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ON THE FEASIBILITY AND DESIRABILITY OF GDP-INDEXED CONCESSIONAL LENDING

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On the feasibility and desirability of GDP-indexed concessional lending

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Abstract

I consider schemes that gear service on concessional debt to changes in countries' real GDP growth. The schemes operate by accelerating and retarding concessional debt repayments. In the case of lower than expected economic growth, borrowing countries will be exempt, partially or fully, from the debt service due. In periods with higher growth, total debt service to the lender will increase. However, as we do not want a poor country to be punished in the form of taxation for achieving economic growth, it would only repay the original sum of debt service due. The difference is paid to the lender by a New Trust Fund, similar to the HIPC Trust Fund. I analyze the effectiveness of the schemes using historic simulations of debt service to IDA, the concessional window of the World Bank, for a set of seven highly indebted African countries. Results show that modifications of this sort appear feasible and increase the flexibility of low income primary producing countries without significant disruptions to the lender finances. The variability of the free foreign exchange relative to the country's GDP is reduced by an average of 3.7%. Because of the significant offsetting between periods of positive and negative economic growth the simulated flows to the lender average roughly 95% of the actual historical flows. The cost to the New Trust Fund over a period of 18 years is less than the IDA assistance provided through the HIPC Trust Fund to these countries over the past 5 years.

1 Introduction

Low-income countries debt is again at the forefront of the policy agenda. After a decade of attempts to relieve these countries of their unsustainable debt burdens and in spite of the debt reduction delivered under the Heavily Indebted Poor Countries (HIPC) Initiative, many countries that had profited from the HIPC Initiative have experienced rising debt burdens again and other poor countries have seen their debt situation worsen. All this has resulted in low-income countries facing significant challenges in meeting their development objectives, including the Millennium Development Goals (MDGs).

These developments have spurred the interest of academia and the international community in the search for possible solutions. Renewed prominence has been given to the possible need for innovation of the design of the countries' financial liabilities [Declaration of Nuevo Leon, 2004; Declaration of the Zambian president, 2004] not only as a means of mitigation of the impact of economic shocks, but also as a way to exploit risk sharing opportunities (IMF, 2004; Shiller, 2003 and 2004; Dreze, 2000; Berlage *et al*, 2000 and 2002). Most recently a more radical proposal has been discussed by the International Financial Institutions (IFIs): linking debt repayments to the country's economic performance, measured in terms of growth of its gross domestic product (GDP).

The idea of indexing sovereign debt to a country's GDP is not new. Specific proposals have been discussed since the 1980s [Krugman, 1988; Froot, Scharfstein and Stein, 1989; Kletzer, 1992; Shiller, 1993, 2003; Barro, 1995; Dreze, 2000] and a handful of countries, Bulgaria, Bosnia and Herzegovina, and Costa Rica, have already issued bonds containing an element of indexation to GDP. Most recently, however, the attention of the international financial community has focused anew on bonds indexed to GDP. The attention has been sparked by the serious intention of the Argentine authorities to include a GDP option in the country's debt restructuring scheme (Presentation by Argentina at the 2003 Dubai IMF Meetings; US SEC, 2004); and the attempts of the international financial institutions, in particular the IMF, to promote the GDP framework not only for emerging markets but also for developed economies (Borensztein and Mauro, 2004; IMF, 2004).

While recent research has made a strong case for indexing debt to GDP in emerging markets, an interesting question to be answered is whether this approach would be applicable and desirable for low income countries, and in partic-

ular member countries of the International Development Association (IDA), the concessional window of the World Bank. IDA members are the poorest countries in the world, and for these countries concessional loans are the main source of financing. The risk of debt distress in these countries primarily increases not due to an increase in the debt burden itself, but due to a deterioration in their capacity to pay. While debt levels in low income countries are fairly stable, these countries experience high volatility in exports and GDP (Easterly 2003). The volatility is partly due to exogenous shocks that cause liquidity problems and require adequate adjustment of their debt service pattern (World Bank 2004).

The idea of real indexation of IDA lending is new. Two instruments have been considered so far: commodity prices indexation (Gilbert and Tabova, 2003, and 2004) and inflation indexed local currency denominated lending (Hausmann and Rigobon, 2003a). Limited potential benefits for the borrowing countries under the former instrument and concerns about adverse selection and moral hazard in the latter inspire the exploration of other options, and in particular GDP as a measure for indexation of IDA lending. In this paper I examine the feasibility and desirability of linking IDA debt repayments to the countries' real GDP growth. The structure of the paper is as follows. Section 2 outlines the rationale for GDP indexation. Section 3 discusses the idea of GDP linked debt in the case of emerging markets. Section 4 analyzes its feasibility for IDA and presents the general structure of the schemes. In section 4 I outline the financial structure of the schemes. Section 5 presents the simulation methodology and results from both the borrower's and lender's perspective. Section 6 concludes. A detailed description of existing GDP-linked arrangements is presented in Appendix.

2 Rationale for GDP indexation and international risk-sharing

Growth-indexed debt is seen as a sensible way to *provide insurance* for a country and to *facilitate international risk-sharing*. While new instruments have the potential to complement the existing practice, in reality, due mainly to "incomplete markets" (see for example Magill, 1996; Kehoe, 2000), the advantages of this have not always been fully utilized. In international macroeconomics a large literature has developed evaluating the gains from risk-sharing among countries.

Baxter and Jehrman (1997) note that individual portfolios implement very little international diversification. Dreze (2000) notes that globalization of risk bearing is far from realized and securitization, through innovative financing instruments, can offer prospects for improvement. In this light, bonds indexed to national income can offer "unquestionable prospects for improved risk-sharing."

The less developed countries are the ones that suffer the most from the inadequate international risk pooling and sharing. They usually have a liability structure that is associated with high volatility. These countries are also most prone to exogenous shocks and as such should benefit from insurance provided by the rich countries. However, there are currently no well-developed institutions whereby a less developed country can buy insurance against its macroeconomic risks. Each country is expected to bear its own risks alone and is heavily penalized when the risks materialize, as happened in the 1980s when the appreciation of the dollar and increased interest rates made their debt levels unsustainable (Dreze 2000; Berlage *et al.*, 2000 and 2002).

When internal economic conditions are difficult, in terms of growth slowdowns, these countries are more likely to experience difficulties servicing their debt, which is currently not contingent on their economic growth. The governments then have three options, all leading to excessive disruption to economic activity:

- they can choose to default on their obligations, which usually has a traumatic effect for a very long period of time for the economy as a whole and is accompanied by combined seize of new financing; or
- renegotiate and seek restructuring, which in principle would have the same consequences as in the case of default, although slightly milder; or
- engage in procyclical policy by tightening their fiscal policies, imposing substantial economic and social cost.

By making payments contingent on the ability to repay, governments would less often experience difficulties in meeting the debt obligations and hence, would avoid having to make a choice between these three options. Indexation of debt to macroeconomic variables has been considered by Merton (1983) and Barro (1995): consumption-linked national debt; Bailey (1983) advocated conversion of defaulted debt into a share of exports; Krugman (1988) and Froot, Scharfstein

and Stein (1989) compared a potential indexation to commodity prices and GDP and emphasized the moral hazards associated with the latter. Shiller (1993, 2000, 2004) and Dreze (2000) have been the biggest advocates of GDP indexation arguing that issuance of instruments whose pay-outs are linked to GDP "could do a great deal to reduce country risk, and promote welfare" and have made specific proposals, presented in more detail below.

3 GDP-linked debt for emerging markets

3.1 Specific proposals to date

3.1.1 Shiller's proposal

Shiller (1993) has proposed the creation of a system of markets, "macro markets", for long-term claims on a wide array of income flows, including GDP, that would provide opportunities for comprehensive risk management. Issuance of instruments whose pay-outs are linked to GDP, or to other indicators of that GDP, of a country, could reduce country risk, and promote welfare (see Athanasoulis, Shiller, and van Wincoop, 1999; and Shiller 2004). However, it has been difficult to get such markets started, because they require "radical financial innovation" with institutional change.

3.1.2 Dreze's proposal

A specific proposal for restructuring low income countries debt was formulated by Berlage, Cassimon, Dreze and Reding (2000). The authors suggest restructuring of the debt of poor countries in the form of bonds indexed on the country's national income net of a deductible. The link to national income has a co-insurance feature: if the country does well, it will reimburse more than required; if it does poorly, it will reimburse less, but still extinguish its obligation. The indexed bonds are comparable to shares of equity in the country's national income. Each year a "sustainable debt service" (SDS) is paid that is only contingent on the country's economic performance, thus making it independent of the initial scheduled payments. The sustainable debt service is defined as a suitable fraction of an adjusted national income (Berlage *et al.*, 2000, and 2002). The proposal is similar to the perpetual claims on a country's GDP, proposed by Shiller.

3.1.3 IMF's advocacy for GDP-linked bonds

Recent publications (Borensztein and Mauro 2004, IMF 2004) have advocated the adoption of GDP-indexed government bonds for emerging markets. The proposed instrument is a combination of a floating rate plain vanilla bond and an insurance contract with payment contingent on realization of real GDP growth. The coupon rate varies according to the performance of the domestic economy. The instrument is seen as an "automatic stabilizer" type mechanism that would reduce the likelihood of crises and the need for procyclical policies by keeping the debt-to-GDP ratio within a narrow range. Simulation results show considerable benefits to the borrowing countries. The potential obstacles to the successful implementation of such a financial innovation arise from the fact that debt repayments are indexed to a variable that is within the control of the government. This can create lower incentives for growth-promoting policies and and can lead to misreporting of statistics (Borensztein and Mauro, 2004; IMF, 2004). However, the extent to which governments would pursue less growth-oriented policies and would be tempted to misreport official statistics remains an open question.

3.2 The experience with GDP-linked debt

A handful of countries, Bulgaria, Bosnia and Herzegovina, and Costa Rica, have already issued bonds containing an element of indexation to GDP. The bonds were issued as part of Brady restructuring agreements and contain clauses that increase the payoff to bondholders if GDP of the debtor country rises above a certain level. Argentina is currently considering GDP indexation for its post-crisis debt restructuring. These are all examples of restructuring of external debt obligations. There are, however, instances of domestic sovereign debt or corporate debt indexed to GDP. A detailed description of the existing GDP-linked arrangements is given in Appendix B.

As GDP-linked debt has many of the characteristics of equity, it offers, in theory, advantages to both the issuer and the bondholder. The issuer makes additional payments only when conditions are good and it can afford the additional payments. The additional payments can be in the form of coupon premium, in the case when interest payments are contingent on the economic performance or additional dividend when the principal is linked to GDP. This allows for a better alignment of debt service and the country's ability to pay,

freeing resources and capacity for growth. Investors, on the other hand, can fully profit from the country's growth through the increased additional payments or declining discount rates on the bonds. In reality, however, the advantages to the investors depend on the incentives of the issuers to grow and the design of the instruments. GDP-linked debt is a good investment whenever the issuer's benefits of higher growth outweigh the cost of higher debt service. Bulgaria, for example, as an emerging market economy a step away from an investment credit rating and accession to the EU, has had the incentives not only to grow, but to achieve sustainable growth. The sustainable growth has made it possible to accumulate the resources not only to finance a higher debt service but also to buy-back a substantial portion of its outstanding debt and refinance it with cheaper resources. The bonds were callable and the indexation clause was set too far out-of-the-money, leading to a buy-back operation before the clause could be triggered.

Despite the obvious potential benefits, GDP-indexed bonds have not gained popularity and have had only limited success. Three main explanations come to mind. First, these arrangements are likely to send the wrong signals to investors, as governments will most surely issue this kind of bonds in times of economic slowdown. Further, the issuer is likely to call the bonds when the economy is performing well with rising prospects for sustainable growth, which eventually increase investors' confidence and lower the interest rates, allowing the government to borrow cheaper by issuing plain vanilla bonds. This was evidenced in the case of Bulgaria. Second, experience so far has shown that it is difficult to accurately price these bonds. The Bosnian warrants have been quoted as being extremely complicated, increasing the difficulty in pricing them, making the instruments less attractive to investors. Third, the existing arrangements may have been poorly designed. From all this, it can be derived that the success of such an instrument, in terms of encouraging investors to buy them, will depend on design features: (i) the design of the callability option; (ii) the determination of the trigger is crucial, so they are not set too far out-of-the-money, as was the case with the Bulgarian bonds.

Whether and how it might be possible to send the right signals, or at least to avoid a negative connotation for investors, remain open questions. In all three cases so far, and Argentina is likely to follow, the bonds were issued as part of a debt restructuring agreement in period of debt distress and economic difficulties. For the investors this presented a good solution to a problem: they could

exchange defaulted debt or debt which is likely to default for a new sovereign bond that had many of the characteristics of equity. If indexed debt is issued not as part of a restructuring but as a normal financing operation, it might not be such good signal to investors, as now they would not have to choose between two bad options.

3.3 Emerging markets vs. IDA borrowers

Recent research on GDP indexation has examined emerging markets only. Before exploring the potentials of such indexation for the poorest countries in the world, it is worth outlining the major differences between the two types of countries that can affect the design of the proposal for IDA debt indexation as compared to the proposal for the emerging markets.

Emerging markets, through their direct exposure to the international financial markets, are in a better position than IDA borrowers to make decisions about their liability structure and have more alternatives to easing their debt repayments or coping with exogenous shocks. IDA countries' potential for managing the maturity structure and currency composition of their debt is limited. A high proportion of their external debt consists of concessional borrowing from the official sector, with interest rates set at levels substantially lower than those of the market and with long maturities not normally accessible in the market. Also, these countries often do not have a choice with respect to the currency terms, which are set in the currency of the lender or in SDR in the case of IDA, exposing the borrower to substantial foreign exchange risk (Eichengreen *et al*, 1999; Hausmann *et al*, 2003b and 2003c). Because of lack of resources, expertise or experience IDA borrowers do not use the opportunities the market presents in terms of hedging instruments, or do so very little: weather derivatives, oil derivatives, foreign exchange derivatives, and credit derivatives. However, an open question remains whether the markets can absorb the exposure of these countries. The size of the position of these countries can be too large in relation to the size of the market. Hence, while in theory these countries can profit from the insurance instruments that the markets offer, the practice can be quite different.

Debt composition and lenders incentives differ substantially in emerging markets and IDA borrowing countries. For the latter, multilateral and bilateral official creditors have been the primary source of financing for the past two decades.

Emerging markets debt, on the other hand, is largely from private commercial sources. While the emerging market economies experience large negative net transfers during crisis, the low income countries have consistently had positive and substantial net resource transfers. The official creditors have had a long-standing commitment to ensuring positive net transfers to the HIPCs, despite the latter's generally low productivity growth, high debt-service levels, and, in some cases, virtual insolvency (World Bank, 1994). With prolonged economic decline, especially in the countries of Sub-Saharan Africa, additional flows of credit would not have been justifiable under commercial financing practices. The official creditors, however, do not operate under commercial principles. Often driven by political concerns and domestic commercial considerations, they eventually commit to maintaining positive net transfers. The positive net transfers have been maintained using various mechanisms: initially through rescheduled debt payments, then by substituting concessional loans and grants for nonconcessional loans (OED, 2003).

These differences have important implications in terms of desirability, design and potential success of a GDP-indexed instrument. The recent research of GDP-indexed debt in emerging markets recognizes that its successful introduction depends on overcoming a number of obstacles, such as (i) complexity and difficulties in pricing; and (ii) inability to call the bonds. In the case of concessional loans indexation, however, these obstacles would not exist due mainly to the differences in financing outlined above. Further, the IMF recognizes that it is hard for any one country to offer a new product on its own and one suggestion is that there should be an international effort, coordinated by the IFIs (IMF, 2004). Here, of course, as part of the international effort, the World Bank, through IDA, can help develop the markets or set the standards by introducing this arrangement in own house for its low income member countries.

4 GDP-indexed concessional lending

4.1 Objectives and scope

The broad objective is to ease concessional debt repayments. More precisely, the objective can be specified as:

- reduction in the variability of country's debt-to-GDP ratios; or
- reduction in the variability of the foreign exchange resources that a country has available after meeting debt obligations relative to its GDP.

Here I consider only IDA lending. IDA does not only help the poorest countries reduce poverty by providing interest-free loans and grants for programs aimed at boosting economic growth and improving living conditions, it also coordinates donor assistance to provide relief for poor countries that cannot manage their debt-service burden. If the new instrument is found to be feasible and effective, it can eventually be copied by other MDBs, making most (if not all) concessional debt service contingent on a country's economic performance.

4.2 Indexation measure

A fundamental issue is the choice of measurement for the indexation that should be determined by the objectives we pursue. Here I study the ability of GDP indexation to successfully insure poor countries against the variety of shocks they are usually exposed to. Further, the GDP is considered the broadest measure of a country's economy, and it represents the total market value of all goods and services produced in a country during a given year. The debt-to-GDP ratio is the "classic" debt burden indicator in the conventional literature on debt dynamics (World Bank and IMF, 2001; and Edwards, 2001 and 2003) Having GDP as denominator makes this ratio responsive to changes in the overall economic performance (IDA, 2004).

4.3 General schemes

Currently, the scheduled concessional debt repayments are fixed. If IDA offers the option of GDP indexation to its borrowers, a country's yearly debt service payment will depend on its economic growth relative to a benchmark.

The scheme would operate by advancing and postponing debt service payments to IDA:

- In the case of lower than expected economic growth, borrowing countries will be exempt, partially or fully, from the debt service due for the particular period. Here, IDA runs a downside risk, i.e. it will receive reduced credit reflows, which will weaken its capacity to provide assistance in the future (IDA, 2004).

- When GDP growth turns out higher than usual, total debt service to IDA will increase. Because we do not want a poor country to be punished in the form of taxation for achieving economic growth, it would only repay the original sum of debt service due. The difference will be paid to IDA by a trust fund that I call here the New Trust Fund. This approach would also help cope with the risk of adverse selection and the potential lower incentives for growth promoting policies in the IDA borrowing countries.

Moral hazard and adverse selection present some of the main potential problems in such a repayment arrangement. While moral hazard relates to the countries' incentives and policies, adverse selection relates to the choice of these countries to participate in the new arrangement. The latter presents a serious potential risk: as adoption of the proposal by IDA borrowers is voluntary, the consequences for IDA in terms of risk diversification and offsetting of exposure would depend on the set of countries that would actually participate in the scheme. This is because the IDA borrowing countries that will opt for this form of debt are those where growth prospects are least secure and specifically, where governments have the informational advantage over the market in realizing that the expectations reflected in the debt contract are insecure. The New Trust Fund would ensure that countries that achieve economic growth would not be punished with higher repayments and reduce their incentives for conventional loans preferences.

While recognizing the seriousness of this problem, the simulations of the proposed arrangement and assessment of the impact on IDA do not pursue to deal with it, as the simulations are conducted for seven IDA borrowing countries, and a full assessment of the impact on IDA and adverse selection simulation would require a simulation of the impact for all 80 countries that are currently in the IDA envelope.

4.4 Role of the New Trust Fund

Donors would compensate IDA for foregone reflows due to higher than anticipated growth in borrowing countries through additional contributions, for example through a Trust Fund, similar to the HIPC Trust Fund. If these contributions are provided in the form of upfront financing commitments it would help reduce IDA risks.

The donors, through the New Trust Fund, would run an upside risk, i.e. they will have to compensate IDA for the foregone value of extra repayments, in the event a country grows. The donors would be in a quite different position than they are under the current arrangements, in which they would be rewarding success in poor countries, contributing in a more straightforward way to the achievement of development goals in the world's poorest countries. On the other hand, however, given the uncertainty of the economic growth path of these countries, the donors would face substantial unpredictability of funds needed for each period. This could undermine their ability to plan and allocate resources, and hence, probably, their willingness to support this scheme. However, by participating in the initiative and promoting and rewarding growth, it is most likely that donors be less frequently asked to provide debt relief, through contributions to IDA, to countries in debt distress, which are usually those who fail to achieve sustainable growth.

If in reality donors are not able to carry the full burden of this arrangement, a combination of donor commitments and adjustments in IDA's financing terms, for example through an increase in the interest rate or fees (in this way, the member countries will be paying insurance premium), may form a possible alternative.

4.5 Conditions for qualifying

Under the proposed scheme IDA will be providing debt relief to its troubled members. However, there should be conditions to qualify for this scheme through a pre-qualification procedure, as certain standards for policy performance should be maintained in order to ensure that the risks to achieving and maintaining the scheme's objectives are minimized. The lack of symmetry for borrowers, i.e. reduced debt service in bad times would not be matched by increased debt service in good times, further strengthens the case for conditionality.

It seems reasonable, in terms of eligibility, to extend the existing procedures, i.e. the HIPC process, and/or blend them with modified conditions specifically tailored to ensure the effectiveness of the new scheme. The design of the HIPC initiative embodies lessons of experience in setting the eligibility criteria, and most notably, linking conditionality with ownership, through the PRSP process for example (see World Bank OED, 2003). The extension of the existing procedures is desirable as it will be building upon existing experience and expertise, and would not impose considerable costs in adjustments for both the poor countries and for operational procedures[1].

In the suggested modification of the conditionalities I draw mainly on the lessons learned from past experiences and recommendations of the OED report (2003) for 1) maintaining the standards for policy performance, and 2) greater focus on pro-poor growth as compared to social conditionality.

A specific conditionality that would complement the existing procedure would be meeting standards for GDP data reporting. This, given the weak statistical capacity in the poorest countries (see for example IMF, 2004 and Borensztein, 2004), would require extra financing and technical assistance. Further, countries would have to re-qualify every few years to ensure that the risks involved for IDA and the donors are minimized.

[1]The HIPC Initiative is open to all countries that are (i) eligible for PRGF and International Development Association (IDA)-only funding; (ii) pursue or adopt IMF- and IDA-supported adjustment programs, and (iii) have an unsustainable debt burden after full use of traditional debt relief mechanisms. Eligibility Requirement: IDA only and PRGF Eligible.

5 Financial structure

Consider a country whose main source of financing is IDA. An IDA loan, of \$A, carries a fixed interest rate of 0.75% and typically has 40 years maturity. Currently the debt service shows little variation over time. The scheduled repayments, fixed under the current arrangement, are S_1, $S_2 \ldots S_t$:

$$S_t = \begin{cases} 0 & \text{if } 0 < \text{t} < 10, \\ 0.02A & \text{if } 10 < \text{t} < 20, \\ 0.04A & \text{if } 20 < \text{t} < 40. \end{cases} \tag{1}$$

I consider schemes, which substitute this fixed repayment structure with revised payments $S*_1$, $S*_2 \ldots S*_t$. Each scheme I consider has a swap and a swaption variant.

5.1 Swaps

Floating-for-fixed interest rate swaps are the most widely traded interest rate derivative instruments. The swap proposal here extends this principle from interest rates to GDP growth. A country's asset structure is floating: it is exposed to volatile revenues and exports, which as separate components or in combination contribute to volatile national income in terms of GDP volatility. Their liability structure, however, is independent of the national income level or its movements. Under the swap scheme the IDA borrowing countries will benefit by swapping their fixed exposure (fixed scheduled debt service repayments) for a floating rate exposure (the GDP growth rate). The revised repayments would be higher than on the corresponding conventional loan when GDP growth is high and lower when low.

Assume a country's real GDP growth for many years has been g, and the realized 4-year moving average GDP growth for year t is $\overline{g_t}$. A fraction $\lambda \geq 0$ of the original loan is swapped into the floating loan:

$$S*_t = \lambda S_t + (1 - \lambda) S_t \tag{2}$$

Let's take a look at the swapped fraction of the debt service $\lambda\ S_t$. Its amount will depend on the changes in GDP growth rate, I call it coefficient of

dependence c, so that the complete formula becomes:

$$S*_t = \lambda c S_t + (1-\lambda) S_t \tag{3}$$

$$c = 1 + (\overline{g_t} - g) \tag{4}$$

When the moving average of growth for a particular year is the same as the GDP growth trend, then $c = 1$ and the debt service will stay unchanged. When the growth is higher than the trend, $c > 1$, the revised repayments would be higher than on the corresponding conventional loan and adversely, lower when the growth falls short of the trend, $c < 1$.

After simplifying through substitution

$$S*_t = \lambda c S_t + (1-\lambda) S_t = \lambda[1 + (\overline{g_t} - g)] S_t + (1-\lambda) S_t = [1 + \lambda(\overline{g_t} - g)] S_t \tag{5}$$

the general formula can be summarized as follows:

$$S*_t = \begin{cases} [1 + \lambda\ (\overline{g_t}\ \text{-}\ g)]\ S_t & \text{if } c \neq 1, \\ S_t & \text{if } c = 1. \end{cases} \tag{6}$$

When GDP growth turns out higher than usual, the repayment would be higher than under the conventional repayment schedule, of which the country would only repay the original sum of debt service due and the difference would be paid by the New Trust Fund, as described above. From the borrowing country's point of view the repayments in the case of indexation will be:

$$S*_t = \begin{cases} [1 + \lambda\ (\overline{g_t}\ \text{-}\ g)]\ S_t & \text{if } \overline{g_t} < g, \\ S_t & \text{if } \overline{g_t} = g, \\ S_t & \text{if } \overline{g_t} > g. \end{cases} \tag{7}$$

The difference between $S*_t$ and S_t is the amount of debt relief the country would receive when it experiences an economic slowdown and will be paid to IDA by the New Trust Fund. From the New Trust Fund's point of view the payments to IDA in the case of indexation will be:

$$S*_t = \begin{cases} 0 & \text{if } \overline{g_t} < g, \\ 0 & \text{if } \overline{g_t} = g, \\ [1 + \lambda\ (\overline{g_t} - g)]\ S_t \text{ - } S_t = \lambda\ (\overline{g_t} - \text{g})\ S_t & \text{if } \overline{g_t} > g. \end{cases} \tag{8}$$

IDA will run a down-side risk. Its loss will be to the amount of foregone repayments in the events of slow economic growth:

$$\text{IDA loss} = \begin{cases} S_t - [1 + \lambda\ (\overline{g_t} - g)]\ S_t & \text{if } \overline{g_t} < g, \\ 0 & \text{if } \overline{g_t} = g, \\ 0 & \text{if } \overline{g_t} > g. \end{cases} \tag{9}$$

A positive minimum payment and a maximum (1.5 times the original due) payment should be introduced, so that when $g > \overline{g_t}$ debt service can be expressed as:

$$S*_t = \min \{ \max[S_t + \lambda(\overline{g_t} - g)S_t; 0]; 1.5S_t\} \tag{10}$$

5.2 Swaptions

A swaption is a variant of the swap structure described above and its aim is to cope only with exceptional movements in the GDP. A swaption is an over-the-counter option to enter into a swap. In exchange for an option premium, the purchaser gains the right (but not the obligation) to enter into a specified swap agreement with the issuer on a specified future date. With the swaption variant the scheme will come into effect only in the case of exceptional GDP growth volatility, it will not be used to cope with normal GDP movements. In the band in which the GDP growth rate is within $\pm\kappa\%$ of the benchmark growth rate, debt repayments are unchanged from those under the standard currency loan, in other words they will be unaffected for moderate variations in the GDP growth. Repayments under this scheme, using the same principles as under the swap structure, will be:

$$S*_t = \begin{cases} \{1 + \lambda[\overline{g_t} \text{ - } (1+\kappa)\text{g}]\}S_t & \text{if } (1+\kappa)\text{g} < \overline{g_t}, \\ S_t & \text{if } (1\text{-}\kappa)\text{g} \leq \overline{g_t} \leq (1+\kappa)\text{g}, \\ \{1 \text{ - } \lambda[(1\text{-}\kappa)\text{g} - \overline{g_t}]\}S_t & \text{if } \overline{g_t} < (1\text{-}\kappa)\text{g}. \end{cases} \tag{11}$$

In the simulations I set κ =10% of the GDP growth trend.

The careful determination of (i) the threshold to which relief is triggered, i.e. the trend g, (ii) the instruments of the scheme, and (iii) the extent of the relief, i.e. the insurance coefficient or hedge ratio λ is crucial for providing enough benefits to the borrowing countries and at the same time maintaining the sustainability of IDA resources.

All schemes are presented under the cap-floor approach, which sets a minimum positive floor and cap of 1.5 times the original debt service to ensure that modified debt service does not depart too much from the original levels.

5.3 Hedge ratio

The structures I consider in this paper swap out \$$\lambda$A of the conventional loan into a floating-for-fixed swap in terms of the economic growth of an IDA borrowing country. The parameter λ determines the degree of insurance of the instrument. Finding the appropriate values for the hedge parameter λ determine how large the swap position should be in relation to the country's debt service on IDA loans.

Traditionally, the hedge ratios can be derived in two ways:

- analytically, using analytical formulas for the variance minimizing hedge, which takes into account the covariance structure of the variables(Ederington, 1979; Anderson and Danthine, 1980), and
- empirically, using regressions or applying a grid search approach.

Under both techniques, the optimal hedge ratio is time-invariant and is calculated using historical data. However, if the standard deviations are changing over time, the use of a single value for the hedge ratio influences the results of such techniques (Allen et al, 2001)[2]. A recent and very popular direction has been to relax the constant minimum variance hedge ratio assumption, and use a more sophisticated technique that allows for time variation. This involves estimating the time-varying hedge ratio using conditional volatility estimates

[2]If the hedge ratio differs by contract, the movement from one contract to the next is likely to lead to instability in the estimated regression coefficients. Tests for parameter instability in the estimated regression suggest that this is indeed the case and our conclusion is that it is preferable to consider the estimation of the hedge ratio in a panel setting with each individual contract considered as a panel of data.

from a multivariate GARCH model (Brooks, 2004).[3] Most recently "dynamic" hedging approaches have been suggested by Lence, Kimle and Hayenga (1993) and Myers and Hanson (1996) (see Allen et al, 2001). However, I do not pursue that direction in the paper.

5.3.1 Hedge ratio in the simulations

In what follows I use the empirical approach to calculate country specific hedge ratios. An advantage of the empirical approach is that it can be applied to calculate hedge ratios for different minimization objectives where exact formulas are unavailable. The hedge ratios, λ, can be determined empirically by regressions of the variable whose variance we wish to minimize on the hedge instrument or by grid search for the minimizing value for λ.

I look at the variance of two ratios:

- debt service-to-GDP ratio S/Y; and
- residual forex-to-GDP ratio $(X - O - S)/Y$.

The debt sustainability literature has typically focused on the debt-service-to-GDP ratio. This measure has the merit of direct comparability across countries (see for example World Bank and IMF, 2001, and Edwards, 2001 and 2003). A variant of this measure is the residual forex-to-GDP ratio. The ratio measures the free foreign exchange resources that a country has available after meeting its debt obligations. This gives a more immediate measure of the impact of debt service payments. Export revenues (X), as the main source of foreign exchange, finance the country's external debt obligations, which in the case of the low income countries are set in the currency of the lender or in SDR in the case of IDA. I also include oil import expenditures (O), as countries importing petroleum may experience difficulties in meeting scheduled loan repayments in periods when oil prices are high.

[3] ARCH and GARCH models (Engle, 1982; Bollerslev, 1986) have been used to estimate time-varying hedge ratios. The time-varying joint distribution of cash and future price changes has been examined for hedging financial instruments (Cecchetti et al, 1988). Bivariate GARCH (BGARCH) models also have been used to estimate time-varying hedge ratios in commodity futures (Baillie et al, 1991; Myers, 1991), in foreign exchange futures (Kroner et al, 1990), in interest rate futures (Gagnon et al, 1995), and in stock index futures (Park et al, 1995 and Tong 1996). These more recent studies suggest that conventional hedging procedures can produce misleading results.

The low correlation between the variables and the complicated relationship between the variance in growth rates and the levels of GDP lead to poor and statistically insignificant results and show that the regression approach is not the best suited approach for finding the hedge ratio for this particular scheme. Currently GDP growth is not highly correlated with debt service, and the objective of the new scheme is to increase that correlation. The poor regression results show that there is scope for such an arrangement but do not, however, show what the proportionality factor should be. Hence, I apply the grid search to find minimizing hedge for both the debt-service-to-GDP ratio and the free forex-to-GDP ratio.

I minimize the variance of the debt service-to-GDP ratio with the hedge ratio λ as follows:

$$min\left(Var\left(\frac{S_t^*}{Y_t} - \overline{\frac{S_t^*}{Y_t}}\right)\right) \tag{12}$$

I take a range of values and look for the minimizing value for λ_1.

Similarly, I minimize the variability of the free foreign exchange relative to the country's GDP as follows:

$$min\left(Var\left(\frac{X - O - S_t^*}{Y_t} - \overline{\left(\frac{X - O - S_t^*}{Y_t}\right)}\right)\right) \tag{13}$$

Here again I take a range of values and look for the minimizing value for λ_2.

The two different hedge ratios, $\lambda_1$and λ_2, for the two minimization objectives are applied to the respective schemes.

I now have a matrix of the structure possibilities for the schemes:

Contract type		swap	swaption
Minimization ratio	Hedge ratio		
S/Y	λ_1	Scheme B	Scheme BB
$(X - O - S)/Y$	λ_2	Scheme A	Scheme AA

Table 1: Structure possibilities for the schemes.

6 Simulations and simulation results

I perform historical simulations over the period 1984-2001 for schemes of the form outlined above using a set of seven highly indebted African countries: Benin, Burkina Faso, Cameroon, Ghana, Madagascar, Malawi and Rwanda. These countries are IDA borrowing countries, for which service on IDA loans is a sufficiently large proportion of total debt service to allow the scheme to have a significant impact on overall debt service.[4]

6.1 Summary results

Detailed simulation results are presented in Table 6 and 7 in Appendix A. Table 6 takes as objective the minimization of the variance of country's residual foreign exchange relative to its GDP whereas Table 7 is based on the minimization of the IDA debt-service-to-GDP ratio. For each country and hedging scheme results are provided for each of the swap-based and swaption scheme using a $\pm 10\%$ threshold.

In the previous section I specified two objectives:

- minimization of the variance of IDA debt-service-to-GDP ratio, S/Y; and
- minimization of the variance of the residual foreign exchange-to-GDP ratio, $(X - O - S)/Y$.

Table 2 reports the results of the simulations per country in terms of these objectives. The schemes that are based on the variance reduction of the second objective, scheme A and AA, are the best performing schemes. Under these two schemes the variability of the free forex relative to the country's GDP is reduced by an average of 3.4% and 3.7%, respectively. The schemes based on the first objective, generally fail to deliver the needed results in terms of variance minimization, the only exceptions being Ghana and Malawi. This can largely be explained by the fact that the actual volatility of the residual foreign exchange-to-GDP ratio, measured as the standard deviation of the ratio about

[4]Source of data: World Bank - World Development Indicators and Global Development Finance database 2003; HIPC countries' completion point documents (2000-2004); HIPC Initiative Status of Implementation reports (2000-2004); and IDA data on actual debt repayments to IDA.

its moving average trend, is considerably larger than in the case of IDA debt-service-to-GDP ratio and, hence, has the potential to be considerably reduced under these schemes (see Appendix A for the actual and simulated volatility of the two ratios per country).

	swap		swaption	
	$(x-o-s)/y$	s/y	$(x-o-s)/y$	s/y
	A	B	AA	BB
Benin	0.3%	0.1%	0.0%	0.0%
Burkina Faso	0.1%	0.0%	0.0%	0.0%
Cameroon	5.8%	0.0%	6.0%	0.0%
Ghana	2.1%	6.7%	2.6%	0.0%
Madagascar	10.0%	0.0%	12.6%	0.0%
Malawi	3.7%	6.7%	2.5%	5.9%
Rwanda	1.9%	0.0%	1.9%	0.0%
Average	3.4%	1.9%	3.7%	0.8%
Median	2.1%	0.0%	2.5%	0.0%

Table 2: Variance reduction per country for the period 1987-2001.

The results differ markedly between the swap and swaption scheme. The swaption schemes perform worse than the swap schemes. The variance minimizing hedge weights are estimated using a linear approach, discussed in the previous chapter. The nonlinearities associated with the swaption scheme imply that a linear approach would not deliver a full optimization of the scheme.

Table 3 reports the results per country for each of the schemes in terms of eased debt service payments. Table 4 gives the summary results of the simulations. All the schemes deliver debt relief for the IDA borrowing countries. When experiencing economic slowdown the countries are exempt, partially or fully depending on the severity of the economic slowdown, of debt service on IDA loans.

The results differ markedly across countries but are fairly consistent across alternative schemes. Schemes A and AA are again the best performers. The schemes based on the minimization of debt service-to-GDP variance, B and BB, as mentioned above, are not fully optimized in terms of variance reduction and have the potential to increase this variance. Hence, considering both the minimization objectives and the potential benefits for the countries, it can be concluded that the schemes that take into account the residual foreign exchange

	$(x-o-s)/y$		s/y	
	A	**AA**	**B**	**BB**
Benin	15.4%	14.1%	0.1%	0.1%
Burkina Faso	7.8%	4.0%	0.0%	0.0%
Cameroon	35.5%	35.5%	0.0%	0.0%
Ghana	5.4%	0.9%	10.5%	1.3%
Madagascar	38.2%	29.9%	0.7%	0.6%
Malawi	25.2%	20.6%	2.0%	1.6%
Rwanda	35.5%	34.3%	0.0%	0.0%

Table 3: Reduction in IDA debt service for 1984-2001 (in %).

have superiority above schemes based on the objective of debt-service-to GDP variance minimization. The swap scheme A provides larger benefits for the recipient countries than the swaption scheme AA. It should be acknowledged, however, that the swaption estimates depend on the choice of a particular bandwidth parameter, which I take here as ±10%. Other choices may give different results.

	Scheme		Debt service reduction	
			%	$m
Average	$(x-o-s)/y$			
	A	swap	23%	40.9
	AA	swaption	20%	32.9
	s/y			
	B	swap	2%	6.9
	BB	swaption	1%	1.6
Median	$(x-o-s)/y$			
	A	swap	25%	40.3
	AA	swaption	21%	39.0
	s/y			
	B	swap	0%	0.1
	BB	swaption	0%	0.1

Table 4: Simulation summary statistics (1987-2001).

Below I present in detail the results under the swap and swaption scheme based on the variance minimization objective for free forex relative to GDP for two of the countries for which I have conducted the simulations: the country for which the schemes perform least well: Benin; and the country for which they perform the best: Madagascar.

6.2 Benin

IDA is Benin's major concessional lender. The country's economy is heavily dependent on highly variable cotton export revenues and oil import expenditures. Cotton accounted for an average 35% of total export revenues over the simulated period, while oil imports averaged 16% of total export revenues over the same period. While export revenues and oil import expenditures have shown considerable variation over time, debt service payments to IDA show relatively little cyclical variation. Figure 1 graphs Benin's revenues, expenditures and debt repayments for the period 1984-2001.

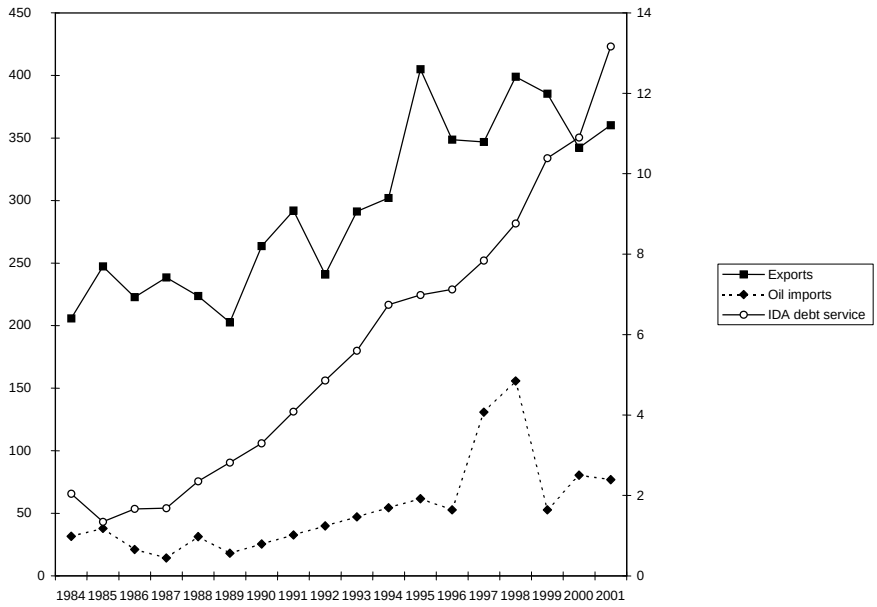

Figure 1: Benin – Total export revenues and oil import expenditures. Values in millions of US dollars.

In terms of meeting the prime objective of the new arrangement, i.e. minimization of the variance of the residual foreign exchange relative to GDP, Benin gives the poorest results of the seven countries in my sample. The swap scheme A provides a reduction of this variance of only 0.3%, whereas the swaption scheme AA fails to contribute to such a reduction.

Despite the poor performance of the variance of this ratio, Benin could have contributed from the new arrangement, as it would have received a total of around US$15 million nominal debt relief over the period, representing 15%

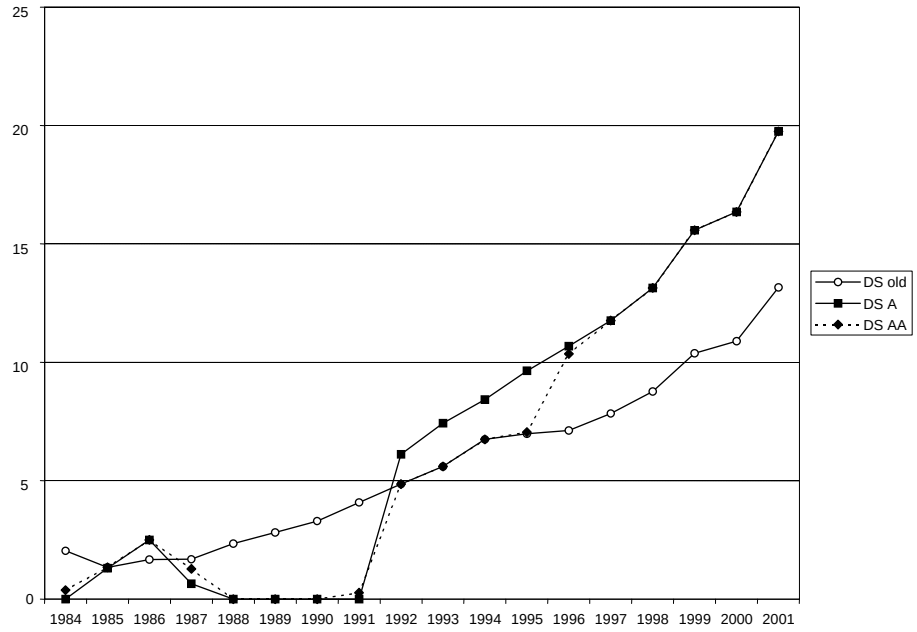

Figure 2: Benin – Total debt service due to IDA. Values in millions of US dollars.

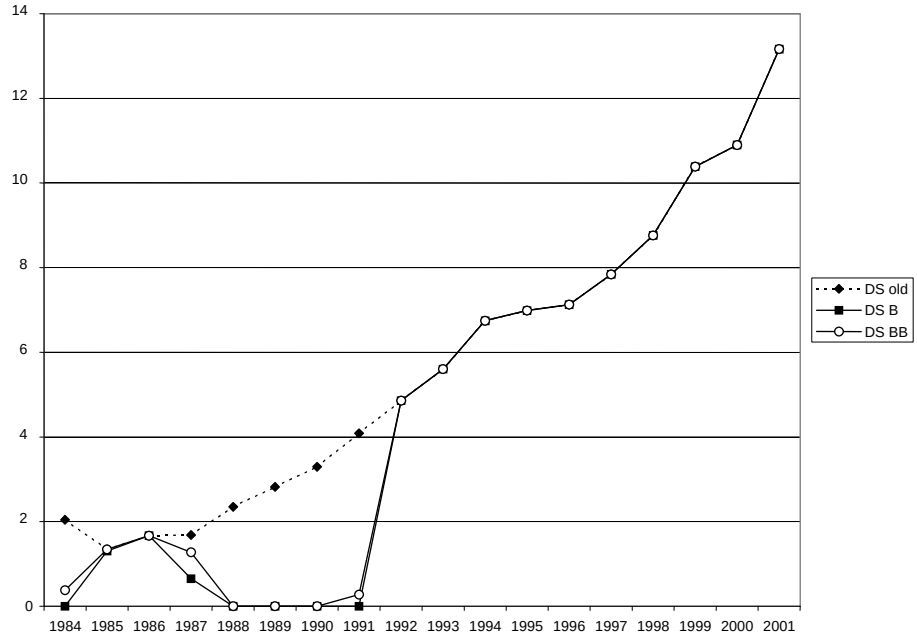

Figure 3: Benin's obligations to IDA. Values in millions of US dollars.

of reduction in total IDA repayments in nominal terms. This small impact can be explained mainly by the fact that growth has accelerated over the last decade. When compared with the HIPC assistance that the country has received since 2000, the total reduction in debt service under the new arrangement is relatively small. Benin has started receiving debt relief under the Enhanced HIPC Initiative in 2000 and so far IDA has delivered US$27.1 million in debt service reduction. The total IDA assistance amounts to US$124.3 million in nominal terms and is being delivered through 50% reduction in debt service over the period 2000-2014(World Bank and IMF, 2003 and 2004).

Figure 2 presents the actual debt service paid and simulated total debt service due to IDA under the new arrangement for the swap and swaption schemes. Consistent with the formulation of the scheme, repayments to IDA would have increased in periods of good economic performance, and decreased when Benin was experiencing economic slowdown. However, as outlined in the structure of the proposal, when GDP growth turns out higher than usual Benin would only repay the original sum of debt service due and the difference would be paid by the New Trust Fund. Figure 3 shows the debt service that Benin would have actually had to pay to IDA.

6.3 Madagascar

Madagascar is the country for which the proposed arrangement would have performed best both in terms of meeting the objective of variance minimization and of delivering sufficient benefits in terms of easing the IDA debt repayments. The swap scheme A reduces the variance of the country's residual foreign exchange-to-GDP ratio by 10%, which the swaption scheme AA reduces it by 12.6%. Figure 4 and 5 show the total debt service due to IDA and Madagascar's obligation respectively. Over the simulated period Madagascar would have seen a nominal debt service reduction of 38% under the swap scheme and 30% under the swaption scheme, representing US$94 million and US$74 million reduction in value terms for the two schemes. An interesting comparison is between the results under the new arrangement and the IDA debt relief that Madagascar has received under the Enhanced HIPC Initiative. Madagascar is a HIPC country that has started receiving debt relief under the Enhanced HIPC Initiative in 2001. Debt relief from IDA approved at the decision point amounted to US$436.7 million in nominal terms and this assistance is being delivered through a 50% reduction

in debt service to IDA over the period 2001-2020. So far, for 2001-2004, IDA has delivered US$59.6 million (World Bank, 2004).

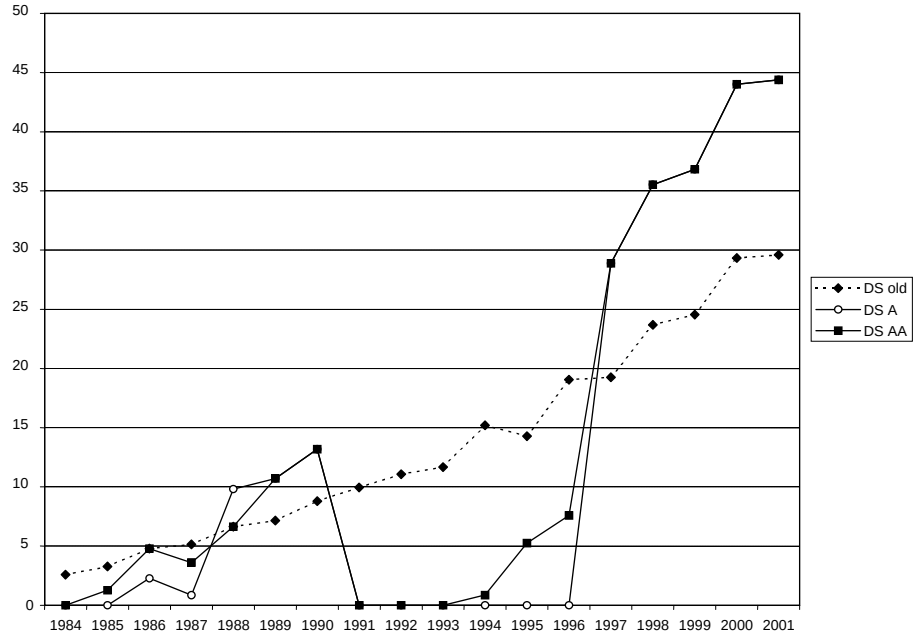

Figure 4: Madagascar – Total debt service due to IDA. Values in millions of US dollars.

6.4 Simulated impact on IDA

We have seen that from the borrower's point of view the proposed schemes have potential benefits. The schemes, however, have costs, the principal cost being the unsmoothing of flows from the borrowing countries to IDA. The impact is charted in Figure 6.4, which looks at the swap and swaption schemes based on the objective of minimization of the free foreign exchange-to-GDP ratio: schemes A and AA. The figure compares the total debt repayments to IDA from the seven countries in my simulation sample with actual historical repayments over the simulated period 1984-2001. [5]

[5]It should be noted that the current results on the IDA impact are based on a sample of seven countries, so they are not indicative of the potential impact on IDA with a bigger set of countries actually participating in the arrangement. In order to simulate IDA's overall impact, simulations can be based on sub-samples of possible beneficiaries and non-beneficiaries or, alternatively, a random sample of IDA borrowers. I do not pursue that direction here.

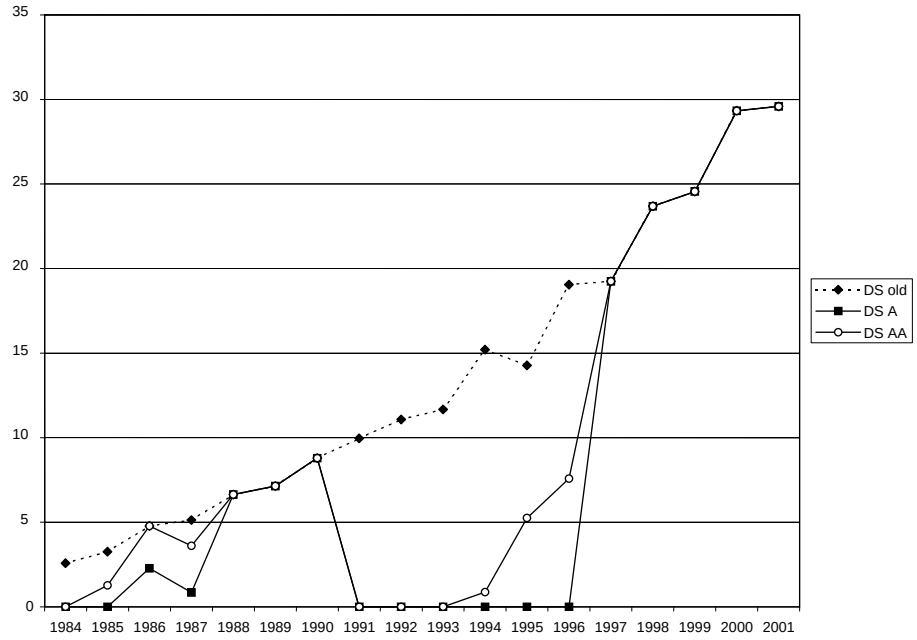

Figure 5: Madagascar – Madagascar's total obligation to IDA. Values in millions of US dollars.

There is no significant contrast between the impact of the swap and swaption scheme. Both schemes generate relatively large departures of debt repayments from their historical time path. The maximum negative divergence of scheme A is US$49.9 million and of scheme AA US$45.5 million in 1994, while the maximum positive divergence is US$50.3 million in 1998 for scheme A, and US$32.8 million in 2000 for scheme AA. One reason for this divergence is the relatively little offsetting due to the high correlation of growth rates in the seven countries. Despite this, there is significant offsetting between the periods of positive and negative economic growth. The consequence is that simulated flows average 95% of the actual historical flows in the swap scheme and 93% in the swaption scheme.

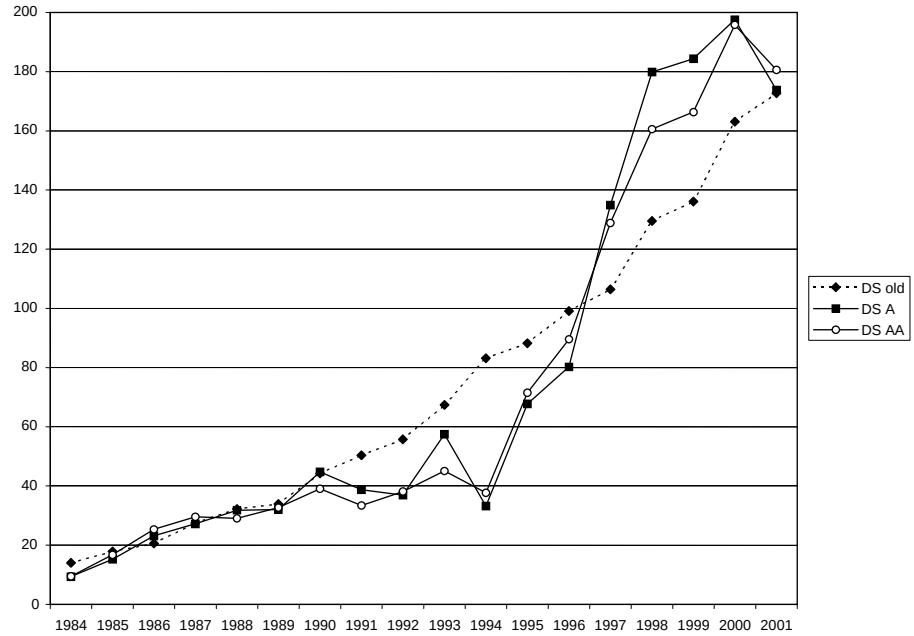

Figure 6: Historical and simulated IDA repayments. Values in millions of US dollars.

The schemes were designed so that the New Trust Fund would bear the upside risk and IDA – the downside risk of the new arrangement. Table 5 summarizes the costs of the schemes for the Trust Fund and IDA and compares them with the debt relief that has already been delivered to the seven countries in the simulation sample over the period 2000-2004 (see Appendix A Table 8 for detailed results per country). The summary results show that on average

the reduced repayments flow to IDA is offset by the contributions of the Trust Fund. For the period 1984-2001 IDA would have accumulated a net loss of only US$26 million in the swap scheme, while under the swaption arrangement it would have even generated a net profit of US$12.6 million. An interesting comparison is between the cost occurred by the New Trust Fund and the IDA HIPC assistance that has already been delivered to the seven countries under the Enhanced HIPC Initiative. In both the swap and swaption arrangement the cost to the New Trust Fund over a period of 18 years (1984-2001) is less than the IDA assistance provided to these countries over only 5 years (2000-2004). These results indicate that there would be no significant disruptions to IDA finances. Figure 7 compares the obligations of borrowing countries and the New Trust Fund to IDA with the historical repayments to the institution.

	New Trust Fund	IDA loss	IDA net	IDA HIPC assistance (2000-2004)
Scheme A	312.6	286.5	26.1	390.1
Scheme AA	217.6	230.2	-12.6	390.1

Table 5: Net impact on IDA.

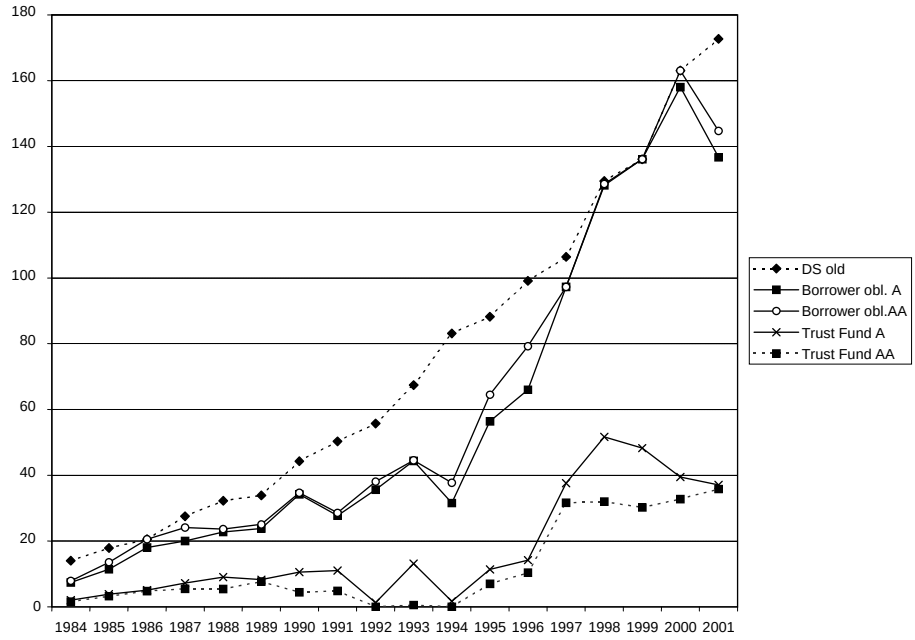

Figure 7: Actual and simulated borrowers' obligation and Trust Fund payments. Values in millions of US dollars.

7 Conclusion

In the present financial architecture low income countries financing, which is predominantly concessional, takes exclusively the form of non-contingent debt. While recent research has made a strong case for indexing debt to GDP in emerging markets, in this paper I have asked the question of whether this approach is feasible and desirable for IDA member countries. I show that flexibility of these countries in meeting their concessional debt service obligations can be achieved by augmenting the existing debt agreements by a set of GDP growth swaps and swaptions. This innovation is both applicable and desirable. It can be achieved by adjusting the value of debt to the repayment capacity through the provision of relief to compensate for low growth in IDA borrowing countries. This is consistent with the general incentives for IDA to promote growth by providing resources to countries that are likely to perform.

The results differ markedly across countries but are fairly consistent across alternative schemes. Considering both the minimization objectives and the potential benefits for the countries, it can be concluded that the schemes that take into account the residual foreign exchange have the potential to be highly effective. Further, the simulations show that there would be no significant disruptions to IDA finances. Because of the significant offsetting between periods of positive and negative economic growth the simulated flows average roughly 95% of the actual historical flows.

We have seen that the benefits of this innovative GDP-linked debt arrangement can be significant for the IDA borrowing countries without being too costly for IDA and the donors. While there are difficulties with any financial innovation, an international effort coordinated by the IFIs, can offer a means of mitigating these difficulties. As part of the international effort, the World Bank can set the standards by introducing this innovative instrument in own house by linking debt service to IDA, the World Bank's concessional window, to the member countries' economic performance.

A Simulation results

	Actual		Simulated		
				DS reduction	
	Standard deviation	Scheme	Standard deviation	%	$m
Benin	1.89%	A swap	1.89%	15.4%	15.66
		AA swaption	1.90%	14.1%	14.35
Burkina Faso	1.50%	A swap	1.49%	7.8%	8.77
		AA swaption	1.50%	4.0%	4.52
Cameroon	3.94%	A swap	3.72%	35.5%	43.49
		AA swaption	3.71%	35.5%	43.49
Ghana	3.60%	A swap	3.52%	5.4%	21.49
		AA swaption	3.51%	0.9%	3.76
Madagascar	2.38%	A swap	2.14%	38.2%	93.85
		AA swaption	2.08%	29.9%	73.62
Malawi	3.00%	A swap	2.89%	25.2%	62.84
		AA swaption	2.92%	20.6%	51.45
Rwanda	1.52%	A swap	1.49%	35.5%	40.34
		AA swaption	1.49%	34.3%	39.00
Average	2.55%	A swap	2.45%	23.3%	40.92
		AA swaption	2.44%	19.9%	32.89
Median	2.38%	A swap	2.14%	25.2%	40.34
		AA swaption	2.08%	20.6%	39.00
The standard deviation measures the standard deviation (about its moving average trend) of the difference between export revenues and the sum of oil import expenditures and IDA debt service payments relative to the country's GDP. Debt service reduction measures the nominal debt relief under the simulated schemes for the period 1984-2001.					

Table 6: Simulation summary statistics (1984-2001). Schemes based on $(X - O - S)/Y$ minimization objective.

	Actual		Simulated		
				DS reduction	
	Standard deviation	Scheme	Standard deviation	%	$m
Benin	0.03%	B swap	0.03%	0.1%	0.11
		BB swaption	0.03%	0.1%	0.09
Burkina Faso	0.03%	B swap	0.03%	0.0%	0.02
		BB swaption	0.03%	0.0%	0.01
Cameroon	0.01%	B swap	0.01%	0.0%	0.00
		BB swaption	0.01%	0.0%	0.00
Ghana	0.11%	B swap	0.11%	10.5%	41.55
		BB swaption	0.12%	1.3%	5.28
Madagascar	0.04%	B swap	0.04%	0.7%	1.84
		BB swaption	0.04%	0.6%	1.54
Malawi	0.18%	B swap	0.17%	2.0%	5.01
		BB swaption	0.17%	1.6%	4.04
Rwanda	0.06%	B swap	0.06%	0.0%	0.00
		BB swaption	0.06%	0.0%	0.00
Average	0.07%	B swap	0.06%	1.91%	6.93
		BB swaption	0.07%	0.53%	1.57
Median	0.04%	B swap	0.04%	0.11%	0.11
		BB swaption	0.04%	0.08%	0.09

The standard deviation measures the standard deviation (about its moving average trend) of the difference between export revenues and the sum of oil import expenditures and IDA debt service payments relative to the country's GDP. Debt service reduction measures the nominal debt relief under the simulated schemes for the period 1984-2001.

Table 7: Simulation summary statistics (1984-2001). Schemes based on S/Y minimization objective.

	Scheme A			**Scheme AA**			**HIPC debt relief**
	New Trust Fund	IDA loss	IDA net	New Trust Fund	IDA loss	IDA net	IDA assistance delivered 2000-2004
Benin	37.4	15.7	21.7	29.7	14.3	15.3	27.1
Burkina Faso	14.1	8.8	5.4	7.1	4.5	2.6	29.0
Cameroon	39.5	43.5	-4.0	39.5	43.5	-4.0	63.9
Ghana	75.3	21.5	53.8	11.1	3.8	7.3	99.9
Madagascar	74.4	93.9	-19.5	71.2	73.6	-2.5	54.9
Malawi	48.6	62.8	-14.3	36.0	51.4	-15.5	67.2
Rwanda	23.3	40.3	-17.0	23.0	39.0	-16.0	48.1
Total	312.6	286.5	26.1	217.6	230.2	-12.6	390.1

Table 8: Cost to the New Trust Fund and net IDA impact.

B Previous experiences with GDP-linked bonds

B.1 External debt

Bulgaria:

The Bulgarian experience presents an interesting case in the discussion of GDP-linked debt, and more specifically of the design and specifications of the agreement (the methodology of the GDP calculations).

In 1994 Bulgaria issued $5.16 billion debt in three types of Brady bonds (interest arrears bonds (IABs), front-loaded interest reduction bonds (FLIRBs), and discount bonds (DISCs) as part of a debt restructuring agreement with its commercial creditors of the London Club. The discount bonds are callable and contain an element of indexation to GDP, defined in the Additional Interest Payments (AIP) clause. Under the AIP the bondholders are entitled to a supplemental interest payment for each year in which Bulgaria's GDP surpasses 125% of its 1993 level provided there is a year-to-year increase in GDP. So only the coupon payments are indexed to the economic performance. For these years there would be a semi-annual interest supplement, coinciding with the regular interest payment dates, and defined as one-half of that year's GDP growth.

$$coupon = base + premium \tag{14}$$

$$premium_t = \begin{cases} 0 & \text{if GDP}_t < 125\%\text{*GDP}_{1993}, \\ \frac{0.5*GDP_t - GDP_{(t-1)}}{GDP_{(t-1)}} & \text{if GDP}_t > 125\%\text{*GDP}_{1993}. \end{cases} \tag{15}$$

The warrant is inseparable from the bond. Though straightforward and simple on first sight, there appeared to be a lot of vagueness to the exact way of calculating GDP growth, making the clause open to interpretation.

The problem was that GDP was not well defined. Although the original documentation defined GDP as the figure associated with the publication of the World Table (succeeded by the World Development Indicators (WDI) of the World Bank, it did not specify which exact series of GDP should be taken into account. The World Bank publishes four series of GDP: in USD and local currency units in both constant and current prices. The choice of GDP measure

is critical to the determination of whether additional interest is payable, as the four different series present four different scenarios with quite different outcomes (Bear Stearns March 25, 2004, see Box 6 on page 35). It can be argued that the appropriate GDP is the constant US dollar or constant local terms indicator, which takes inflation into account and reflects economic growth in real terms.

Box 6: Scenario's Bulgaria

Scenario 1: U.S. dollar GDP at current prices
For example, in the case of the U.S. dollar, current price series, the GDP trigger is breached in 2001, and additional interest would be payable in 2003. On the stock of US$679 million, this would suggest US$51 million in interest arrears outstanding.
Scenario 2: GDP in leva at current prices
Under this scenario, the GDP threshold was breached in 1994. The interest arrears would be a massive US$228 million, excluding the interest on interest also due.
Scenario 3: GDP in constant leva prices
The GDP threshold is crossed in 2005, leaving the MOF with time to call the bonds, on any of the call dates between 2004 and 2006. No additional interest liability would then be due.
Scenario 4: GDP in constant U.S. dollars (deflated by U.S. CPI)
The GDP threshold is crossed in 2003, leaving the MOF with time to call the bonds on any of the call dates in 2004. No additional interest liability would then be due.

Source: Bear Stearns

As the bonds were callable, it was widely expected that Bulgaria will buy them back and refinance with cheaper debt. Bulgaria's rapid economic growth since 1998 was an indication that the country is approaching the point when additional interest payments will be triggered, making the service of the discount bonds too expensive. Bulgaria began to refinance its Brady bonds through cheaper Eurobonds and in July 2004 the government exercised its option to redeem its discount bonds and repaid all discount bonds 20 years before maturity. The external debt buyback reduces the external debt-to-GDP ratio, a significant and robust predictor of external debt problems, increasing the creditworthiness

of the country. Upon announcement of the operation, the Fitch and Standard & Poor's assigned an investment grade to Bulgaria, raising the country's foreign currency rating from BB+ to BBB-.

Bosnia and Herzegovina:

In December 1998, Bosnia and Herzegovina finalized a debt rescheduling agreement with the London Club. The London Club forgave some 73 percent of the debt on a present discounted value basis. The remaining US$ 400 millions was reissued as Brady bonds, which had two components: a "basic amount" of some US$147.8 million and a "performance amount" for the rest. The basic amount was rescheduled over 20 years with a seven-year grace period. The performance amount would fall due once and if Bosnia and Herzegovina GDP per capita reaches US$2,800 (measured at 1997 prices) for two consecutive years before 2018, the maturity date of the bonds. In other words, once the GDP trigger is breached, the bondholders are entitled to receive a new bond, called new performance bond that would pay LIBOR + 13/16 in 24 equal installments with the bonds amortizing in 24 equal installments. Here, both principal, in the face of a new bond, and interest payments, on this new bond, are actually indexed to the growth in GDP.

The trigger here is GDP per capita. Both series of data included in the benchmark calculation, GDP levels and population, are subject to continuous revisions, as the country is struggling to improve its official data reporting. This, however, increases the uncertainty of the timing the warrant will be triggered. The Central Bank of Bosnia and Herzegovina has recently revised the data on the country's GDP including the large informal sector, estimating that the nonobserved economy accounts for more than 37 percent of total economic activity. It has yet to be seen whether the IFIs will take the Central Bank revisions into account. There have also been uncertainties about the population data.

Bosnia and Herzegovina has grown steadily after the war and if it continues to do so, it is most likely that it will be able to generate sufficient resources to buyback the indexed bonds before they become too expensive to service.

Argentina:

In December 2001 the government suspended principal and interest payments on Argentina's public external debt. Alternatives for debt restructuring have been discussed ever since and in June 2004, Argentina announced its final

proposal, which includes a GDP indexation element (US SEC, 2004).

Three new types of debt securities will be issued together with a detachable GDP-linked unit. The initial government proposals, announced at the annual IMF-World Bank meeting in Dubai in 2003, linked interest payments to GDP growth, while the latest plans are to index the principal payments, entitling bondholders to annual payments contingent upon Argentina's achievement of levels of gross domestic product in excess of pre-determined levels (Latin American Weekly Spotlight, 2004). Payment amount will be 5% of the difference between actual GDP and base case GDP in local currency units, with base case GDP the projected real GDP at an annual growth rate of 3%. Payments are triggered when actual real GDP as of the reference date exceeds the base case GDP, and the annual growth rate exceeds 3% (US SEC, 2004). This means that an additional payment will be made when the economy grows above a certain level. This coupon linked to GDP growth will mature in 30 years and will be payable in December of each year. In order to define the time and the amount of the payment, a base scenario is envisaged with annual growth of 3% as of the end of 2004. When GDP in a given year exceeds the level marked out by the previous calculation and records simultaneous expansion of over 3% annually, the payment of the additional coupon is triggered. This payment is calculated as 5% of the difference between current GDP and the GDP of the base scenario, measured in current values, and is expressed in the currency of the corresponding bond according to the market exchange rate[6].

$$annualpayment = \begin{cases} 0 & \text{if } \mathrm{GDP}_t < 1.03{*}\mathrm{GDP}_{t-1} \\ & \text{and/or } \mathrm{g}_t < 3\%, \\ 0.05{*}(\mathrm{GDP}_t - 1.03{*}\mathrm{GDP}_{t-1}) & \text{if } \mathrm{GDP}_t > 1.03{*}\mathrm{GDP}_{t-1} \\ & \text{and } \mathrm{g}_t > 3\%. \end{cases} \tag{16}$$

The GDP-linked unit will be detachable from the plain vanilla bond, unlike the inseparable warrants in the case of Bulgaria and Bosnia and Herzegovina, and will be traded if a market for the stripped coupon develops.

[6] http://www.consargtoro.ca/economicjun2004.htm

B.2 Domestic debt

Singapore:
The Singapore government has issued two types of GDP-indexed shares, New Singapore Shares (NSS) and Economic Restructuring Shares (ERS). The NSS were introduced in 2001 to help the lower income group tide over the economic downturn. The ERS were introduced in 2003 as part of the offset package meant to help Singaporeans adapt to the structural changes in the economy, especially the increase in the goods and services tax rate. Both types of shares earn annual dividends, in the form of bonus shares. The bonus shares are calculated at a rate of 3% plus the real GDP growth rate of the preceding calendar year, with a guarantee of at least 3%.[7]

B.3 Corporate debt

Michelin:

A GDP linkage has found its place in corporate risk financing, setting new grounds for corporate thinking on risk management.

Compagnie Financière Michelin (CFM), the financial and holding arm of the Michelin tyre group, was granted combined bank and insurance capital facility, co-arranged by Swiss Re New Markets (SRNM) and Société Générale (SG).

Under the terms of the joint SG/SRNM transaction, CFM has guaranteed access to a bank credit facility and the option to draw under certain conditions on an insurance facility. The trigger event for the latter is a fall in the combined average annual GDP growth rate in Michelin's main markets – the euro zone and the US – below a certain level. This level is set at 1.5% in the first three years and 2% in the last two years of the five-year option. The insurance trigger arises from the fact that Michelin's revenues are highly correlated to GDP growth in these markets. This guarantees the necessary resources to weather any crisis, as well as to make an acquisition without equity increases .[8]

[7]Source: http://www.nss.gov.sg
[8]Source: www.financewise.com/public/edit/riskm/art/art-profile.htm

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