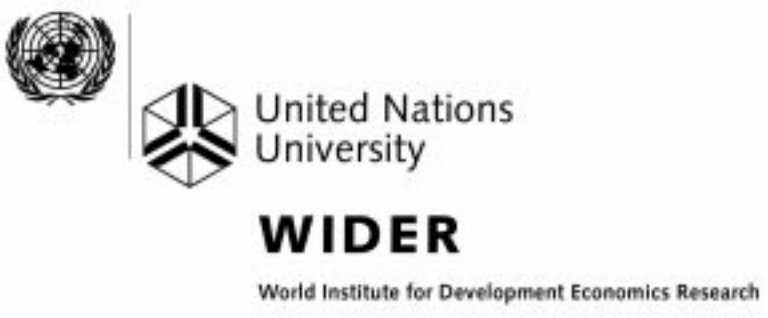

Discussion Paper No. 2001/95

External Debt and Growth in Developing Countries

A Sensitivity and Causal Analysis

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Abstract

The paper aims to enhance the existing literature on the debt-growth nexus by analysing the relationship in two separate country groups using the extreme bounds analysis for sensitivity tests and the mixed, fixed, and random coefficient approach that allows for heterogeneity in the causal relationship between debt and growth. Irrespective of the debt measure used, the results are robust across the two country groups—HIPC and non-HIPC—as well as two different testing procedures. The extreme bounds analysis shows that the relationship between a debt measure and economic growth is robust to changes in the conditioning set of information included in the regression equations. The mixed, fixed, and random coefficient approach, on the other hand, show a statistically significant negative causal impact running from each of the four debt measures to economic growth in both country groups. The results have important policy implications.

Keywords: external debt, growth, sensitivity analysis, causality

JEL classification: F34, F35, 011

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1 Introduction

What factors determine the long-term growth prospects of an economy? This question has been researched in numerous empirical studies over the last few decades.[1] In this context, the growth effects of foreign indebtedness have received special attention.[2] Arguments suggesting that foreign indebtedness promotes growth usually involve a complementary role that foreign aid plays to domestic savings and thus to resource mobilization, capital accumulation, and industrialization.[3] Arguments suggesting a negative relationship between foreign indebtedness and growth emphasize how domestic savings are crowded out by the flow of foreign aid.[4]

The external debt burden of many low- and middle-income developing countries has increased significantly in the last two decades prompting the multilateral Paris Club and other official bilateral and commercial creditors to design a framework in 1996 to provide special assistance for heavily indebted poor countries (HIPC) for whom traditional debt relief mechanisms (provided under the Paris Club's Naples terms) are not sufficient. In return, these countries agree to pursue IMF- and World Bank-supported adjustment and reform programmes and meet specific policy and performance criterion.

The HIPC Initiative has been considered a major breakthrough mainly due to its key goal of reducing the debt of poor countries to sustainable levels that would allow them to avoid the process of repeated debt rescheduling. As of August 2001, forty-one countries have been classified as being eligible for debt relief under the HIPC Initiative. These countries saw their total indebtedness increase from $60 billion in 1980 to $105 billion in 1985 and $190 billion in 1990 (IMF 2000). Of this group, 23 countries have debt relief agreements in place, with relief already flowing in. Two countries (Bolivia and Uganda) have already reached their completion points under the enhanced HIPC Initiative of 1999, which replaced the original HIPC Initiative of 1996 (IMF 2001).

Nevertheless, major concerns have been raised by policy-makers and academicians with the enhanced HIPC Initiative. These concerns can be broadly stated as follows: (i) the growth assumption is too optimistic; (ii) debt sustainability analysis is inappropriate; and (iii) country selection is too narrow.

It is the third issue that is the main focus of this paper. Should the debt retirement initiative be limited to the 41 HIPC countries, or should more countries be included under the debt reduction initiative? The answer to this question has important policy implication as a significant number of countries that have been presumed to have a sustainable debt burden also suffer from ever-increasing debt service payments leading to a cancellation of many domestic development projects thereby compromising long-term poverty-reducing growth prospects. Developing (including middle-income)

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1 Levine and Renelt (1991) present an extensive review of the empirical growth literature.

2 Dalgaard *et al.* (2000) provide a survey of the empirical analyses conducted during the last three decades on the effectiveness of foreign aid.

3 See Lewis (1953) and Amartya Sen (1983) for a detail discussion on this issue.

4 See Boone (1994 and 1996) and Foxley (1987) on this issue.

country debt rose from $500 billion in 1980 to $1 trillion in 1985 and around $2 trillion in 2000 (IMF 2000).

A large number of recent studies on external debt have concentrated only on the countries included in the HIPC Initiative. If our intention is to analyse the overall relationship between debt and growth, then such concentration would lead to a sample selection bias.[5] This paper addresses this concern by comparing the impact of foreign indebtedness on economic growth in two separate groups of developing countries to see if the effect varies across these two groups. One group consists of countries that are currently eligible to participate in the HIPC Initiative; while the other group consists of severely and moderately indebted countries that have not yet qualified for the HIPC programme. The first group has thirty-five countries.[6] The second group has twenty-five.[7]

The results of this study would help us to assess if the issue of debt reduction, retirement, or write-off be limited to the HIPC group or be extended to other countries that are in dire need of assistance.[8]

Methodologically, the paper suggests two improvements over the existing studies in this area. First, most studies in this area consider only a small number of explanatory variables in trying to establish a statistically significant relationship between debt and growth. However, economic theory does not provide a complete specification of which variables are to be held constant when statistical tests are performed on the relation between debt and growth (Cooley and LeRoy 1981). Thus it is likely that many candidate regressions may have equal theoretical basis, but the coefficient estimates on the debt variable may depend on the conditioning set of information. The paper uses a variation of Leamer's (1983) extreme bounds analysis, as suggested in Levine and Renelt (1992), to test the robustness of coefficient estimates to changes in the conditioning set of information.

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5 Hansen (2001) makes a similar point.

6 The thirty-five HIPC countries included in the sample are Benin, Bolivia, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Guyana, Honduras, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nicaragua, Niger, Rwanda, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Uganda, and Zambia. Of the original list of forty-one countries that were considered for HIPC Initiative assistance, several countries were dropped from analysis for a number of reasons. A recent debt sustainability analysis showed that Yemen has a sustainable debt burden after the application of the traditional debt relief mechanisms. Angola, Kenya, and Vietnam have also been judged sustainable after the delivery of the Paris Club's Naples Term. The Lao PDR indicated its intention of not requesting assistance under the HIPC Initiative [IMF (2001)]. Sao Tome and Principe was dropped from the sample due to the lack of consistent data.

7 The twenty-five non-HIPC countries included in the sample are Algeria, Argentina, Bangladesh, Brazil, Cameroon, Chile, Columbia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Guatemala, India, Indonesia, Jamaica, Morocco, Nigeria, Pakistan, Paraguay, Peru, the Philippines, Sri Lanka, and Zimbabwe. These include countries that are moderately to severely indebted and not included in the HIPC list.

8 There is an ongoing debate on the merits of debt retirement and write-off in the developing countries. While organizations like Jubilee Plus have spoken forcefully for complete debt write-off, many organizations, such as, IMF have taken an opposite stand. Interested readers are referred to, among others, the web sites www.jubileeplus.org and www.imf.org for a discussion of their respective viewpoints. See also, Roodman (2001).

Second, most of the studies in the cross-sectional debt-growth literature have assumed that observed data are random outcomes of a controlled experiment. However, if the data are not random draws from a homogeneous population, ignoring heterogeneity among the cross-sectional units will result in biased or meaningless estimates (Balestra and Nerlove 1966; Hsiao 1986). In this paper, following Hsiao *et al.* (1989) and Weinhold (1999), we employ a specification consistent with the dynamic partial adjustment principle. We initially explore the issue of homogeneity across different countries. Initial estimations show a high degree of heterogeneity across countries. Next, we control for the country-specific differences by assuming that the coefficients of country-specific factors are fixed and different while the coefficients of the other variables are random draws from a common population.

The paper is organized as follows. Section 2 briefly looks at the debt-growth nexus. Section 3 reports the results from the sensitivity analysis. Section 4 introduces the concept of causality in Panel data; while Section 5 reports the results from the causality tests. Concluding remarks are included in Section 6.

2 The debt-growth nexus

Worldwide events in the 1970s and 1980s—particularly the oil price shocks, high interest rates and recessions in the developed countries, and then weak primary commodity prices - are usually referred to as the major contributors to debt explosion in the developing countries (IMF 2000). A number of studies in the literature have summarized these factors to include, but are not limited to, (1) exogenous factors, such as adverse terms of trade shocks; (2) the absence of sustained adjustment policies, particularly when facing exogenous shocks, which gave rise to sizeable financing needs and failed to strengthen the capacity to service debt; this includes inadequate progress in most cases with structural reform that would promote sustainable growth of output and exports; (3) the lending and refinancing policies of creditors, particularly lending on commercial terms with short repayment periods by many creditors in the late 1970s and early 1980s and non-concessional rescheduling terms for most of the 1980s; (4) the lack of prudent debt management by debtor countries, driven in party by excessive optimism by creditors and debtors about the prospects for increasing export earnings and thereby building debt-servicing capacity; (5) lack of careful management of the currency composition of debt; and (6) political factors, such as civil war and conflict (see Afxentiou and Serletis 1996, and Brooks *et al.* 1998) for a detailed discussion on this issue).

Whatever the reasons that have led to the unprecedented surge in the debt volume, developing countries are faced with a mounting debt problem that would severely constrain economic performance in these countries. Some poor countries increasingly resort to new borrowing simply to service debt (IMF 2000).

A major motivation for debt relief arises from the presumption that a deleterious interaction exists between a heavy debt burden (or a debt overhang) and economic growth (Serieux and Samy 2001). The widely discussed ‘debt-overhang theory’ suggests that heavy debt burden creates a disincentive for private investment because of fears of future taxes and/or debt-induced crises (Krugman 1987 and 1988). This reduces investment spending, leading to a slowdown in economic growth. The cycle continues with further

reduction in investment following the economic slowdown, an increase in the debt-income ratio, and a reinforcement of the disincentive effect, which ultimately leads to stagnation.

A heavy debt burden can also affect growth through other avenues, such as the crowding out effect. The debt-servicing cost of the public debt can crowd out public investment expenditure, thus reducing total investment directly and also indirectly by reducing complementary private expenditure (Diaz-Alejandro 1981). It can also reduce the productivity of investment due to lost externalities from certain types of public investment, such as physical infrastructure (Serieux and Samy 2001). Boone (1994 and 1996) used panel data regression based on a sample of more than 90 countries covering two decades to show that external aid has no impact on investment or growth in standard neoclassical growth models.

In a number of theoretical models, however, reasonable levels of current debt inflows are expected to have a positive effect on growth. In traditional neoclassical models, allowing for capital mobility, or the ability of a country to borrow and lend, increases transitional growth. There is an incentive for capital-scarce countries to borrow and invest as the marginal product of capital exceeds the world interest rate. Eaton (1993) extends the Uzawa-Lucas model and shows that an increase in the cost of foreign capital that lowers external borrowing leads to lower long-run growth. Using an empirical model, Burnside and Dollar (2000) have shown that foreign aid contributes positively to economic growth, but only in good policy environments. On the other hand, Hadjimichael *et al.* (1995) and Lensink and White (1999) have found positive but decreasing marginal returns to aid flows.

Given the absence of any conclusive evidence on the relationship between external aid and economic growth, the following sections will utilize two alternative methods to further analyse the relationship in a wide array of developing countries.

3 Sensitivity analysis

We initially explore whether the relationship between various measures of foreign indebtedness and economic growth is robust or fragile to small changes in the conditioning information set. The reliability and the robustness of the relationship are evaluated using a version of Leamer's (1983) extreme bounds analysis as developed in Levine and Renelt (1992).

In particular, the following regression is estimated:

$$PCGDP = a + b_m M + b_i \mathbf{I} + b_z \mathbf{Z} + u \qquad (1)$$

where PCGDP is the growth of per capita GDP, M is a particular debt variable, **I** is the set of base variables included in all regressions and **Z** is a subset of variables selected from a pool of variables identified by past studies as potentially important explanatory variables of economic growth.[9]

9 Following Kormendi and Meguire (1985), it is assumed that the explanatory variables in equation (1) are independent and linear.

We first select the debt variable (M), and run a base regression that includes only the **I**-variables and the debt variable. Then we compute the regression results for all possible linear combinations of up to three **Z** variables and identify the lowest and highest values for the coefficient of the debt variable, b_m, that cannot be rejected at the 5 per cent level of significance. If the estimated coefficient of debt variable remains significant over this procedure, the correlation is said to be 'robust'. The 'extreme bounds' are the highest estimated correlation plus two standard errors and the lowest minus two standard errors. If the coefficient fails to be significant in some regression, the correlation is termed as 'fragile'. Widmalm (2001) has suggested that, to reduce multicollinearity, no pair of variables in **I**, **Z,** or M should measure the same underlying phenomenon.

Following Levine and Renelt (1992) and Widmalm (2001), the set of variables in the **I** set is determined as follows. The first variable is a lagged value of the log of per capita GDP. A negative correlation between this variable and the dependent variable would support the view of conditional convergence, which is consistent with neoclassical growth models as well as some endogenous growth models.[10] Following the empirical growth study models, the investment/GDP ratio is included.[11] The third base variable is the average annual growth rate of population.[12]

The pool from which the set of control variables **Z** is drawn includes variables that are considered to be potential sources of economic growth. The first variable is export/GDP ratio, which measures the degree of openness in a country. The ratio of government expenditures to GDP when included as fiscal policy in the developing countries is used to promote economic growth. These two variables help to control for differences in total factor productivity. Exogenous shocks are accounted for by including the growth in terms of trade. The degree of financial deepening in these countries is considered using the M2/GDP ratio. The assumption is that an increase in financial deepening would enhance growth. In a 'cash-in-advance' theory of money, higher anticipated inflation rate is predicted to reduce capital formation (Stockman 1981; Widmalm 2001). Hence the inflation rate is also included.[13]

First, the robustness of different measures of external debt is examined. In the empirical literature, the external debt stock and total debt service have been the most popular measures of external debt employed. In order to make this study comparable to previous studies, four variables using these two measures of external debt are generated—total debt service/GDP ratio (TDS/GDP), total debt service/exports ratio (TDS/EXP), debt/GDP ratio (DEBT/GDP), and debt/exports ratio (DEBT/EXP). The use of these two measures will also help to isolate the debt overhang effect (which can be captured

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10 See, for example, Quah (1993).

11 Following Widmalm (2001), provisions are made for reverse causality by using a two-stage least square estimator.

12 Although few empirical studies in the growth literature include all of these three variables, most studies control for some subset. Levine and Renelt (1991) surveys forty-one studies on economic growth and provides a list of variables included in these studies. Moreover, these variables are consistent with new growth models that depend on constant returns to reproducible inputs or endogenous technological change (Barro 1990; Romer 1990).

13 The pool of variables in the **Z** set is deliberately kept small in order to make the results more tangible and understandable.

with a variable representing the burden of future debt service, such as the debt stock) from the potential crowding out effect (proxied by a contemporaneous debt service ratio, Pattillo *et al.* 2001).

The sample period covers 1982-99. The starting point of the sample corresponds to the beginning of the debt crisis. For each variable, three-year averages are calculated in order to net out the effects of short-run fluctuations, while maintaining the ability to utilize the time series dimension of the data.[14] Data on the debt variables are collected from the *Global Development Finance* dataset of the World Bank, while the data on all the other variables are taken from the *International Financial Statistics Tape*. There are 210 observations for the HIPC group and 150 observations for the non-HIPC group.

Equation (1) is estimated, using a pooled cross-section time series approach, where different measures of debt are, in turn, substituted for M. One advantage of this pooled cross-sectional data is that it can allow for time specific effects, as the worldwide conditions for growth, may not be equally advantageous over time.[15] The extreme bound results for the thirty-five HIPC group are reported in Table 1 while those for the twenty-five low- and middle-income countries are reported in Table 2.[16]

In Table 1, the correlation between each of the four measures of indebtedness and growth in the HIPC group turns out to be robust. The coefficients are negative and statistically significant suggesting that external indebtedness retards economic growth in the HIPC group. This finding is consistent with the World Bank-IMF view that unless drastic actions are taken by these countries to reduce their external indebtedness, economic growth will suffer.

Table 2 provides similar statistics for the twenty-five countries not in the HIPC group. Interestingly, the results are similar to those reported in Table 1. Irrespective of the debt measure employed, there is a robust negative correlation between the debt variable and economic growth. This indicates that foreign indebtedness has reduced the potential growth of per capita income in these countries. One policy implication of this result is that, when it comes to seriously tackling the issue of debt and providing adequate debt relief, our attention should not be focused only on the HIPC group. Low economic growth in other severely and moderately indebted countries can also be traced to their foreign debt problem. And hence debt relief policies should also be devised for these countries.

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14 As pointed out in Pattillo *et al.* (2001), the time series dimension of the data is important, as an understanding of how debt affects economic growth over time (the within-country variability of the panel data) is at least as important as understanding how countries with different levels of debt experienced different growth patterns (the between-country variability of panel data).

15 Following Widmalm (2001), a fixed effects test of whether growth rates in these country groups as a whole are influenced in a common direction in different time periods was conducted. The hypothesis of no time specific effects was strongly rejected. This is similar to the findings reported in Easterly *et al.* (1993) who reported that country characteristics influence the relative levels of income rather than differences in growth rates.

16 To conserve space, the sensitivity results for the base variables (included in the **I**-set) are not reported here. In general, the lagged per capita GDP growth and investment-GDP ratio have been found to be robust, while the population growth rate has been found to be fragile. These results are available from the author.

The robustness of these results is now examined in the next section in the context of panel causality tests performed within a mixed, fixed and random model.

4 Causality in panel data

In the existing literature on panel data, most of the standard causality tests are performed using the following model:

$$y_{it} = a_0 + a_j y_{it-1} + b_j x_{it-1} + f_i + u_{it} \quad (2)$$

where i = 1...n, and f_i is the fixed effect.[17] The fixed effect can be eliminated by taking the first difference of equation (2) which gives

$$y_{it} - y_{it-1} = a_j(y_{it-1} - y_{it-j-1}) + b_j(x_{it-1} - x_{it-j-1}) + (u_{it} - u_{it-1}) \quad (3)$$

However, in equation (3), the error term $(u_{it} - u_{it-1})$ is correlated with the regressor y_{it-j}- y_{it-j-1}. To take care of this correlation problem, equation (3) is estimated using a two-stage least square method with instrumental variables procedure with a time-varying set of instruments. The issue of causality from x to y is, then, tested using the following joint hypotheses:

$$b_1 = b_2 = ... = b_m = 0.$$

The problem with this estimation process is the assumption that the coefficient on the explanatory variables is equal across all the units in the panel data. In other words, these models are based on the underlying assumption of homogeneity of the relationships in question across countries in the panel. However, given the diverse nature of different developing countries, a degree of heterogeneity both in the dynamic structure as well as the relationships between different macroeconomic variables is likely to exist, especially in a panel dataset. Estimating such dynamic heterogeneous models by imposing homogeneous parameter values can potentially lead to misspecification biases in the estimation process. In fact, Monte Carlo simulations have shown that these estimates will be biased and inconsistent, and that the bias would increase as the sample size gets larger (Pesaran and Smith 1995; Weinhold 1999). As Nair-Reichert and Weinhold (2001) have shown, this restriction of a single coefficient on the causal variable implies that either causality occurs everywhere or it occurs nowhere in the panel. In other words, the assumption eliminates the possibility that the dataset can be heterogeneous.[18]

Hence in a panel dataset, a more flexible criteria would be desirable. An alternative specification would be the Mixed Fixed and Random (MFR) model as suggested by Hsiao *et al.* (1989) in a non-dynamic setting. Recently, Weinhold (1999) and Nair-Reichert and Weinhold (2001) have considered a variation of the MFR model as an alternative specification for panel data causality testing in the presence of heterogeneous dynamics.

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17 See Nair-Reichert and Weinhold (2001) for a detailed discussion on this issue.

18 In addition, Nair-Reichert and Weinhold (2001) have suggested that in a heterogeneous data set it is possible that the mean coefficient could have statistically significant values of either sign but still not reflect much of the underlying economic condition.

In particular, they consider the model

$$y_{it} = a_i + b_i y_{it-1} + d_{1i} x^*_{1it-1} + d_2 x_{2it-1} + u_t \quad (4)$$

where x^*_{it-1} denote the orthogonalized candidate causal variable after the linear influences of the remaining right-hand side variables have been taken into account. Orthogonalization provides for appropriate interpretation of the estimated variances by making sure that the coefficients are independent.

The advantage of the MFR model is that it can be used to control for the effects of both the fixed and random country-specific factors so that parameters characterizing common behaviour across countries and over time can be consistently estimated. As shown in Hsiao *et al.* (1989), this model allows improved predictions for any one country by combining the information on all the countries through a Bayes procedure. It is ideally suited for testing the presence of causality in heterogeneous panel datasets as it allows for a distribution of causality across the panel. This method uses the distributional information to get a general idea of the degree of heterogeneity. As pointed out by Nair-Reichert and Weinhold (2001), the combination of a less-biased mean estimate and an idea of the degree of heterogeneity provides a better understanding of the underlying process than the traditional panel causality tests.

5 Estimation results from the MFR model

Table 3 presents the results for the thirty-five countries in the HIPC group from the following regression equation using a non-dynamic fixed effects panel:

$$\begin{aligned} PCGDP = {} & a_i + a_1 X_{it} + a_2 GDP_{it} + a_3 INV_{it} + a_4 GEXP_{it} \\ & + a_5 GOVTEX/GDP_{it} + a_6 M2/GDP_{it} + u_{it} \end{aligned} \quad (5)$$

where *X* represents TDS/GDP, TDS/EXP, DEBT/GDP, and DEBT/EXP, respectively. Columns (1)-(4) in Table 3 show the results from estimating equation (5) for the four debt variables. The results are not consistent across the debt variables. Two of the variables, TDS/GDP and DEBT/GDP have a statistically significant negative sign while the remaining two debt variables are statistically insignificant. The initial level of per capita GDP has the expected negative sign and is statistically significant. The remaining four variables, investment/GDP ratio, growth of export/GDP ratio, growth of government spending/GDP, and M2 as a proportion of GDP have a statistically significant positive impact on the growth of the per capita income. One possibility for the differing results for the foreign debt variable may be that debt variables have an impact only on those countries that have reached a particular threshold of openness.

We, therefore, test to see if the coefficients on the debt variables depend on the level of openness in a country:

$$b_k = b_{k0} + b_{k1} OPEN_{it} \quad (6)$$

By substituting the value of b_k in equation (5), we get

$$PCGDP_{it} = a_i + a_1X_{it} + a_2GDP_{it} + a_3INV_{it} + a_4GEXP_{it} + a_5GOVTEX/GDP_{it} + a_6M2/GDP_{it} + a_7INTER_{it} + u_{it} \quad (7)$$

where $a_6 = a_k$ and INTER is the interaction term of each of the debt variables, TDS/GDP, TDS/EXP, DEBT/GDP, and DEBT/EXP with the level of Openness. These interaction variables are denoted as OPEN1, OPEN2, OPEN3, and OPEN4, respectively.

Table 4 presents the results for each debt variable after taking into account the possibility of interaction. These results are significantly different from those reported in Table 3. Once the four debt variables are allowed to vary with the level of openness in the country, all of them become statistically significant and start negative at very low levels of openness and remain negative at higher levels of openness. These results indicate that the economic growth returns of additional foreign aid actually decrease with increased openness.

For countries with non-traded currencies, external debt-service payments require the purchase of foreign currency, which must be earned either from exports, capital inflows, or drawing down reserves. In the absence of substantial reserve coverage, rising exports, or sizeable capital inflows, higher debt service means reduced import capacity (Serieux and Samy 2001). This usually leads to import compression that is effected either through price rationing (currency devaluation) or non-price rationing (import restrictions). This may lead to reduced imports of capital goods that can eventually lead to reduced investment and thus lower economic growth (Moran 1990).

The coefficient estimates for the other variables in the equation are as expected. Initial level of per capita GDP has a statistically significant negative impact supporting the convergence hypothesis. The remaining four variables, INV, GEXP, GOVTEX/GDP, and M2/GDP, have a statistically significant positive impact on the growth of per capital GDP.

Table 5 reports similar results for the twenty-five countries in the non-HIPC group. The coefficient estimates for the debt variables are all negative and statistically significant suggesting the adverse effect that foreign indebtedness is having on these economies. This result reinforces the findings from the extreme bound analysis and shows that growth-retarding impact of external debt is not limited in the HIPC group. Other low- and middle-income countries are also suffering from similar economic malaise.

The initial level of per capital GDP has the expected negative sign and is statistically significant. The coefficient estimates for INV, GEXP, GOVTEX/GDP, and M2/GDP have the anticipated positive sign and are statistically significant. However, the coefficient estimates for the interaction variables are not similar to those reported earlier. In case of the ratio of the two debt variables to GDP, OPEN1 is insignificant, while OPEN3 is negative but significant only at the 10 per cent level. The interaction term in the TDS/EXP equation is statistically significant but positive, while in the DEBT/EXP equation the term is significant but negative.

Next, we test for the presence of a causal relationship between the four debt variables and the growth of per capita income in the context of dynamic panel models. Here, the growth of per capita GDP is modelled as a function only of lags of itself and other independent variables. Thus the model shown in equation (5) now becomes

$$PCGDP_{it} = a_i + dPCGDP_{it-1} + a1X_{it-1} + a_2GDP_{it} + a_3INV_{it} + a_4GEXP_{it} + a_5GOVTEX/GDP_{it} + a_6M2/GDP_{it} + u_{it} \quad (8)$$

As shown by Nair-Reichert and Weinhold (2001), the inclusion of the lagged dependent variable provides a proxy for many omitted variables. Due to data constraint, the lag length is limited to one.

Tables 6 and 7 provide the causality test results for the two groups of countries. These results are derived from an MFR estimation of the basic model (5) in which the coefficient on the lagged dependent variable is country specific and the coefficients on the other independent variables are allowed to have a normal distribution. The mean and variance of each of the independent variables are given in the tables. The variance estimates in both tables indicate the presence of heterogeneity across the two panels.

Table 6 shows the results for the HIPC group. Both the government expenditure and M2 variables, expressed as a ratio of GDP, have a statistically significant positive causal impact on per capita income growth. Interestingly, the variance of the government expenditures variable, while large, is much smaller relative to the mean than the variance of the M2 variable. This indicates that the degree of heterogeneity across the countries in the sample is smaller for government fiscal policy than for monetary policy. As the M2/GDP variable measures the degree of financial deepening in a country, the results suggest that the degree of financial deepening has varied significantly across countries.

The growth rate of export also has a significantly positive causal impact on per capita income growth. This represents the positive impact that export-oriented growth strategy, embraced by many of these low-income countries, had since the early 1980s. Initial level of per capita GDP has the anticipated negative sign while the investment/GDP ratio has the anticipated positive sign. Both are statistically significant.

As for our main variable of interest, debt, the result is consistent irrespective of the debt measure employed. Debt has a statistically significant negative causal impact on per capita real GDP growth in the HIPC group. Not only is the mean impact negative, but the relatively small value of the variances indicates that this relationship is universal across the panel.

Interestingly, Table 7 also reports similar results for the non-HIPC group. All four debt measures have a statistically significant negative causal impact on per capita real GDP growth. The results are universal across the panel as indicated by the small variances. The findings for the remaining variables are not significantly different from those reported in Table 6.

Finally, in Table 8, following the method suggested in Nair-Reichert and Weinhold (2001), we check for the robustness of the results. From a theoretical standpoint, the MFR estimation has built-in diagnostics in the form of the estimated variances that show whether the results are influenced by a few outlier countries. To make sure that this has not been the case, a cross-validation leverage check is performed in which one country from each panel is dropped from the dataset and the model is reestimated with the remaining countries. For instance, for the HIPC group, the model is reestimated by dropping one of the 35 countries at a time. This process is repeated 35 times so that any undue effects of an outlier country will be reflected by significantly different results for the sample omitting that country. Similar procedure is employed for the twenty-five non-HIPC countries.

Table 8 (a) shows that, for the HIPC countries, the standard deviation of the mean estimate is quite low at 0.093 and the range varies from 0.311 to 0.402. The level of significance of

the mean estimate is very high, with the average t-statistics significant at least at the 5 per cent level.

Table 8 (b) reports the results for the non-HIPC group. The results are similar to Table 8 (a). The mean estimate is highly significant and the range varies from 0.5175 to 0.7004. Again, the standard deviation of the mean estimate is only 0.0561 and the mean is statistically significant. These results indicate the robustness of our findings and the absence of any outlier country in the sample.

6 Conclusions

The multilateral donor institutions have identified forty-one countries to be eligible for the HIPC Initiative and is seeking a solution to their debt problems by combining substantial debt reduction with policy reforms to raise long-term growth and reduce poverty. The findings in this paper show that the economic malaise due to foreign indebtedness is not limited to the HIPC group. Other low- and middle-income countries suffering from either severe or moderate indebtedness have also experienced a similar adverse effect on long-term economic growth.

The paper aims to enhance the existing literature on the debt-growth nexus by analysing the relationship in two separate country groups using the extreme bounds analysis for sensitivity tests and the mixed, fixed and random coefficient approach that allows for heterogeneity in the causal relationship between debt and growth. Irrespective of the debt measure used, the results are robust across the two separate country groups, HIPC and non-HIPC, as well as two different testing procedures. The extreme bounds analysis shows that the relationship between a debt measure and economic growth is robust to changes in the conditioning set of information included in the regression equations. The mixed, fixed and random coefficient approach, on the other hand, shows a statistically significant negative causal impact running from each of the four debt measures to economic growth in both country groups.

From the policy perspective, the findings have important implications. If the objective of the debt-debate is to enhance the long-term growth prospects of the indebted countries, it may not be enough to limit the debt reduction initiatives only to the forty-one HIPC group. Countries outside the HIPC Initiative are also finding themselves in a vicious cycle of debt, low growth, poverty, and still higher debt. Without going into the merits of the proposals for debt write-off for all countries, it can be safely asserted that the initiative has to be extended to all the indebted countries, and not only to a selected few. Only then can the fruits of economic growth be enjoyed by all people. Otherwise, the debt-debate would continue in the near future without any net tangible improvement as new countries would inevitably join the ranks of countries that find their debt unsustainable.

Table 1
Results from the extreme bound analysis
of the various debt measures in thirty-five countries in HIPC group

M-Variable	Bound	b_m	R^2	Z
TDS/GDP	high	-0.548 (2.01)	0.41	EXP/GDP, GOVTEX/GDP, INF
	base	-0.663 (2.61)	0.42	
	low	-0.918 (3.16)	0.47	EXP/GDP, GOVTEX/GDP, M2GDP
TDS/EXP	high	-0.022 (3.10)	0.38	EXP/GDP, GOVTEX/GDP, M2/GDP
	base	-0.31 (3.66)	0.41	
	low	-0.36 (3.79)	0.44	GOVTEX/GDP
DEBT/GDP	high	-0.681 (2.07)	0.49	EXP/GDP, GOVTEX/GDP, INF
	base	-0.873 (2.55)	0.50	
	low	-0.910 (3.31)	0.51	INF, GOVTEX/GDP
DEBT/EXP	high	-0.104 (3.81)	0.33	M2/GDP, GOVTEX/GDP
	base	-0.098 (3.50)	0.35	
	low	-0.084 (2.87)	0.35	EXP/GDP

Note: The base 'b' is the estimated coefficient of the M-variable in equation (1) when per capita GDP growth is regressed, using 2SLS, on the M- and I-variables. The high 'b' is the estimated coefficient from the regression with the extreme high bound (b_m + two standard deviations); the low 'b' is the coefficient from the regression with the extreme lower bound. The I variables are the lagged value of the log of per capita GDP, Investment/GDP, and population growth rate. In the Z column are the additional variables that produce the extreme bounds (high and low, respectively). These variables are the export/GDP ratio (EXP/GDP), government expenditures/GDP ratio (GOVTEX/GDP), M2/GDP, and inflation rate (INF). The figures in parentheses are the absolute values of the t-statistics.

Table 2
Results from the extreme bound analysis
of the various debt measures in twenty-five countries in non-HIPC group

M-Variable	Bound	b_m	R^2	Z
TDS/GDP	high	-0.093 (2.34)	0.39	EXP/GDP,GOVTEX/GDP,M2/GDP
	base	-0.104 (3.01)	0.39	
	low	-0.119 (3.00)	0.37	EXP/GDP,INF
TDS/EXP	high	-0.210 (4.37)	0.27	EXP/GDP,GOVTEX/GDP,M2/GDP
	base	-0.169 (2.20)	0.28	
	low	-0.155 (2.16)	0.28	INF
DEBT/GDP	high	-0.366 (3.77)	0.40	EXP/GDP,INF
	base	-0.344 (3.22)	0.39	
	low	-0.219 (4.15)	0.34	INF
DEBT/EXP	high	-0.055 (2.77)	0.41	EXP/GDP,GOVTEX/GDP,INF
	base	-0.076 (2.89)	0.42	
	low	-0.070 (2.95)	0.38	GOVTEX/GDP

See notes to Table 1.

Table 3
Contemporaneous OLS fixed effects panel regressions
for thirty-five countries in HIPC group

Variables	(1)	(2)	(3)	(4)
TDS/GDP	-0.780 (3.69)			
TDS/EXP		0.025 (1.06)		
DEBT/GDP			-0.057 (2.06)	
DEBT/EXP				-0.003 (1.44)
GDP	-1.246 (3.22)	-1.875 (4.10)	-1.567 (3.65)	-2.006 (4.54)
INV	0.769 (3.88)	0.610 (2.81)	0.875 (2.94)	0.591 (2.49)
GEXP	2.104 (3.65)	1.022 (2.85)	1.359 (3.10)	0.942 (2.08)
GOVTEX/GDP	0.709 (4.06)	0.366 (2.01)	0.070 (1.40)	0.085 (1.55)
M2/GDP	1.802 (4.20)	0.780 (3.86)	1.603 (4.85)	0.743 (2.34)
R^2	0.36	0.39	0.31	0.37

Note: The dependent variable is the growth rate of real per capita GDP. The column headings (1)-(4) represent the four debt measures, TDS/GDP, TDS/EXP, DEBT/GDP, and DEBT/EXP, respectively. Fixed effects are not shown. The figures in parentheses are the absolute values of the heteroskedasticity-consistent t-statistics.

Table 4
Contemporaneous OLS fixed effects panel regressions
with interaction term for the thirty-five countries in HIPC group

Variables	(1)	(2)	(3)	(4)
TDS/GDP	-0.159			
	(3.77)			
TDS/EXP		-0.310		
		(5.77)		
DEBT/GDP			-0.619	
			(7.40)	
DEBT/EXP				-1.135
				(6.08)
GDP	-2.683	-2.769	-3.844	-1.504
	(3.20)	(3.99)	(4.09)	(2.68)
INV	0.997	1.054	1.399	1.086
	(4.20)	(5.87)	(5.96)	(4.02)
GEXP	4.166	2.960	1.008	0.602
	(7.25)	(6.32)	(3.78)	(2.95)
GOVTEX/GDP	2.004	1.306	0.576	0.085
	(3.88)	(4.77)	(3.90)	(2.01)
M2/GDP	0.365	0.195	0.720	0.565
	(2.95)	(1.98)	(3.66)	(2.65)
OPEN1	-0.642			
	(4.95)			
OPEN2		-0.409		
		(7.35)		
OPEN3			-1.044	
			(5.76)	
OPEN4				-3.042
				(5.31)
R^2	0.49	0.47	0.41	0.39

Note: The dependent variable is the growth rate of real per capita GDP. The column headings (1)-(4) represent the four debt measures, TDS/GDP, TDS/EXP, DEBT/GDP, and DEBT/EXP, respectively. OPEN1, OPEN2, OPEN3, and OPEN4 are the interaction terms of the four debt variables and the export/GDP ratio, respectively. Fixed effects are not shown. The figures in parentheses are the absolute values of the heteroskedasticity-consistent t-statistics.

Table 5
Contemporaneous OLS fixed effects panel regressions
for twenty-five countries in non-HIPC group

Variable	(1)	(2)	(3)	(4)
TDS/GDP	-0.256			
	(2.49)			
TDS/EXP		-0.199		
		(3.76)		
DEBT/GDP			-0.033	
			(1.99)	
DEBT/EXP				-0.176
				(4.32)
GDP	-3.375	-2.291	-3.416	-3.501
	(3.94)	(2.85)	(4.71)	(6.05)
INV	0.825	0.571	1.323	0.985
	(4.43)	(3.81)	(5.16)	(3.25)
GEXP	0.333	0.610	1.004	0.778
	(2.61)	(4.25)	(4.50)	(2.20)
GOVTEX/GDP	4.590	3.166	3.090	2.059
	(5.14)	(6.24)	(6.71)	(3.52)
M2/GDP	0.622	0.513	0.890	0.056
	(1.98)	(2.06)	(2.13)	(2.88)
OPEN1	-0.095			
	(1.77)			
OPEN2		0.008		
		(2.15)		
OPEN3			-0.128	
			(1.85)	
OPEN4				-0.063
				(3.80)
R^2	0.24	0.19	0.31	0.25

Note: The dependent variable is the growth rate of real per capita GDP. The column headings (1)-(4) represent the four debt measures TDS/GDP, TDS/EXP, DEBT/GDP, and DEBT/EXP, respectively. OPEN1, OPEN2, OPEN3, and OPEN4 are the interaction terms of the four debt variables and the export/GDP ratio, respectively. Fixed effects are not shown. The figures in parentheses are the absolute values of the heteroskedasticity-consistent t-statistics.

Table 6
Causality tests in a mixed, fixed random model;
Thirty-five countries in HIPC group, 1982-98

Variable	(1)	(2)	(3)	(4)
TDS/GDP	-0.714			
	(3.67)			
	[1.46]			
TDS/EXP		-1.190		
		(4.70)		
		[2.16]		
DEBT/GDP			-2.440	
			(7.66)	
			[8.15]	
DEBT/EXP				-6.355
				(12.14)
				[8.32]
GDP	-1.491	-1.282	-1.508	-1.611
	(3.12)	(3.40)	(5.32)	(5.18)
	[17.34]	[20.76]	[35.18]	[32.10]
INV	1.265	1.452	1.710	0.952
	(3.90)	(4.37)	(5.10)	(2.55)
	[20.16]	[23.08]	[37.20]	[19.44]
GEXP	1.375	2.411	4.400	0.785
	(2.90)	(6.25)	(7.85)	(3.95)
	[8.55]	[15.76]	[20.16]	[40.02]
GOVTEX/GDP	2.076	1.992	0.988	0.342
	(3.15)	(7.12)	(3.76)	(3.10)
	[16.21]	[24.60]	[19.05]	[28.66]
M2/GDP	0.108	0.394	0.480	0.990
	(2.19)	(4.70)	(5.13)	(4.29)
	[21.43]	[18.35]	[16.44]	[17.77]

Note: The figures in parentheses ( ) are the absolute values of the t-statistics while the figures in bracket [ ] are the coefficient variance. For a description of the Table, see notes to Tables 3 and 4.

Table 7
Causality tests in a mixed, fixed random model;
Twenty-five countries in non-HIPC group

Variable	(1)	(2)	(3)	(4)
TDS/GDP	-0.311 (2.88) [1.99]			
TDS/EXP		-1.774 (3.89) [1.76]		
DEBT/GDP			-1.856 (3.54) [6.10]	
DEBT/EXP				-2.040 (2.64) [1.34]
GDP	-3.371 (3.20) [20.78]	-3.380 (3.75) [28.24]	-2.265 (2.98) [34.10]	-3.229 (3.04) [38.90]
INV	1.044 (4.98) [12.76]	1.050 (4.65) [14.20]	1.420 (5.16) [22.40]	1.772 (5.62) [30.66]
GEXP	0.242 (2.16) [5.10]	0.056 (2.05) [8.22]	0.128 (3.11) [6.24]	0.317 (3.63) [10.56]
GOVTEX/GDP	0.410 (2.99) [20.18]	0.585 (3.84) [33.81]	0.281 (2.06) [40.16]	0.699 (4.28) [35.90]
M2/GDP	0.166 (1.98) [29.71]	0.078 (1.88) [38.30]	0.132 (2.06) [24.77]	0.095 (1.80) [40.26]

Note: The figures in parentheses ( ) are the absolute values of the t-statistics while the figures in bracket [ ] are the coefficient variance.

Table 8 (a)
Cross-validation check of the results
for the thirty-five countries in the HIPC group

Variable	Mean	Std. dev	Minimum	Maximum
a	0.3527	0.0362	0.3117	0.4025
t-stat.	3.710	0.383	2.412	4.926

Table 8 (b)
Cross-validation check of the results
for the twenty-five countries in the non-HIPC group

Variable	Mean	Std. dev	Minimum	Maximum
a	0.6224	0.0561	0.5175	0.7004
t-stat.	4.051	0.443	3.455	3.016

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