Growth implosions and debt explosions:

Do growth slowdowns cause public debt crises?[1]

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Abstract: The worldwide growth slowdown after 1975 was a major negative fiscal shock; lower growth lowers the present value of tax revenues and primary surpluses and thus makes a given level of debt more burdensome. Most countries failed to adjust to the negative fiscal consequences of the growth implosion and so public debt to GDP ratios exploded. The growth slowdown therefore played an important role in the debt crisis of the middle income countries in the 1980s, the crisis of the Highly Indebted Poor Countries (HIPCs) in the 1980s and 1990s, and the increased public debt burden of industrial countries in the 1980s and 1990s. In addition, the HIPCs' debt problems were worse because they grew more slowly after 1975 than other low income countries due to worse policies. Econometric tests and fiscal solvency accounting confirm the important role of growth in debt crises.

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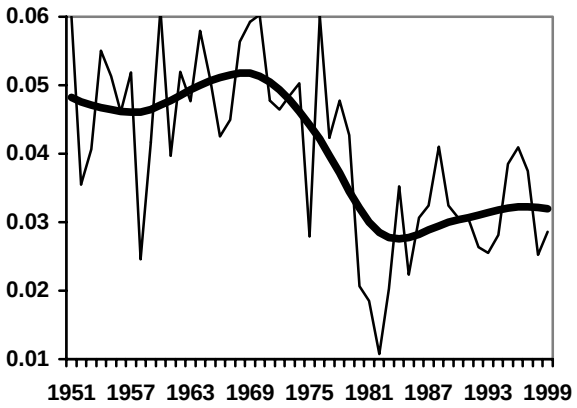
Never take a sleeping pill and a laxative on the same night.
--saying passed along by my Aunt Marilyn

It is well known that GDP growth has slowed down in recent decades for virtually all countries.[2] The unweighted cross-country world average of GDP growth slowed from about 5 percent in the quarter-century before 1975 to about 3 percent in the quarter century since 1975 (Figure 1).[3]

Figure 1: The Unweighted World Average GDP Growth Rate (Actual and HP Smoothed)



This paper examines a consequence of the growth implosion that has not attracted much attention – its effect on public finances. Since taxes rise one for one with output (Calderon, Easterly, and Serven 2000), slower growth reduces the present value of the stream of future taxes. This makes a given level of public debt more difficult to service. Moreover, if public deficits are not changed to adjust to the growth slowdown, the debt to GDP ratio will rise.

Indeed, the growth implosion had as a counterpart a debt explosion. The worldwide average public debt to GDP ratio rose steeply in the 70s and 80s, before leveling off in the 1990s (Figure 2).[4]

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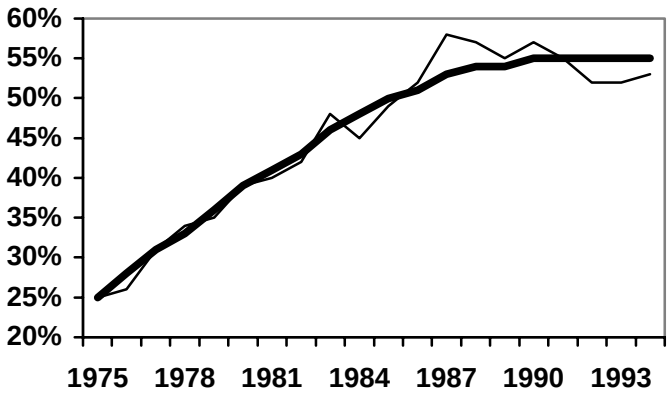
[2] See Ben-David and Papell 1998 for a formal econometric treatment. For data sources for Figure 1 and the following figures, see the Data Appendix.

[3] I used 100 for the smoothing parameter for the HP filter. A test of the equality of means for growth 50-75 and growth 75-99 for the 131 countries with data shows a statistically significant downward shift of 1.93 percentage points.

[4] The data come from Loayza et al. 1998, as I will explain below. Unfortunately, data are not available prior to 1975.

Figure 2: Worldwide average public debt to GDP ratio
(actual and smoothed series)



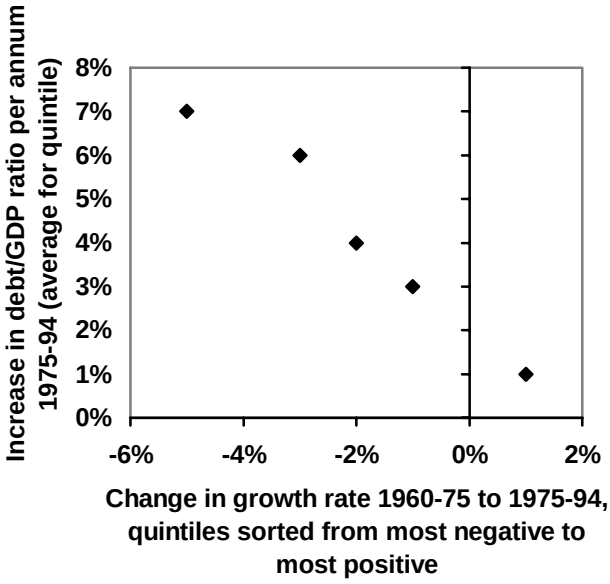
This paper will argue that the slowdown in growth had an important role in the development of debt problems in the highly indebted poor countries (HIPCs), in the highly indebted middle income countries, and in the industrial countries. A fall in growth could explain why debt levels that were sustainable under a previous growth regime became unsustainable and triggered a crisis under a new growth regime. I will test this hypothesis below with some accounting for changes in debt ratios attributable to growth and those attributable to deficits. I will also test econometrically the number of debt reschedulings as a function of the interaction between initial debt levels and growth. The paper does not suggest that the growth slowdown is a monocausal explanation of debt crises, but it did play an important role.

The paper does not attempt to explain the growth slowdown, implicitly taking it as exogenous. This does not seem unreasonable when we are dealing with a global phenomenon that affected practically all countries. The growth slowdown is essentially one worldwide observation, which could have any number of explanations (change in discount rates, slower technological progress, slower population growth, etc.).

However, the growth slowdown was more severe in some countries than in others, and those countries were the ones with the most rapid growth in debt to GDP ratios (Figure 3). The coefficient of a regression of the log change in Public Debt/GDP 1975-94 on the change in the growth rate 1960-75 to 1975-94 is insignificantly different than negative one, implying there was *no* adjustment of the pace of borrowing to the slowdown in growth.

A plausible story is that the decline in growth was unanticipated, and even many years into the growth slowdown countries were unaware that it was permanent rather than transitory (if the growth decline were transitory, then continued borrowing could have been optimal). In effect, countries were calibrating their borrowing over 1975-94 to the old growth rate 1960-75, not to the new growth rate 1975-94. Hence, the degree of the growth slowdown had a strong effect on the rise in public debt ratios. The paper will examine some of the determinants (including fiscal variables) of the cross-section variation in degree of growth slowdown.

Figure 3: Change in growth and rise in public debt ratio to GDP



It will follow that policy variables that make some countries slow down less or more than others do have fiscal consequences. The emphasis in adjustment programs in response to debt crises is usually on correcting macroeconomic imbalances, such as budget deficits, or in granting debt relief that alleviates the amount of adjustment needed. However, growth plays an important role in determining how much adjustment or relief is needed in order to comply with the government's intertemporal budget constraint. A permanent fall in growth is an adverse fiscal shock that has to be offset by other fiscal or relief measures just like any other fiscal shock like a permanent drop in export prices of the state petroleum monopoly, for example. Conversely, faster growth makes it easier to service the initial stock of public debt and requires less of a non-interest budgetary surplus — or less debt relief — to attain solvency. This suggests that it is important to design policy incentives for faster growth as part of any adjustment package.

The role of growth in the intertemporal budget constraint has long been known (Buiter 1990, Buiter and Patel 1992, 1997, Fischer and Easterly 1990), but fiscal adjustment packages are seldom designed taking growth slowdowns into account or evaluating the fiscal consequences of policy-induced changes in growth. This may be because the work on the intertemporal budget constraint was done before the advent of the endogenous growth literature. The voluminous empirical literature of the past decade on the determinants of growth suggests many policy measures that can raise growth as part of a fiscal adjustment package: correction of overvalued exchange rates, fostering financial development, improving infrastructure, and so on.

By the same token, it is very important to consider consequences for the economy's growth rate when designing fiscal adjustment or debt relief programs. For example, if fiscal adjustment is achieved by cutting essential infrastructure spending, this

would lower growth. Such a package could perversely take the government further away from solvency, since the present value of the public sector surplus with a lower growth rate could fall more than it is increased by the direct effect of cutting infrastructure spending.[5]

1. The intertemporal budget constraint

Many authors have identified the government's intertemporal budget constraint as the ultimate constraint on the government's fiscal activities (see for example Buiter 1985, Buiter and Patel 1997, Anand and Van Wijnbergen 1988, Blanchard et al. 1990, Auerbach 1997).

$$(1) \qquad \int_0^{\infty} e^{-rt}\left(T_t + S_t + A_t - G_t\right)dt \geq D_0$$

where all variables are defined in real terms as follows:

T_t=Tax revenue at time t

S_t=Seignorage revenue at time t

A_t=Aid receipts at time t (including the grant-equivalent component of concessional financing which is given by nominal amount of new concessional loans minus the present value of their debt service evaluated at discount rate r)

G_t=Government spending at time t

D_0= Public debt at time zero

r= discount rate

The intertemporal budget constraint says that the present value of the government's non-interest surpluses (also known as primary surpluses) over time must be equal to or greater than the initial public debt stock. Intuitively, the government is only solvent if it runs a surplus large enough to cover not only the interest on the debt but also some payment towards the principal of the debt as well.

If we think of a long run steady state where all these revenues and expenditures form a constant ratio to GDP, then it is easy to get a closed form solution for the required non-interest surplus to satisfy the intertemporal budget constraint. To illustrate consider the case where taxes relative to GDP are at their steady state value in time zero. In the future, real tax revenues will grow at the rate of GDP growth g. Then the present value of taxes is

[5] Alesina and Ardagna 1998 and Alesina, Perotti, and Tavares 1998 stress that fiscal adjustments that cut government consumption expenditure are more expansionary than other fiscal adjustments. Easterly 1999 discusses how fiscal adjustments can be an "illusion" when they cut public assets as much as liabilities.

$$(2) \qquad PVT = \int_0^\infty e^{-rt} T_0 e^{gt} dt = \int_0^\infty e^{-(r-g)t} T_0 dt = \frac{T_0}{r-g}$$

Or we can put things in terms of ratios to GDP as follows:

$$(3) \qquad \frac{PVT}{Y_0} = \frac{T_0 / Y_0}{r-g} = \frac{\tau}{r-g}$$

where τ is the steady state ratio of taxes to GDP. This present value is only finite if $r>g$, which is the usual condition.[6] An increase in growth will raise the present value of future taxes. Budget planners in the US are familiar enough with this result as to rely on optimistic growth projections to make future budgets balance. Surprisingly enough, however, there is little talk of the role of growth when designing fiscal adjustment packages in developing nations.

Similarly define the steady state primary surplus to GDP ratio as $\sigma = T/Y + A/Y + S/Y - G/Y$. We assume the economy is in steady state at time zero.[7] Then the steady state condition for the intertemporal budget constraint to be satisfied is:

$$(4) \qquad \frac{\sigma}{r-g} = \frac{D_0}{Y_0}$$

This is a familiar condition for the primary surplus from the fiscal solvency literature (Blanchard et al. 1990, Buiter 1990, Buiter and Patel 1997, Cuddington 1997).[8] This is simply accounting; it does not address the issue of whether the public debt is optimal (nor will I address this issue in this paper, which sticks to a positive analysis of debt problems).

Equation (4) also is a condition for stabilizing the debt to GDP ratio. The primary surplus (including seignorage) that keeps the debt to GDP ratio stable is σ from equation (4). To derive it another way, write down the equation for the change in the debt to GDP ratio

$$(5) \qquad \Delta \frac{D}{Y} = -\frac{T_t + S_t + A_t - G_t}{Y_t} + (r-g) * \frac{D_t}{Y_t}$$

Setting the change in the debt to GDP ratio to zero, we get equation (4) for the sustainable primary surplus σ. The government is solvent if it is able to run a primary surplus that keeps the current debt to GDP ratio constant.

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[6] Otherwise the economy is dynamically inefficient. In any case, the solvency constraint does not apply if $r<g$.

[7] Calderon, Easterly, and Serven 2000 also find that government expenditures are cointegrated with GDP, with a coefficient of unity.

[8] Calderón, Loayza, and Serven.2000 point out that a flaw in the analogous sustainability condition for the current account of the balance of payments is that the external debt at any one point in time is not necessarily the desired debt from a portfolio allocation perspective.

We can define the intertemporal fiscal balance at time *t* (IFB_t) as the difference between the actual primary surplus (preferably cyclically adjusted or purged of temporary fluctuations with time series techniques) and the primary surplus from (4) that ensures solvency (Blanchard et al. 1990 have a similar expression for the tax rate, Buiter and Patel 1997 have an analogous expression that they call the "primary gap", Auerbach 1997 and Auerbach and Gale 2000 call it the "fiscal gap").

$$(6) \qquad \frac{IFB_t}{Y_t} = \frac{T_t + S_t + A_t - G_t}{Y_t} - \sigma = \frac{T_t + S_t + A_t - G_t}{Y_t} - (r - g)\frac{D_t}{Y_t}$$

We can see that in addition to the usual focus on the current primary balance and the debt ratio, growth plays an important role in whether there is a intertemporal fiscal imbalance. The effect of growth on required fiscal adjustment will be larger, the greater is the stock of initial debt (see the interaction term between growth and debt in equation 6). Although the role of growth in debt sustainability is well known, not much attention has been paid to the fiscal impact of changes in growth on solvency.

If debt servicing problems develop because of insolvent public sectors, then good predictors of debt servicing problems will be *D/Y* (because of the constant *r* for all countries times the debt ratio) and *g* interacted with *D/Y* (*g*D/Y*). Any adverse shock to economic growth will be a fiscal shock, increasing the distance of the current public stance from solvency. Conversely, anything that increases growth makes a given primary surplus more likely to achieve solvency.

The stock equivalent of (7), assuming again that the current ratio of primary surplus to GDP will continue indefinitely, is:

$$(7) \qquad \frac{W_t}{Y_t} = \frac{T_t + S_t + A_t - G_t}{Y_t} \Big/ (r - g) - \frac{D_t}{Y_t}$$

The "government net worth" W_t is the difference between the present value of the future primary surpluses as a ratio to GDP, if the ratio of primary surplus to GDP remains fixed indefinitely, and the current debt level. If it is negative, the government is insolvent at the current growth rate, fiscal policies, and debt levels. The insolvency will have to be resolved through some combination of higher growth, fiscal adjustment, and/or debt relief.

The effect of growth on public net worth to GDP is as follows:

$$(8) \qquad \frac{\partial W / Y}{\partial g} = \frac{\sigma_t}{(r - g)^2}$$

(Defining the left-hand term as *e*, σ_t as *m*, and *c=1/(r-g)*, we would then have $e=mc^2$.) Evaluating this derivative at the point of zero government net worth, we can substitute in for σ_t with the σ that maintains solvency from (4). The effect of growth on net worth evaluated at zero net worth thus depends on the debt ratio:

$$(9) \qquad \frac{\partial W/Y}{\partial g} = \frac{D/Y}{(r-g)}$$

The intuition here is that growth effects on net worth are larger, the higher is your initial debt, because higher debt forces you to run a higher primary surplus to service it. The present value of running such a primary surplus as a fixed ratio to GDP indefinitely is higher the higher is the growth rate, hence the high effect of growth on net worth in highly indebted countries. A corollary is that an additional percentage point of growth reduces the amount of fiscal adjustment needed for solvency more in a high debt country than in a low debt country.

Extensions (that I will not pursue in this paper except in passing) could include defining *D* to include contingent liabilities like the net present value of the social security system and to net out public assets like oil reserves.

Another extension would be to consider changes in interest rates as well as growth. I have been implicitly treating the interest rate as exogenous. While it makes sense for a small country, this is less tenable when we are talking about a worldwide growth slowdown. In the Ramsey model with log utility, $r-g=\rho$, where ρ is the discount rate. Thus r would move one for one with g if ρ were unchanged. In practice, however, world real interest rates increased over the period that growth was falling. A possible explanation is that the discount rate shifted upward. In any case, I will focus on changes in growth in what follows and leave changes in r for future research.

2. Applications of the framework

Let's now discuss several applications of the effect of growth on public sector solvency.

Application I: Growth, policies, and debt crises

What is the combination of fiscal deficits and poor growth that made highly indebted countries become highly indebted? Table 1 shows data on 5 groups of economies: the highly indebted poor countries (HIPCs), the not highly indebted poor countries, the highly indebted middle income countries, the not highly indebted middle income countries, and the industrial countries. The classification of a country as "highly indebted" is from the World Bank's *Global Development Finance* and refers to the end of the period.[9] We show data on their debt in 1975 and 1994. The data on the present value of publicly guaranteed external debt obligations is constructed for this paper from the World Bank's *Global Development Finance* database for low income countries. For middle income countries the public external debt data for 1975-94 is taken from Loayza et al 1998. (The reason for the different sources is that low income countries have access to concessional official lending, and so the present value of debt obligations is a better measure of debt burden than the face value of the debt. Middle income countries are

[9] For middle income countries, highly indebted includes "severely indebted" and "moderately indebted". For low income countries, highly indebted includes only the "severely indebted". This difference in classification is because there are many more severely indebted poor countries, so I need this breakdown to have a decent size not-highly indebted control group.

presumed to borrow at market interest rates.) To exclude exchange rate valuation effects, I evaluate the 1975 foreign debt at the 1994 real exchange rate for each country.

I also have data on public domestic debt for 1975-94 from Loayza et al. 1998 (unfortunately I don't have data on the terms of domestic debt, so these are taken at face value). All debt stocks are net of government financial assets like international reserves for net foreign debt and government deposits for net domestic debt.

From the debt ratios in 1975 and 1994 and the GDP growth rate, we can calculate the implied primary fiscal deficit from (5).[10] Table 1 shows the results. One group of economies that got into high public debt problems because of slow growth were the industrial economies, whose growth was significantly below that of developing countries that were not highly indebted (Table 1). Their primary deficit was lower than that of the developing non-highly-indebted countries, but their slow growth compared to those countries yielded much higher debt ratios. One obvious explanation for the lower GDP growth of industrial countries was their much lower rate of population growth (0.6 percent per annum over 1975-94, compared to 2.6 percent in low income countries).[11] Rapid population growth may be good or bad from other welfare points of view, but it does help to service the public debt!

For the middle income countries, the highly indebted ones had the same growth rates but slightly higher primary deficits as a ratio to GDP than other middle income countries. This was costly because the highly indebted middle income countries already had higher public debt to GDP ratios in 1975 than other middle income countries (which was going to make them more vulnerable to the decline in growth after 1975 – see below). We don't have information on public debt prior to 1975, so we don't know what was the decomposition of the highly indebted countries' debt ratio evolution prior to 1975 between growth and primary deficits. We do know that the highly indebted middle income countries already had 1.2 percentage point lower growth than other middle income countries in 1960-75, although this difference is not statistically significant. The development of the debt crisis in some middle income countries, compared to the lack of debt crisis in other middle income countries, was some combination of higher initial debt to GDP (reflecting some combination of higher borrowing and lower growth before 1975) and slightly higher primary deficits. Because of the higher initial debt, the primary balance should have been better in the highly indebted countries than the primary balance in other middle income countries to attain solvency.

[10] Evaluated at the geometric average of the end of period and beginning of period debt to GDP ratios, which is a good approximation to the solution iteratively solving year by year for the primary deficit that would yield the1994 debt ratio as the endpoint, starting with the 1975 debt ratio.

[11] This assumes that population growth does not just lower per capita growth one for one, leaving aggregate growth unchanged. Most cross-country regressions in the literature have either a small negative effect of population growth on per capita growth, none at all, or argue that it is not robust (Kelley and Schmidt 1994, Kling and Pritchett 1994, Pritchett 1996).

Table 1: The Evolution of Public Debt

	1975			1994						
	Net domestic debt	Net foreign debt	Total net public debt	Net domestic debt	Net foreign debt	Total net public debt	GDP Growth rate 75-94	Implied primary deficit/GDP, 75-94	Obs. on debt	Obs. on growth
Highly indebted poor countries	8%	41%	48%	9%	82%	94%	1.8%*	-0.44%	15-30	36
Not highly indebted poor countries	17%	10%	28%	17%	27%	41%	4.4%	0.14%	9	14
Highly indebted middle-income countries	14%	12%	27%	13%	39%	56%	3.4%	0.52%	20-23	28
Not highly indebted middle income countries	12%	-3%	9%	18%	6%	24%	3.4%	0.40%	17-24	32
Industrial countries	32%	-3%	29%	54%	5%	59%	2.4%**	0.06%	21-22	23

* HIPC growth significantly less than non-HIPC poor country growth.
** Industrial country growth significantly less than Not Highly Indebted poor or middle income countries.
World real interest rate is calculated at 6% for 1978-94 (LIBOR-Dollar Inflation).

For the poor countries, what is interesting is that the HIPCs became HIPCs NOT because of higher primary deficits. They actually ran a primary surplus over 1975-94 (shown as a negative deficit), while the non-HIPC poor countries were running a small primary deficit. The glaring difference between HIPC and non-HIPC poor countries was in their growth rate -- the non-HIPCs grew twice as fast as the HIPCs over 1975-94, a difference that is statistically significant.

Another way of looking at the development of debt problems is to look at the change in growth rates over time. Table 2 shows the change in growth for the 5 country groups from 1960-75 to 1975-94. What was the difference in country net worth due to the low growth rates in 1975-94, compared to a counterfactual under which growth remained constant at the 1960-75 rate? Using (10), I evaluate the effect of growth on net worth at the initial debt level in 1975 for the 5 groups.

Table 2: Effect of Growth on Net Worth and Change in Debt, 1975 and 1994

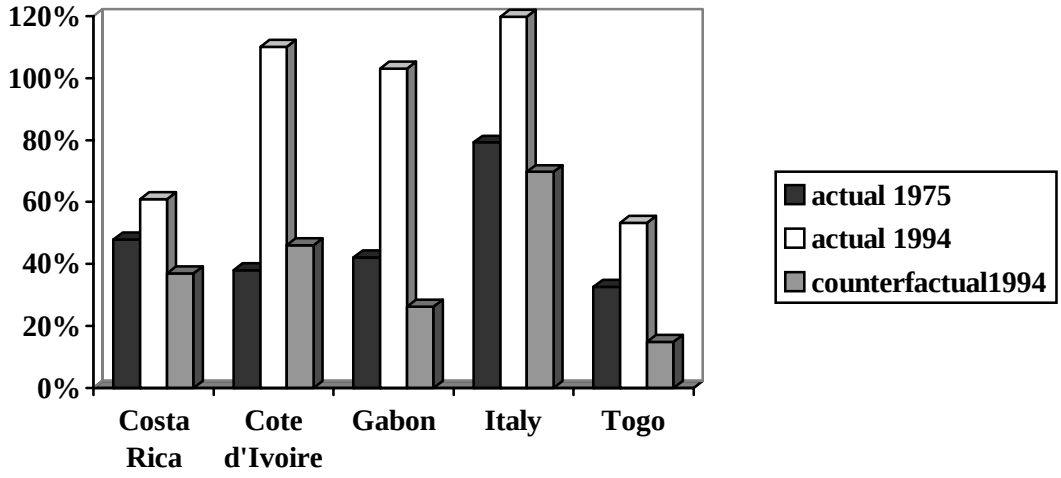
	Total net public debt, 1975	Total net public debt, 1994	Growth rate 60-75	Growth rate 75-94	Change in debt ratio 75-94	Effect on net worth of change in growth 60-75 to 75-94, evaluated at initial debt ratio
Highly indebted poor countries	48.3%	94.1%	3.6%	1.8%	45.7%	-24.9%
Not highly indebted poor countries	27.6%	40.6%	3.7%	4.4%	13.0%	10.2%
Highly indebted middle-income countries	26.9%	56.2%	4.9%	3.4%	29.2%	-21.2%
Not highly indebted middle income countries	9.1%	24.0%	4.9%	3.4%	14.9%	-7.0%
Industrial countries	29.0%	58.7%	4.5%	2.4%	29.7%	-22.8%

The fall in growth had a large negative effect on government net worth for the highly indebted poor countries, highly indebted middle income countries, and the industrial countries. These were the three groups of countries which had large increases in public debt ratios (negative net worth accumulation). If growth had stayed at the level it was in 1960-75, these debt problems would not have developed in anything like the magnitude they did.

In contrast, the not highly indebted poor countries actually had an increase in growth. The not highly indebted middle income countries did have a fall in growth, but it was not as costly as it was for the highly indebted middle income countries because the not-highly-indebted middle income countries had much lower initial public debt ratios in 1975. The highly indebted middle income countries would likely not have developed a debt crisis (like that which erupted in Latin America and elsewhere in 1982) if growth rates at stayed at their 1960-75 levels.

Another way of calibrating the effect of the policy-induced growth slowdown is to ask how their debt would have evolved if the primary deficit had remained at the same level as a ratio to GDP but the growth rate had been at the 1960-75 level. Figure 4 gives the example of some illustrative country cases, who would have known unchanged or lower debt levels under the counterfactual that growth had remained at the 1960-75 levels. These 5 examples would not have experienced debt crises if growth rates at remained at their 1960-75 levels. In general HIPCs', HIMCs', and industrial countries' debt would have remained at far more manageable levels if 1960-75 growth rates had continued.

Figure 4: Actual debt to GDP ratios compared to counterfactual that growth had continued at 1960-75 rate



Application II. Econometric tests of growth effects on debt rescheduling

I can do a more formal econometric test of debt problems with data on external debt reschedulings. A prediction of the need for external debt rescheduling can be given as the difference between the current value of the primary surplus and that required to attain public sector solvency at existing public debt levels.[12] This is just the intertemporal fiscal balance (IFB) given earlier in (6). We can think of an equation that has

Prob (rescheduling)=f(*IFB*)

I implement this equation first by regressing the number of debt reschedulings for 1980-94 on the components of the IFB: the actual primary surplus, a constant times the initial D/Y ratio, and growth times the D/Y ratio. I first use as a dependent variable the number of debt reschedulings over 1980-94, as given by the World Bank's World Debt Tables.[13] Note that these data apply only to developing countries; industrial countries are excluded from the sample.

I instrument both for the primary surplus and for the growth rate as the amount of debt rescheduling could have had feedback effects on both variables. Debt difficulties could inhibit growth (although I found no evidence for that earlier), and rescheduling could have as a condition that the primary surplus be increased.

My data on the primary surplus is constructed from the IMF's Government Finance Statistics from data on the overall national government surplus or deficit plus

[12] Berg and Sachs 1988 take the approach of relating debt rescheduling during 1982-87 to country fundamentals like inequality, share of agriculture, and trade openness. My approach differs in deriving the need for debt rescheduling directly from the intertemporal budget constraint.

[13] The data on debt reschedulings is from Bruno and Easterly 1998

interest spending. This definition includes aid receipts as revenue. However, there is one element of aid that goes uncounted in these figures, which is the grant element of concessional financing. This has been calculated for the years 1975-95 by Chang, Fernandez-Arias, and Serven 1999. I add in their calculation of the grant element as percent of GDP into the primary surplus. Finally, I calculate seignorage revenues using the discrete time approximation $(g+\pi)/(1+g+\pi) * H/Y$ where π is the percent inflation rate, g is the GDP growth rate, and H/Y is the ratio of money base to GDP. The period of the data (1980-94) is truncated at the end by the availability of the fiscal and debt data and at the beginning by the availability of data on reschedulings. This period nevertheless covered the period of the debt crises in both middle income and low income countries.

There is a problem of simultaneity about the primary surplus and debt rescheduling. Highly indebted nations will be forced to run higher primary surpluses to keep the debt from exploding (including using the inflation tax and marshalling more aid receipts). On the other hand, the debt identity says that countries with a higher primary surplus are less likely to need rescheduling.

There is also the problem that growth is an endogenous variable, and that debt crises may have caused low growth rather than the other way around (although I found no evidence for that hypothesis when I regress growth on initial debt, controlling for other factors). To deal with these simultaneity problems, I run IV regressions for both the frequency of debt rescheduling and the primary surplus. I run both single equation IV and GMM for the system of two equations. My instruments are initial debt levels, and instruments for growth interacted with initial debt -- the growth of trading partners and dummies for Africa and Latin America. Trading partner growth was heavily dominated by OECD growth and thus did not represent feedback from debt crises to growth. The other variables are also plausibly exogenous and excludable from the debt rescheduling equation.[14] Nevertheless, no instrumentation is perfect, so we should treat with caution the causal interpretation of these findings.

The regression results are shown in table 3. We see that the regression fails to confirm a role for the primary surplus in the single equation for debt rescheduling, but the primary surplus does have a negative effect on the frequency of rescheduling in the system estimation. Initial debt increases the frequency of rescheduling in both methods. The sign on the GDP growth term interacted with initial debt is negative and significant in both methods. Growth has a strong role to play in whether a debt crisis develops.

The single equation results on the primary surplus do not show any association between debt and actual primary surplus, but the system estimator does show that countries with initially large debt run larger primary surpluses. The dependence of the primary surplus on the interaction term between growth and debt is insignificant, although of the predicted negative sign.

[14] A test of the overidentifying restrictions for the debt rescheduling equation fails to reject the restrictions by a large margin, confirming that the instruments are appropriate.

Table 3: Results on Debt Rescheduling, Fiscal Balance, and Growth for Developing Countries

Dependent variable	# of debt reschedulings		Primary fiscal surplus/GDP, 1980-94		# of debt reschedulings, 1980-94		Primary fiscal surplus/GDP, 1980-94	
Estimation method	TSLS		TSLS		GMM, Equation 1		GMM, Equation 2	
	Co-efficient	T-statistic	Co-efficient	T-statistic	Co-efficient	T-statistic	Co-efficient	T-statistic
Constant	2.1	1.87	0,022	2.62	2.8	3.08	0.014	2.21
Primary fiscal surplus/ GDP, 1980-94	2.7	0.08			-47.8	-2.02		
PV Debt/GDP, 1980	10.4	3.97	0.028	1.59	12.1	6.04	0.042	2.87
Growth8094* Debt/GDP	-272.2	-3.60	-0.490	-1.06	-292.1	-6.39	-0.517	-1.36
observations	49		49		49		49	

Instruments for all equations: PV Debt/GDP 1980, Trading partner growth PV Debt/GDP, Africa dummy*PV Debt/GDP, Latin America dummy*PV Debt/GDP, Trading Partner Growth, Africa dummy, Latin America dummy.

Application III. Did fiscal adjustment compensate for the fall in growth?

We have seen that a worldwide decline in growth contributed to debt problems in many countries. But these countries did not stand still. There was a widespread trend towards fiscal adjustment over 1975-94. To what extent did this fiscal adjustment compensate for the fall in growth, from the perspective of the intertemporal fiscal imbalance? Table 4 shows that countries did improve their intertemporal fiscal imbalance despite the fall in growth from 1975 to 1994. To implement this exercise, I perform the following steps. For the industrial countries, I derive the permanent component of the primary surplus by doing the standard cyclical adjustment of the deficit, applying the Hodrik-Prescott filter to isolate the cyclical components of GDP and of the primary surplus to GDP ratio. I then remove the portion of the primary surplus to GDP ratio correlated with the GDP cycle, to yield the cyclically adjusted primary surplus. As for the developing country groups, they display no evidence of cyclicality in their primary balances, so I simply apply the Hodrik-Prescott filter directly to their primary balance to GDP ratios. To define the intertemporal fiscal imbalance in 1975, I substitute the growth for 1960-75 and the permanent component of the primary surplus and public debt ratio in 1975 into equation (6). This gives the counterfactual of what was the imbalance in 1975 under the assumption that 1960-75 growth rates would continue. In 1994, I use the 1975-94 growth rate, the 1994 public debt to GDP ratio, and the permanent component of the primary surplus in 1994. This whole exercise should be taken with a grain of salt because of the small sample sizes available with the fiscal data (6-12 HIPCs, 5-7 non-HIPC low income, 9-15 highly indebted middle income, 8-13 lightly indebted middle income, and 15-21 industrial countries).

Table 4: Intertemporal Fiscal Balances, 1975-1994

	Growth rate 60-75	Growth rate 75-94	Primary surplus/GDP, 1975 (permanent component)	Primary surplus/GDP, 1994 (permanent component)	Inter-temporal fiscal balance/GDP, 1975	Inter-temporal fiscal balance/GDP, 1994
Highly indebted poor countries	3.6%	1.8%	-0.5%	4.3%	-1.6%	0.4%
Not highly indebted poor countries	3.7%	4.4%	-1.6%	4.1%	-2.3%	3.4%
Highly indebted middle-income countries	4.9%	3.4%	-1.5%	5.6%	-1.8%	4.1%
Not highly indebted middle income countries	4.9%	3.4%	0.2%	3.8%	0.1%	3.2%
Industrial countries	4.5%	2.4%	-2.2%	0.2%	-2.7%	-2.0%

World real interest rate is calculated at 6% for 1978-94 (LIBOR-Dollar Inflation)

All country groups improved their intertemporal fiscal imbalances from 1975 to 1994, despite the fall in growth. However, the fall in growth and rise in public debt ratios meant that the change in the intertemporal fiscal imbalance was much less than the improvement in their primary surpluses. The HIPCs, for example, improved their primary surplus by nearly 5 percentage points of GDP, but their intertemporal fiscal imbalance improved by only 2 percentage points of GDP. The highly indebted RICH countries improved their primary surplus by 2.4 percentage points of GDP, but their intertemporal fiscal balance improved by only 0.7 percentage points. In fact, the industrial country scofflaws were the only country group that still had a negative IFB in 1994. Some industrial countries have made further fiscal adjustments since 1994 (for example the Euro countries that had to observe a fiscal deficit target in 1997 under the Maastricht Treaty), but still not enough to reverse the negative IFB. This does not even take into account the large net pension liabilities in industrial countries (a mean of 95 percent of 1994 GDP for 20 OECD countries according to Roseveare et al. 1996), which are worse than in developing countries because of aging populations in OECD countries. If we included the net pension liabilities in 1994 public debt, the industrial countries would have an intertemporal fiscal imbalance of 5.5 percentage points of GDP. They need to make a permanent fiscal adjustment of this amount to attain solvency. This suggests that industrial countries are in the worse shape fiscally – from the intertemporal point of view -- of any of the country groups shown here. The worst five when both public debt and net pension liabilities are included are Sweden, Denmark, Canada, Belgium, and Italy, all with intertemporal fiscal imbalances at over 6 percent of GDP. The latest calculation on the US shows an intertemporal fiscal imbalance of 1.3 percent of GDP, despite all the talk about budget surpluses (Auerbach and Gale 2000). Those country groups fiscally better off than the rich countries includes even the HIPCs – perhaps we now need a Highly Indebted Rich Countries (HIRC) debt forgiveness program.

Before we get too excited about the fiscal virtue of the HIPC countries, however, we should look at how they achieved the healthy primary surplus/GDP ratios by 1994 that they did. If we exclude aid flows (including both grants and the grant component of concessionary financing), then the primary surplus improved only 1 percent of GDP from 1975 to 1994, which was not enough to prevent the worsening of the intertemporal fiscal

imbalance excluding aid (Table 5). So it was increased aid flows that accounted for most of the HIPCs' fiscal improvement from 1975-94. Even the small amount of fiscal adjustment the HIPCs did turns out to be due to increased seignorage revenue, which may not be the most desirable kind of fiscal adjustment. Excluding both aid and seignorage revenue, the HIPCs' primary deficit to GDP ratio did not improve at all over 1975-94 (Table 5), which meant their intertemporal fiscal imbalance worsened. The HIPC debt initiative may reflect aid-weariness by the major donors, and the desire to substitute debt forgiveness for continuing heavy aid flows.

Table 5: Highly Indebted Poor Countries' Decomposition of Fiscal Adjustment

	Primary surplus/ GDP, (permanent component)		Intertemporal fiscal balance/ GDP	
	1975	1994	1975	1994
Including aid and inflation tax	-0.5%	4.3%	-1.6%	0.4%
Excluding aid but including inflation tax	-3.2%	-2.2%	-4.4%	-6.2%
Excluding aid, excluding inflation tax	-4.1%	-4.1%	-5.3%	-8.1%

Application IV: why did the HIPCs have slower growth?

Although I am taking the worldwide cross-time decline in growth as exogenous, we know from the empirical growth literature that we can to some extent explain cross-country growth differences. Moreover, some fiscal policy variables themselves may have growth consequences, and thus an impact on the intertemporal fiscal balance besides their direct effect.

One example is infrastructure spending. A large literature (set off by Aschauer 1989) has argued for large effects on growth of infrastructure spending. These findings have been challenged by other studies (Holtz-Eakin 1994). However, the micro level evidence supports the ideas of large effects on economic activity of infrastructure (Reinikka and Svensson 1999). Calculations of project rates of returns also find high returns for infrastructure spending and operations and maintenance that also improves infrastructure service delivery. Physical indicators of infrastructure like paved roads, electricity generation, and telephone density per worker have also been found to have a strong effect on subsequent growth (Easterly and Levine 1997, Canning 1999, Canning and Bennathan 2000). Public investment in transport and communication has been found to have a strong effect on growth (Easterly and Rebelo 1993). This is not to say that all government investment is productive, as Pritchett 2000 makes very clear. However, transport and communications spending seems to be one government activity that is somewhat less subject to the "white elephants" problem. Thus, one could get perverse intertemporal effects by cutting deficits with cuts in infrastructure spending.

However another example of a fiscal policy variable with growth effects is the simple ratio of government balances to GDP, which themselves have been found to have a direct effect on economic growth (Fischer 1993, Easterly and Rebelo 1993, Easterly, Schmidt-Hebbel and Rodriguez 1994). Thus one gets the pleasant fiscal arithmetic that reducing budget deficits improves the intertemporal fiscal balance both by directly lowering the deficit and by increasing growth.

I replicate the Easterly and Rebelo 1993 results here with more recent data, using a panel of decade averages for the 1970s, 1980s, and 1990s (they used decade averages for the 70s and 80s). Table 6 shows the results on the transport and communication spending and budget balances with the same controls (to the extent possible) that Easterly and Rebelo 1993 used.[15] I still find that public spending on transport and communications has a significant effect on growth, as does the government's budget balance. There are the well-known problems with interpreting these effects as causal, so I intend this exercise to be illustrative only. The effect of infrastructure spending is 2 to 3 times larger than the growth effect of the budget balance. Therefore, if we interpret these effects as causal, a reduction in the budget deficit implemented entirely by reducing infrastructure would have a negative effect on growth, worsening the government's intertemporal fiscal position compared to a budget deficit reduction package that did not decrease infrastructure spending. Cuts in infrastructure spending could actually provoke the public debt crisis they are meant to avoid. In Zambia, cuts in transport and communications spending of 1.8 percentage points from the 70s to the 90s decreased public net worth by 9.4 percentage points of GDP.[16]

Does this regression explain why the HIPCs had lower growth over 1975-94 than other low income countries? I first examine one possible explanation -- the low growth could be a consequence of high debt rather than the other way around. However, I dismiss this possibility because initial debt to GDP ratios are completely insignificant as determinants of growth when added to regression 3.

[15] I use the IMF's Government Finance Statistics data on government spending on transportation and communications instead of the consolidated public sector investment in transport and communications that Easterly and Rebelo used, because the latter has not been updated. Likewise I omit Easterly and Rebelo's controls of war, revolutions, and coups, because these data have not been updated for the 90s. I use the same primary enrollment, secondary enrollment, and financial depth variables that Easterly and Rebelo used, updated through the 1990s. Finally I use real exchange rate overvaluation to measure trade openness because that has been found to be a more robust variable than export share (Dollar 1992, Easterly 2000b).

[16] Evaluated at the 1994 public debt to GDP ratio and the 1975-94 growth rate.

Table 6: Replication of Easterly and Rebelo 1993 Growth Regressions for Fiscal Variables and Other Controls

	Regression 1		Regression 2		Regression 3	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant	0.01274	4.62	0.02253	0.90	0.04211	1.60
Public spending on Transport and Communcation/GDP	0.00338	3.47	0.00226	2.05	0.00255	2.01
Government Surplus/GDP	0.00132	4.20	0.00139	4.45	0.00139	3.41
Initial Income			-0.00493	-1.32	-0.00850	-2.20
Primary Enrollment			0.00025	2.56	0.00023	2.24
Secondary Enrollment			0.00016	1.36	0.00019	1.46
M2/GDP					0.00026	2.38
Real Overvaluation					-0.01187	-2.55
	R-Squared	Observations	R-Squared	Observations	R-Squared	Observations
70s	-0.073	56	-0.129	53	-0.250	46
80s	0.034	73	0.118	66	0.211	58
90s	0.152	56	0.195	47	0.319	41

Dependent Variable: Per Capita Growth
Estimation Method: Seemingly Unrelated Regression
Pooled sample of 70s, 80s, 90s

Policy differences are a more promising explanation of HIPCs' lower growth.[17] Table 7 shows the differences between HIPC and non-HIPC right-hand-side variables. HIPCs in the 1980s and 1990s spent about 2 percentage points of GDP less on transport and communications than other low income countries, as in the Zambia example earlier. The lower infrastructure spending in HIPCs had a negative net worth effect of 10-15 percentage points of GDP. If the lower infrastructure spending was a consequence of fiscal austerity in HIPCs, this kind of fiscal austerity had a perverse effect on government net worth compared to fiscal austerity packages that protect infrastructure spending.

They had more overvalued currencies in the 80s and 90s than other low income countries. By the 1990s, they had lower primary and secondary enrollments and lower M2/GDP (an indicator of financial development that has been argued to causally affect growth, as in Levine, Loayza and Beck, 2000). These policy differences explain a substantial share of the growth differences between HIPCs and other low income countries (virtually all of it, by the 1990s). Moreover, the net worth effect of these explained growth differences are substantial -- by the 90s, the effect of the explained lower growth on public net worth was -49 percent of GDP. That is, if we take these policy effects as causal, if HIPC policies in the 90s had been at the level of other low income countries, growth would have also been at the higher level of the other low income countries. This in turn would have substantially improved net worth -- by an

[17] Easterly 2000a documented that HIPCs had worse policies on a wide range of dimensions than other developing countries.

amount sufficient to practically virtually wipe out the higher public debt of HIPCs compared to other low income countries.

Table 7: Differentials in Policy Variables HIPCs vs. Non-HIPC Low Income Countries

	Policy Differentials (t-stats below)			Coefficient from growth regression	Growth Effect			Net Worth Effect		
	1970s	1980s	1990s		1970s	1980s	1990s	1970s	1980s	1990s
Public Spending on Transport and Communication/GDP	-0.243 (-0.330)	-2.192 (-2.137)	-1.646 (-2.328)	0.00255	-0.1%	-0.6%	-0.4%	-0.9%	-14.7%	-11.5%
Government Surplus/GDP	-0.856 (-0.502)	3.457 (1.237)	-1.428 (-0.713)	0.00139	-0.1%	0.5%	-0.2%	-1.8%	12.6%	-5.4%
Initial Income	0.054 (0.347)	-0.231 (-1.675)	-0.313 (-2.203)	-0.00850	0.0%	0.2%	0.3%	-0.7%	5.2%	7.3%
Primary Enrollment	-5.024 (-0.550)	-14.818 (-1.562)	-19.270 (-2.503)	0.00023	-0.1%	-0.3%	-0.5%	-1.8%	-9.2%	-12.4
Secondary Enrollment	-5.012 (-1.282)	-7.745 (-1.649)	-11.158 (-2.381)	0.00019	-0.1%	-0.1%	-0.2%	-1.4%	-3.8%	-5.8%
M2/GDP	-3.299 (-1.324)	-6.167 (-1.626)	-12.292 (-3.043)	0.00026	-0.1%	-0.2%	-0.3%	-1.3%	-4.2%	-8.6%
Real Over-valuation	0.209 (2.013)	0.409 (3.281)	0.387 (1.944)	-0.01187	-0.2%	-0.5%	-0.5%	-3.8%	-12.8%	-12.6%
Total explained growth or net worth differential					-0.8%	-1.0%	-1.8%	-11.8%	-26.9%	-49.0%
Actual growth or public debt differential					-1.7%	-2.8%	-1.9%	14.33	69.34	57.36
(t-statistic)					(-2.30)	(-4.61)	(-1.80)	(1.22)	(2.13)	(1.94)

These policy variables can help explain the differences across countries in the degree of growth slowdown and the likelihood of debt problems. However, these variables turn out not to be helpful in explaining the world average growth slowdown from the 70s to the 90s. That remains a mystery not explained by this paper.

When trouble arises & things look bad, there is always one individual who perceives a solution & is willing to take command.

Very often, that person is crazy.

--Saying passed along by my Aunt Marilyn

3. Conclusions

This paper offers a fresh perspective on debt crises from the point of view of growth slowdowns' effect on fiscal solvency. This is not to say that growth slowdowns are the only cause of debt crises, or that raising growth is an easy panacea for escaping them. The usual suspects of exchange rate and macroeconomic mismanagement are still relevant, but should be viewed in a more comprehensive framework through fiscal solvency accounting.

The growth slowdown in 1975-94 compared to 1960-75 helps explain the debt burden problems in the Highly Indebted Poor Countries (HIPCs), highly indebted middle income countries, and the industrial countries. I can econometrically explain the frequency of debt rescheduling over 1980-94 with the primary surplus and with growth interacted with initial debt, instrumenting for the primary surplus and for growth. Nevertheless, all groups of countries except industrial countries had attained fiscal solvency through large changes in their primary budget balances by 1994.

The slower growth of HIPCs compared to other low income countries over 1960-75 is explained by about 2 percentage points of GDP less spent on transport and communications, more overvalued currencies in the 80s and 90s, lower primary and secondary enrollments, and lower M2/GDP. If we take the effects of these policies on growth as causal, the HIPCs could have largely avoided their debt burden problems by choosing better policies.

The reason for the worldwide growth slowdown is left unexplained. One conceivable explanation is that governments shifted toward greater impatience in the second half of the period, both fostering less growth and tolerating higher debt to GDP ratios. However, I failed to find any cross-section correlation between high debt and slow growth, which one would have expected if this story held.

In any case, for individual countries that can affect their growth rate through country policies, growth-enhancing measures are a very important form of fiscal policy to confront a debt crisis.

Data Appendix

GDP Growth: for 1951-1960 from Summers-Heston, for 1961-1998 from World Bank on-line database.

Public debt: from Loayza et al 1998, covering both domestic and external debt. I net out foreign exchange reserves from public external debt. The domestic debt is net of government deposits in the banking system. Where the country is eligible for concessional loans, I use the present value of debt service series from the World Bank, which is an internationally comparable measure of public external debt burden (removing the grant element of concessional loans). The data on the present value of publicly guaranteed external debt obligations is constructed for this paper from the World Bank's *Global Development Finance* database.

Primary fiscal surplus: from Government Finance Statistics, International Monetary Fund

Seignorage revenues: calculated from inflation and money base variables in International Financial Statistics, International Monetary Fund

Foreign aid revenues: from Chang et al. 1999. Includes both conventionally measured aid receipts and the grant element of concessional lending.

Debt reschedulings: from Bruno and Easterly 1998; originally from World Bank World Debt Tables. Number of debt rescheduling agreements between 1980 and 1994.

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