Assumptions

	Public Foreign Debt		Nominal
	Stock	Int. Pay.	GDP
Initial Value	2,061	124	7,521

	Grants	Exports	Exchange rate
Initial Value	30.0	3,188	3,486
Growth (t0)	2.0	2.5	11.0
Growth (t15)	2.0	8.0	5.0

	Discount rate (%)	Interest rate (%)	Inflation rate (%)	Real GDP growth (%)	Rev. to GDP(%)	Primary Spending to GDP(%)	Average Maturity (years)
Value (2000)	6.0	6.0	9.0	2.5	17.0	18.0	22
Value (2015)	6.0	6.0	5.0	5.0	17.0	18.0	22

Source: Authors' calculations, using SimSIP simulator software.
Note: Pay. = interest payment; Rev. = revenue.

rate as GDP. In this external sustainability analysis, we also assume that the GDP growth rate gradually increases from 2.5 percent in 2000 to 5 percent in 2015, and we keep this assumption about GDP growth the same for all our scenarios.

The different scenarios for this external sustainability analysis are determined by differences in the growth rate of exports. For the baseline scenario, we assume that exports grow at the same rate as GDP (2.5 percent in 2000 and 5.0 percent in 2015); in a low-export scenario, we assume that the growth rate of exports remains always at 2.5 percent; and in a high-export scenario, we assume that the growth rate of exports increases gradually from 2.5 percent in 2000 to 8.0 percent in 2015.

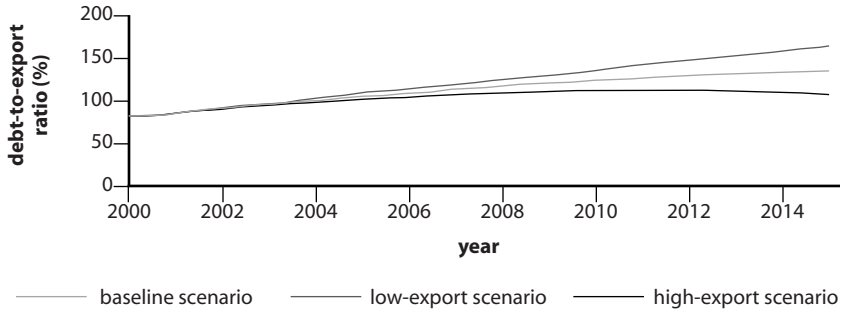
The results of these three scenarios are presented in figure 6.2, which shows an exponentially increasing external debt-to-export ratio for the low-export scenario, a more or less linear increase in the external debt-to-export ratio for the baseline scenario, and an initially increasing but then decreasing external debt-to-export ratio for the high-export scenario. In any case, we can see that, except for the high-export scenario, Paraguay is unlikely to achieve long-term external debt sustainability for the initial conditions and other assumptions as provided in figure 6.1. Again, this outcome would change if, for example, government revenues were to rise faster than spending.

Fiscal Sustainability

We analyze Paraguay's fiscal sustainability by looking at the impact of alternative scenarios on the public debt-to-GDP ratio, the public debt-to-

revenue ratio, and the public debt service-to-revenue ratio. The initial conditions and basic macroeconomic assumptions are provided in figure 6.1; the assumptions on Paraguay's domestic public and publicly guaranteed debt are shown in figure 6.3. We then modify the macroeconomic assumptions by considering, first, a pessimistic scenario of 0 percent GDP growth throughout the projection period and, second, an optimistic scenario of a gradual increase in the GDP growth rate from 2.5 percent in 2000 to 10 percent in 2015. Note that whereas growth in a country depends in part on policy decisions regarding spending, taxation, and debt, it is defined here in a purely exogenous way to simplify the analysis. Thus

Figure 6.2. Results of Different Export Growth Scenarios



Source: Authors' calculations, using SimSIP simulator software.

Figure 6.3. Assumptions on Public Domestic Debt

Public Domestic Debt

	Public Domestic Debt (US $)	Interest on Public Domestic Debt		
Initial Value	265	34.45		
	Share of Domestic Financing	**Interest Rate**	**Discount Rate**	**Average Maturity**
Value (t0)	10	13	6	5
Value (t15)	15	8	6	5

Source: Authors' calculations, using SimSIP simulator software.

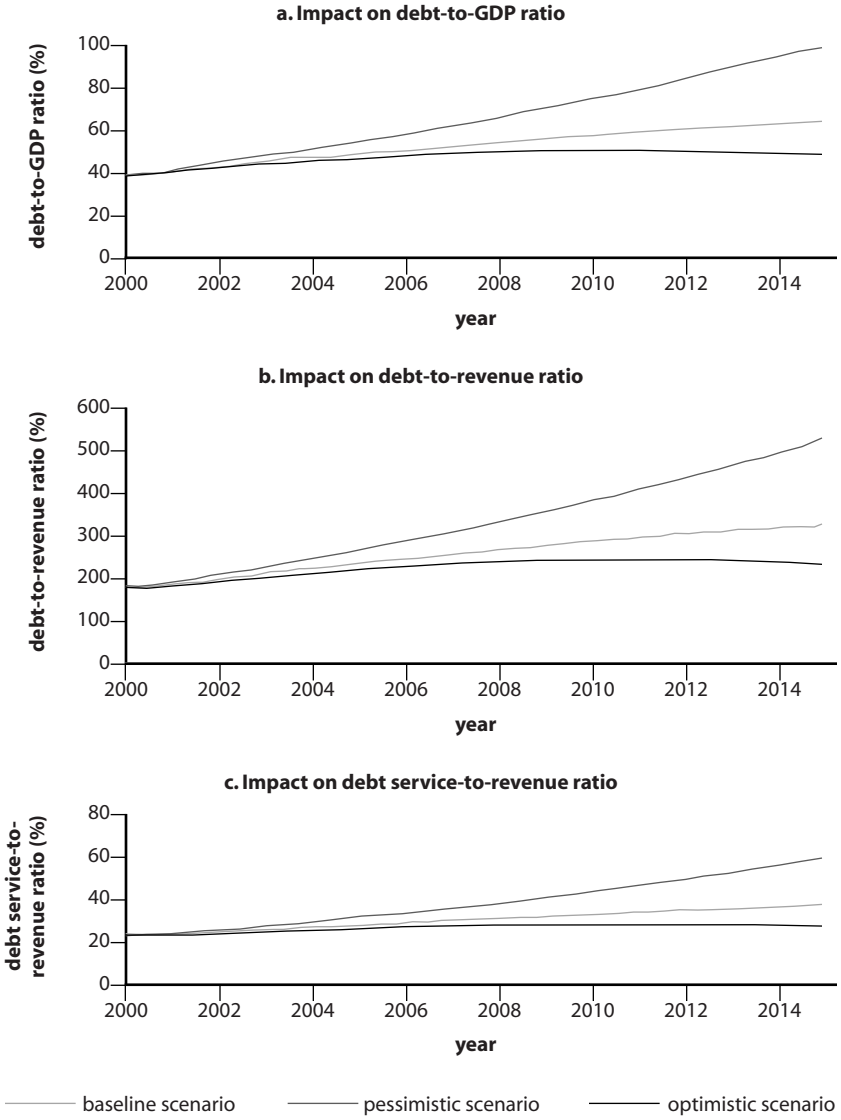
there is no feedback to growth from the other variables in the model. Also, although the simulator enables the user to assess the impact of debt relief, we do not do this here because Paraguay does not participate in the HIPC Initiative.

Figure 6.4 presents the results for the three GDP growth scenarios. The graphs show the evolutions of the debt-to-GDP ratios, the debt-to-revenue ratios, and the debt service-to-revenue ratios for the baseline, pessimistic, and optimistic growth scenarios. In the optimistic scenario, the debt ratios do not increase substantially, whereas they are much higher in 2014 than in 2000 in the baseline and pessimistic scenarios. That is because, in the assumptions in figure 6.1, we have maintained levels of spending and revenues that lead to a deficit, and over time, that deficit, together with interest payments, increases the debt level.

In the graphs presented in figure 6.5 we see the impact of different evolutions of government revenues and spending, keeping other initial conditions and assumptions as shown in figures 6.1 and 6.3. The high-expenditure scenario gradually increases the government's primary expenditure to reach 20 percent of GDP in 2015, leaving the initial percentage for 2000 unchanged at 18 percent. This implies that the government gradually increases its primary budget deficit (that is, before taking into account its debt service) to reach 3 percent of GDP in 2015. Alternatively, the high-revenue scenario gradually increases the revenue-to-GDP ratio from the initial 17 percent in 2000 to 19 percent in 2015. The gradual increase of the revenue-to-GDP ratio over 15 years suggests that the government will run a decreasing primary deficit for the first 7 years, and the deficit then will turn into an increasing primary surplus starting in 2008. However, debt-to-GDP ratios will continue to increase until 2010 because debt service payments remain.

Comparing the high-expenditure scenario in figure 6.5 with the pessimistic scenario in figure 6.4, we can see that the zero growth rate of GDP has a more detrimental impact on Paraguay's debt than does the gradual increase in the share of government expenditures to GDP. On the other hand, the gradual increase in the share of government revenues to GDP—from 17 percent to 19 percent—has a more positive effect on Paraguay's indebtedness than does the high-growth GDP scenario. Of course, those conclusions are specific to our assumptions; the reader could run the simulator with other assumptions.

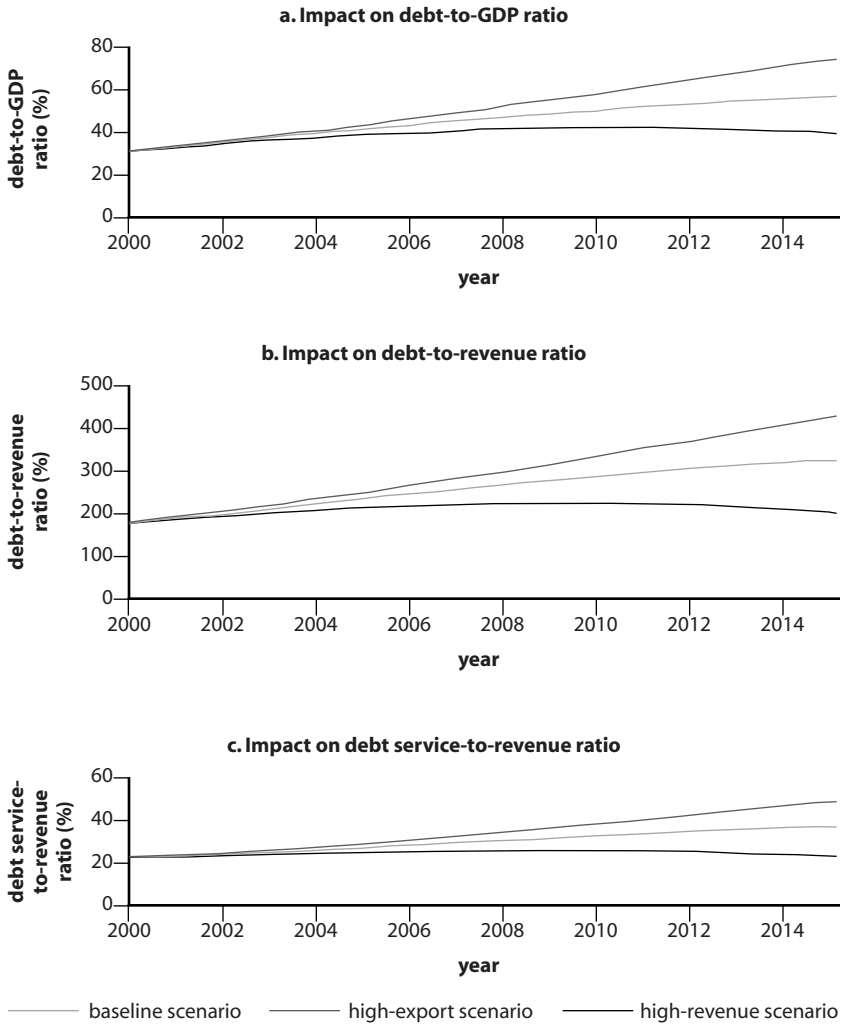
Figure 6.4. Results of the Baseline, Pessimistic, and Optimistic Scenarios



Source: Authors' calculations, using SimSIP simulator software.
Note: GDP = gross domestic product.

Note that these differences in results are largely due to having kept the expenditure-to-GDP and the revenue-to-GDP ratios constant in both the pessimistic and the optimistic scenarios. In reality, changes in growth rates

Figure 6.5. Results of Different Revenue and Expenditure Scenarios



Source: Authors' calculations, using SimSIP simulator software.
Note: GDP = gross domestic product.

usually will have an impact on the expenditure and revenue shares. Here we analyzed the impact of the various changes separately to see the effect of each parameter change and to show that similar results can be reached through different parameter changes.

Simulations for the Deficit-Debt Consistency Module in Paraguay

We now estimate the level of budget deficit that is consistent with various levels of short-run or long-run indebtedness and various growth scenarios. The two matrices shown in table 6.1 provide the short-term and

Table 6.1. Short- and Long-Term Consistency Matrices

a. Short-term consistency matrix

	GDP growth (%)		
Total public debt/GDP	*3*	*4*	*5*
	Sustainable deficit		
10	0.1	0.2	0.3
20	0.2	0.4	0.5
30	0.3	0.5	0.8
40	0.4	0.7	1.1
50	0.4	0.9	1.3
External public debt/exports (%)	*Sustainable deficit*		
10	0.1	0.3	0.4
20	0.2	0.5	0.9
30	0.2	0.8	1.3
Total public debt/revenue (%)	*Sustainable deficit*		
140	0.1	0.3	0.5
160	0.1	0.4	0.6
180	0.1	0.4	0.7
200	0.1	0.4	0.7
220	0.2	0.5	0.8

b. Long-term consistency matrix

	GDP growth (%)		
Total public debt/GDP	*3*	*4*	*5*
	Sustainable deficit		
10	0.3	0.4	0.5
20	0.6	0.7	0.9
30	0.8	1.1	1.4
40	1.1	1.5	1.8
50	1.4	1.8	2.3
External public debt/exports (%)	*Sustainable deficit*		
10	1.2	1.3	1.5
20	2.3	2.7	3.0
30	3.5	4.0	4.5
Total public debt/revenue (%)	*Sustainable deficit*		
140	0.7	0.9	1.1
160	0.8	1.0	1.2
180	0.9	1.1	1.4
200	0.9	1.2	1.5
220	1.0	1.4	1.7

Source: Authors' calculations, using SimSIP simulator software.
Note: GDP = gross domestic product. Given real GDP growth rates (%), deficit-to-GDP ratios (%) consistent with various total nominal public debt-to-GDP ratios (%), nominal public external debt-to-export ratios (%), and total nominal public debt-to-revenue ratios (%).

long-term deficit-to-GDP ratios that are consistent with a range of GDP growth rates and a range of debt-to-GDP ratios, keeping the initial values and other parameters constant at their short- and long-term values. The short-term scenario corresponds to the values specified in figure 6.1, which means that the figures take into account 2000 data. The long-term scenario is based on the 2015 calculated values of the same parameters in figure 6.1. In both cases we assume that the share of domestic financing is kept constant at 12.8 percent and that the interest rate on public domestic debt remains fixed at 13.0 percent.

We can see that the budget deficit-to-GDP ratios for the long-term analysis are higher than for the short-term analysis, largely because of the more-than-proportional decrease in the rate of devaluation compared with the decrease in the inflation rate.[17] Recall that the driving force for the consistency matrix is the factor k, defined in equations (6.9) and (6.10). If the devaluation and inflation rates would decrease in the same proportion, there would not be much difference between the short- and long-term consistent budget deficit-to-GDP ratios. The short- and long-term deficit-to-GDP ratios that are consistent with a range of GDP growth rates and a range of debt-to-exports and debt-to-revenue ratios are also shown in table 6.1. The positive effect of the relatively lower devaluation also is visible in the short- and long-term comparisons for these simulations. Furthermore, we can see that the consistent deficit-to-GDP ratios for all three short-term analyses are about the same. That is true because GDP, exports, and revenues all grow at the same rate of 2.5 percent for the short-term analyses. Conversely, the comparison of the long-term analyses shows that the consistent deficit-to-GDP ratios are considerably higher for the external public debt as a share of exports analysis, which occurs because exports are assumed to grow at 8 percent, compared with the 5 percent growth rates of GDP and revenues.

Finally, note that when assessing what level of budget deficit is sustainable, it is best to rely on the lowest level admissible under the various debt criteria because the various criteria must more or less be observed, given that there are good economic rationales for observing each and every criterion.

As shown in the SimSIP manual, there are a couple other general results that can be pointed out without running further simulations and that are worth mentioning here:

- The higher the real GDP growth rate and the higher the value of a debt indicator are, the higher is the value of the consistent budget deficit-to-GDP ratio, though it should be stressed that high debt indicators can lead to a debt overhang and low levels of GDP growth.
- The higher the inflation rate and the lower the devaluation rate are, the higher is the value of the consistent budget deficit-to-GDP ratio, though it should be stressed that the two variables usually are moving in the same direction because higher inflation rates usually suggest higher devaluations in the future.
- If a country is in the process of obtaining increasingly concessional loan terms from external creditors, the deficit-to-GDP ratios consistent with a specific NPV debt indicator and a given growth rate are higher than with a specific nominal debt indicator. (We did not discuss this here because our analysis is in nominal terms).
- If GDP and exports grow at the same rate, there will be no difference between the consistent ranges of deficit-to-GDP ratios for both the debt-to-GDP ratios and the debt-to-export ratios. Similarly, if GDP and revenues grow at the same rate, there will be no difference between the consistent ranges of deficit-to-GDP ratios for both the debt-to-GDP ratios or the debt-to-revenues ratios.
- The higher the growth rates of exports are, relative to the growth rates of GDP, the higher are the ranges of consistent deficit-to-GDP ratios for the debt-to-export ratios, compared with the consistent deficit-to-GDP ratios for the debt-to-GDP ratios. Similarly, the higher the growth rates of revenues are, relative to the growth rates of GDP, the higher are the ranges of consistent deficit-to-GDP ratios for the debt-to-revenues ratios, compared with the consistent deficit-to-GDP ratios for the debt-to-GDP ratios. Finally, the higher the growth rates of exports are, relative to growth rates of revenues, the higher are the ranges of consistent deficit-to-GDP ratios for the debt-to-export ratios, compared with the consistent deficit-to-GDP ratios for the debt-to-revenues ratios.

Conclusion

Using alternative macroeconomic assumptions and using the Debt Projection Module of the SimSIP Debt simulator, we have shown that both optimistic and pessimistic views on the Paraguay's future debt sustain-

ability can be entertained. As in other countries, changes in key parameters tend to have a large impact on sustainability. As our high-revenue scenario showed, for example, a gradual increase in the share of revenues to GDP from 17 percent to 19 percent over a period of 15 years (keeping everything else constant) could lead to a reversal in the otherwise worsening debt ratios in Paraguay. This sensitivity to changes in assumptions makes it difficult to provide good long-term estimates of a country's indebtedness; but it also shows that, in principle, public action to correct trends can be implemented, assuming that there is a capacity and the political will to do so. At the same time, we know that some factors are not necessarily within the control of governments. For example, changes in exchange rates are not always related to economic fundamentals, or they may overshoot fundamentals. When there is a crisis of investor confidence caused by increasing budget deficits, it can trigger first a currency crisis and then a debt crisis.

This study was written for illustrative purposes, and not for policy suggestions. However, it is worthwhile to recall that, at the time of writing, there were conflicting views of Paraguay's debt outlook. That is not too surprising because debt sustainability is an important topic for developing countries, and a sensitive one. From a macroeconomic point of view, it is also an area that must be dealt with very carefully. For example, greater debt may imply a higher deficit because of the interest expense, and this may be considered sustainable if high rates of economic growth are forecast. But if those high growth rates do not materialize for some reason, a country may fall into a debt spiral. When conducting debt analysis, therefore, one should be very careful not to use such an analysis to prop up spending and deficit budgets, even within the context of poverty reduction strategies that show high levels of need in any given country.

Annex

Table 6A.1. Trends in Paraguay's Debt, 1991–2000

Current US$ millions

Type of debt	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
Total PPG debt	1,771	1,377	1,338	1,472	1,535	1,516	2,246	1,933	2,385	2,583
External debt	1,685	1,364	1,283	1,359	1,441	1,403	1,452	1,578	2,072	2,234
Public external debt	719	732	774	833	1,007	1,008	1,022	1,128	1,589	1,695
Publicly guaranteed external debt	965	632	508	526	434	395	429	450	483	539
Domestic debt	87	13	56	114	95	113	794	355	314	349
Public domestic debt	37	7	34	70	66	82	559	254	240	265
Publicly guaranteed domestic debt (estimated)	50	6	22	44	29	32	235	101	73	84
Private external debt	20	21	26	138	338	408	482	534	558	450
Memorandum items										
Gross domestic product	5,265	6,249	6,447	6,875	7,853	9,016	9,628	9,612	8,598	7,741
PPG external debt-to-GDP (%)	32.0	21.0	19.9	19.8	18.3	15.6	15.1	16.4	24.1	28.9
Total external debt	1,705	1,385	1,308	1,496	1,778	1,811	1,934	2,112	2,630	2,684
Exports of goods and services	1,885	1,810	2,539	2,688	3,140	2,775	2,615	2,426	1,779	1,525
Total external debt-to-exports (%)	90.4	76.5	51.5	55.7	56.6	65.3	73.9	87.1	147.8	176.0

Sources: Public external and public domestic debt data are from the Government of Paraguay's Web site (http://www.hacienda.gov.py); the sums of PPG external debt, private external debt, GDP, and exports are from the World Bank's Development Indicators database (except PPG external debt for 2000, which is based on data from the Central Bank of Paraguay); publicly guaranteed domestic debt data are estimated based on the ratio of public to publicly guaranteed external debt; GDP is from the World Bank's Development Indicators database; and the percentage of external debt relative to GDP is calculated on the foregoing data.

Note: GDP = gross domestic product; PPG = public and publicly guaranteed.

Notes

1. The SimSIP Debt simulator and its manual are available free of charge on the World Bank's SimSIP Web site, http://www.worldbank.org/simsip.
2. We use data until 2000 in this report; the situation has deteriorated further since then.
3. This share increased from 3.1 percent of GDP in the early 1990s to 7.4 percent in the late 1990s. Even at the end of that decade, only the Dominican Republic, El Salvador, Guatemala, and Peru had lower levels of spending as a share of GDP, whereas 11 countries in the study sample of the study had higher levels of spending; for Honduras, the level of spending was the same as for Paraguay.
4. This is a sharp increase to the June 2002 debt outlook, which projected the debt/GDP ratio at about 54 percent. The latest EIU's debt outlook is available on the American International Group's Web site, http://www.aigonline.com.
5. A detailed derivation of the theory underlying the two modules can be found in the simulator's Manual, which is available on the Web.
6. Again, we want to emphasize that the assumptions used and the results presented are for illustrative purposes only and should not be interpreted as the authors' own projections for Paraguay. Given the no-charge availability of the simulator on the Internet, the reader is welcome to simulate Paraguay's debt sustainability based on alternative assumptions.
7. For the key issues related to long-term debt sustainability of heavily indebted poor countries (HIPCs), see Gunter (2001) and IMF and World Bank (2001).
8. For more information, see the World Bank's HIPC Web site, www.worldbank.org/hipc/.
9. Please see http://www.undp.org/mdg/ for further information.
10. As Sachs et al. (1999) have pointed out, if debt sustainability is approached from a human and social development perspective, most of the poorest countries have an unsustainable debt simply because they have more urgent needs to reduce poverty than to make debt-service payments.
11. Note that there exists a variety of options for defining each of these three macroeconomic variables. For example, exports could include or exclude worker's remittances, take into account reexports or not, and be based on current-year values or be averaged over some time period.
12. There are many options for determining discount rates; and, depending on user preferences, distinctions can be made in terms of the currency in which future debt service is payable (for example, the discount rate for the U.S. dol-

lar or the British pound), the kind of reference rate to use for the discount rate (for example, the lending rate or the borrowing rate), the time period for the discount rate (such as the short-term or long-term lending rate), and the period over which the discount rate is averaged (such as over the last six months or the last 10 years). Because of the practical and theoretical limitations of using a complex definition of short-term discount rates to determine long-term debt sustainability, the SimSIP Debt's Debt Projection Module uses only one discount rate, which is flexible over time. As illustrated in more detail in Gunter (2002), there is no definitive correct or wrong concept of how to define discount rates. Generally however, using long-term average discount rates is preferred to avoid changes in the resulting NPV calculations that arise from marginal and arbitrary short-term changes in discount rates.

13. To avoid negative implications of increased money financing on growth, money financing usually is restricted. In general, the noninflationary level of seigniorage is limited to about 1 percent of GDP.
14. Note that changes in $\beta(t)$ over time may be occurring because of a natural relationship between taxes and income growth. We do not discuss here whether tax bases tend to rise proportionately with GDP, less so, or more so; nor do we estimate the elasticity of spending to GDP. The SimSIP simulator lets the user choose different values for the key parameters over time.
15. In reality, increased borrowing tends to increase the growth rate of real GDP up to some critical level (which is difficult to determine), and consistently high government deficits tend to have negative effects on real GDP growth and price stability. Depending on the country's access to foreign concessional financing, the costs of new borrowing also may increase with a rising fiscal deficit. At low levels of fiscal deficits, the portion of concessional financing will be relative high. With rising financing gaps, more and more new loans will have increased interest rates.
16. See the SimSIP Debt manual for the detailed equations.
17. In Paraguay, the developments of the late 1990s have shown that the rate of devaluation was persistently above the inflation rate. Although this may be caused by some catch-up effect from the early 1990s, when devaluations were considerably smaller than inflation rates, we would expect that the rate of devaluation is slightly above the rate of inflation in the long term.

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