

**EXTERNAL DEBT RELIEF INITIATIVES AND  
ECONOMIC GROWTH IN LEAST DEVELOPED  
COUNTRIES**

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**ABSTRACT**

In the late 1990s, the World Bank and the International Monetary Fund (IMF) initiated a series of debt relief programs for highly indebted poor countries (HIPCs) based on the idea that high levels of indebtedness impede growth by discouraging domestic and foreign investment. This paper examines the relationship between external debt and growth with a focus on the effects of multilateral debt relief. In particular, we use a sample of 33 least developed countries (LDCs) over the period 1970-2010 to explore the impact of indebtedness on growth before and after participating in the debt relief initiatives. In contrast to previous studies, we employ a combination of parametric and non-parametric methods to investigate the linear and nonlinear aspects of the debt-growth relationship. In the non-parametric analysis, we model growth as a discrete-time Markov process and estimate the transition probabilities for HIPCs. The results show that lower debt levels stimulate economic growth. The average impact of debt on growth in HIPCs becomes negative at about 64-78% of GDP depending on the initial growth conditions. In the period after joining the debt relief initiatives, HIPCs generally exhibited a higher chance of moving towards or persisting in the positive range of growth. However, this process was related to lower debt levels mostly in countries that had initially exhibited moderate to rapid growth, while debt relief seems to have been less relevant for future growth in countries that started off in a state of moderate economic decline. Furthermore, the results of the regression analysis show that the marginal effect of public and publicly guaranteed (PPG) debt on growth is negative and significant. Debt relief programs were found to mitigate the negative impact of debt, both after their initiation in 1996 and after the HIPCs reached their decision point. Generally, the overarching policy that can be drawn from this paper is that LDCs, and HIPCs in particular, should strive to reduce their PPG debt levels to at least below 64%-78% of GDP in order to experience and maintain positive growth rates, *ceteris paribus*. Notwithstanding, our findings also suggest that if HIPCs, and LDCs in general, want to reduce or maintain their debt to sustainable levels, they should adopt some of the conditions imposed by the international financial institutions on HIPCs as part of their macroeconomic policy framework, such as developing and implementing a poverty reduction strategy through a broad based participatory process.

**JEL Classifications:** F31, O47, O57

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## INTRODUCTION

Almost two decades after the initiation of the World Bank and International Monetary Fund (IMF) debt relief initiatives in heavily indebted poor countries (HIPCs), scholars are now in a position to fully evaluate the expected impact of these programs, especially on economic growth. While studies on public debt<sup>1</sup> and external debt<sup>2</sup> provide a good starting point, the literature on the debt relief – growth nexus is very limited due to data limitations. As a result, the majority of existing studies have drawn inferences on the impact of debt relief on growth based on indirect analysis. Only a few exceptions have explicitly evaluated these effects on growth using rigorous empirical analysis (Johansson 2010). Accordingly, the goal of this paper is to assess the economic impact of these international financial institutions' (IFIs) multilateral debt relief initiatives on the recently observed positive economic growth in least developed countries (LDCs) while controlling for policy, institutional, and key economic factors. In contrast to previous studies, we employ a combination of parametric and non-parametric specifications to explore the relationship between debt, debt relief initiatives, and economic growth of LDCs.

In the non-parametric analysis, we model growth as a discrete-time Markov process and estimate the transition probabilities of LDCs and HIPCs for different positive and negative ranges of growth. Next, we link the transition probabilities to the corresponding levels of debt, which allows us to pinpoint the debt thresholds that cause growth to turn negative. This procedure is used for the sample period of 1970-2010 as well as for the years before and after LDCs participated in the HIPCs debt relief initiatives. The effects of debt relief on growth are then derived from a comparison between the two subperiods.

In the parametric analysis, we employ the generalized method of moments (GMM) technique to estimate growth regression models over the period of 1984-2010. The role of the debt relief initiatives is assessed by introducing an interaction term into the regression model that enables us to estimate the additional marginal effect of debt on growth as a result of participating in the HIPCs debt relief programs. In particular, the interaction term takes two forms. First, the debt coefficient interacts with a dummy variable for the period 1996-2010 capturing the accrued benefits from engaging in the HIPCs initiative process, regardless of whether a country successfully completes the process or not. By using this term, we postulate that the potential future debt forgiveness will stimulate these countries to engage in growth enhancing activities as they work to meet the debt relief requirements. Second, the debt coefficient interacts with the decision point dummy focusing only on those countries that actually reach the decision point, the first stage in the two-stage debt forgiveness process, and qualify to continue to the completion point.

Generally, our results show that lower debt levels stimulate economic growth. Moreover, the average impact of debt on growth in HIPCs becomes negative at about 64-78% of gross domestic product (GDP) depending on the initial growth conditions. Further, we show that debt relief initiatives reduce the negative marginal effect of debt on growth.

## BACKGROUND AND RELATED LITERATURE

Sweeping macroeconomic policy reforms under the IMF structural adjustment programs were introduced in most developing countries in the 1980s as a way to get these countries back onto a sustained economic growth path. By the mid-1990s, it was increasingly clear that a bolder approach was needed to address excessive debt that was detrimental to the growth performance of many developing countries. In response, the World Bank and the IMF introduced the HIPC's debt relief initiative in 1996, followed by an enhanced HIPC's initiative in 1999 and the Multilateral Debt Relief Initiative (MDRI) in 2005. The objective of the HIPC's debt relief initiatives and MDRI, which distinguishes them from other bilateral donor debt relief programs such as the Paris club, was to reduce the multilateral public and publicly guaranteed (PPG) debt (beyond the traditional debt relief mechanisms provided by official bilateral and private creditors) of the poorest eligible countries to sustainable levels and to ensure a permanent exit from repeated debt rescheduling (Fonchamnyo 2009). In return, this would eliminate, or at best, reduce the debt overhang and liquidity constraint effects, increasing investment activities and, consequently, economic growth.

Debt relief programs have been embraced by proponents as a necessary policy tool for tackling the poverty problem in low-income countries. By reducing the debt stock, and thereby the debt service payments, these programs are expected to improve the fiscal space (Heller 2005) of beneficiary countries, enabling them to channel their scarce resources into more productive areas (Bird and Milen 2003). In contrast, critics of debt relief programs have argued that low-income countries, unlike middle-income countries, do not suffer from a debt overhang<sup>3</sup> but rather, from low-quality institutions (Arslanalp and Henry 2005; Asiedu 2003) and lack a sound macroeconomic environment (Presbitero 2008). In fact, debt relief may actually worsen the economic situation in these countries by lowering the incentives for institutional and key macroeconomic reforms due to moral hazard (Bauer 1991; Easterly 2002) and adverse selection on the part of donor countries (Buiter and Srinivasan 1987).

Results based on direct empirical analysis of the effects of debt relief on growth are mixed. Hussain and Gunter (2005), Fonchamnyo (2009), and Yang and Nyberg (2009) agree that debt relief stimulated growth and reduced poverty in HIPC's. However, a narrow export base and the deterioration in the terms of trade coupled with weak policy and institutional frameworks seem to have eroded some of the beneficial effects of debt relief. Johansson (2010), Chauvin and Kraay (2005), and Presbitero (2009), on the other hand, do not find any robust effects of debt relief on growth and show that institutional quality does not play a role in the debt relief – growth relationship.

Furthermore, Pattillo et al. (2011) found the relationship between external debt and growth in developing countries to be non-linear and hump-shaped. They estimated that the marginal impact of debt on growth turns negative for debt levels above 25% of gross domestic product (GDP) and 70% of exports.<sup>4</sup> Cordella et al. (2005) report similar findings in a sample of 80 developing countries (with 30 HIPC's), but also show that in countries with bad policies and institutions the threshold at which the effect of debt becomes negative is much lower (10-15% of GDP). While these threshold levels tend to vary across samples (based on income level) and within samples (depending on macroeconomic policies and institutional quality), the potential economic implications cannot be ignored. For example,

these findings suggest that debt relief programs can mitigate the detrimental effects of high levels of indebtedness, however the effectiveness and magnitude of these programs may vary widely across countries, affecting panel regression estimates.

## METHODOLOGY

### Non-parametric Model

The non-parametric analysis involves the modeling of growth in a dynamic framework. For this purpose, we design a discrete-time Markov matrix that contains the estimated probabilities of a transition from an initial state  $i$  at time  $t$  to a state  $j$  at time  $t+\tau$ . The main diagonal of the matrix is an indicator of persistence showing the probabilities of an observation remaining in the same state in  $t$  and  $t+\tau$ . We express each transition as the movement from a growth rate at time  $t$  to a growth rate at time  $t+1$ . Given that we use the average annual growth rate over a 3-year period, we in fact estimate the transition probabilities of a country moving from one 3-year growth period to the next. These probabilities are then related to the corresponding average levels of debt at the initial time  $t$ . This procedure enables us to determine the debt thresholds that result in positive or negative growth before and after joining the HIPC's debt relief initiatives.

Furthermore, we test the robustness of our results in a continuous space by estimating the marginal effect of debt on growth (both measured as an average over a 3-year period) conditioned on the initial level of debt at the beginning of the 3-year period. We illustrate the results graphically as non-parametric methods do not yield scalar estimates of marginal effects.

### Parametric Model

The parametric model is estimated using the following regression specification:

$$\begin{aligned} \Delta y_{it} = & \beta_0 + \beta_1 y_{it-\tau} + \beta_2 Debt_{it-\tau} + \beta_3 d1996 + \beta_4 dd + \beta_5 d1996 * \\ & Debt_{it-\tau} + \beta_6 dd * Debt_{it-\tau} + \beta_7 dtropic * Debt_{it-\tau} + \beta_8 Open_{it-\tau} + \\ & \beta_9 Inv_{it-\tau} + \beta_{10} Gov_{it-\tau} + \beta_{11} Infl_{it-\tau} + \beta_{12} Polity2_{it-\tau} + \\ & \beta_{13} Totgr_{it-\tau} + \beta_{14} ODA_{it-\tau} + \beta_{15} FD_{it-\tau} + \eta_t + \nu_i + \varepsilon_{it} \end{aligned} \quad (1)$$

where  $y_{it}$  is the natural logarithm of real output per capita in country  $i$  at time  $t$ . Country-specific and time fixed effects are denoted by  $\nu_i$  and  $\eta_t$ , respectively.  $\Delta y_{it}$  is the average annual growth rate of output per capita in country  $i$  between the years  $t$  and  $t-\tau$ , where  $\tau$  takes the value of 3. In line with the growth literature, we average the growth rate across 3-year non-overlapping periods. All independent variables are initial values at the beginning of each 3-year period with the exception of terms of trade growth (*Totgr*), which is averaged over the 3-year period. The major right-hand side variables of interest are external debt (*Debt*) and the two interaction terms (*d1996\*Debt* and *dd\*Debt*). We focus on external PPG debt since it constitutes the bulk of LDCs external debt, but we also evaluate the effects of total external debt. Debt stock is expressed as a percentage of GDP, measuring the debt overhang effects. Two dummies, which are entered as standalone arguments, as well as interaction terms with the debt variable, capture the resulting

unconditional and conditional economic growth effects accruing in those countries committed to the debt relief initiative process. The 1996 dummy variable (*d1996*) takes the value of 1 over the years 1996-2010, and 0 otherwise. The decision point dummy (*dd*) takes the value of 1 between the year a country reached its decision point in the debt forgiveness process and 2010, and 0 otherwise. The coefficients of the interaction terms are interpreted as the additional marginal effects of initial debt on real per capita GDP growth after the introduction of the debt relief in 1996 or after reaching the decision point. We expect the interaction terms to be positive, signifying the reduced debt burden on the domestic economic resources.

The growth literature (Barro 1991; Levine and Renelt 1992; Sala-i-Martin et al. 2004) guides us in selecting the core set of growth determinants; however the estimated model variables are constrained by the available data. The initial level of output per capita ( $y_{it-\tau}$ ) is included to test for the presence of  $\beta$ -convergence. Furthermore, we include variables for trade openness (*Open*), measured as the percentage of merchandise trade in GDP, fiscal policy (*Gov*) represented by government consumption spending, and monetary policy (*Infl*), which is calculated as the logarithm of (1+ CPI inflation rate). Governance is measured by the Polity2 index reported on a scale of -10 to +10; with -10 indicating strongly autocratic (political suppression) and +10 strongly democratic (political freedom) political systems. The proportion of money supply (M2) in GDP is used as a proxy for the depth of the financial market development (*FD*). Official development assistance (*ODA*), which is the largest source of development funds in most LDCs, is expected to have a positive effect on growth. Investment (*Inv*) captures the direct effects of domestic investment activities on growth, while the terms of trade growth (*Totgr*) controls for external shocks. Additionally, following Easterly and Levine (2003), a dummy variable for the countries in the tropics interacted with the debt variable (*dtropic\*Debt*) is included to assess whether long lasting institutions (proxied by the tropics dummy, *dtropic*) determine the debt impact on growth.

The regression estimation is conducted using the system GMM (SGMM) approach of Arellano and Bover (1995) and Blundell and Bond (1998), which controls for endogeneity bias, measurement bias, unobserved country fixed effects, and other potentially omitted variables. Relative to the difference GMM, SGMM is robust to weak instrument bias. It uses suitable lagged levels and lagged first differences of the regressors as their instruments. To minimize the number of GMM-style instruments used, we restrict the maximum lags of dependent and predetermined variables for use as instruments to one. Furthermore, time dummies are included to remove universal time-related shocks from the errors (Roodman 2006).

## Data

The non-parametric analysis is conducted using a sample of 33 LDCs (including 25 HIPC) over the period 1970-2010 (see Table 1.1). The economic variables were collected from the Penn World Table version 7.1 (Heston, Summers & Aton 2012), the World Bank's World Development Indicators and the United Nations Conference on Trade Development. The Polity2 governance index was obtained from the Polity IV Project (Marshall and Jaggers 2011). Table 1.2 contains the descriptive statistics for the selected variables of the growth regressions.

**TABLE 1.1. LIST OF COUNTRIES USED IN THE ANALYSIS**

Bangladesh	Gambia, The* (Dec. 2000)	Nepal
Bhutan	Guinea* (Dec. 2000)	Niger* (Dec. 2000)
Benin* (July 2000)	Guinea-Bissau* (Dec. 2000)	Rwanda* (Dec. 2000)
Burkina Faso* (July 2000)	Laos	Senegal* (June 2000)
Burundi* (Aug. 2005)	Lesotho	S. Leone* (March 2002)
Cambodia	Liberia* (March 2008)	Solomon Islands
Central Afr. Rep.* (Sept. 2007)	Madagascar* (Dec. 2000)	Sudan* (pre-decision)
Chad* (May 2001)	Malawi* (Dec. 2000)	Togo* (Nov. 2008)
Comoros* (June 2010)	Mali* (Aug. 2000)	Uganda* (Feb. 2000)
Congo, Dem. Rep.* (April 2006)	Mauritania* (Feb. 2000)	Zambia* (Dec. 2000)
Ethiopia* (Nov. 2001)	Mozambique* (April 2000)	Vanuatu

*Note: \* indicates participation in the HIPC debt relief initiatives. Decision point dates are in parenthesis.*

**TABLE 1.2. DESCRIPTIVE STATISTICS FOR SELECTED REGRESSION VARIABLES (1984-2010)**

<b>Variable</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>N</b>
Real GDP per capita growth	1.09	5.18	-23.22	39.41	297
PPG debt (% of GDP)	84.18	77.62	0.10	690.83	296
<i>d1996</i> *PPG debt	47.25	71.12	0.00	690.83	296
<i>dtropic</i> *PPG debt	75.08	81.91	0.00	690.83	296
<i>dd</i> * PPG debt	14.77	39.89	0.00	411.36	296
Inflation	2.25	1.24	-5.78	7.41	265
M2 (% of GDP)	25.43	18.76	0.91	128.28	280
Openness (% of GDP)	56.95	32.45	8.12	182.12	297
Governance index	-1.76	5.92	-10.00	19.00	274
TOT growth	4.69	47.21	-239.72	245.94	297
Government Consumption (%)	14.93	11.11	2.41	66.36	297
Investment (%)	17.19	9.71	0.72	61.71	297
ODA (% of GDP)	19.69	1.05	17.11	21.98	297

*Note: The real GDP per capita growth and terms of trade (TOT) growth are averaged over 3-year periods. All other variables are initial values at the beginning of the period.*

## RESULTS

### Non-parametric Analysis

The transition matrix is presented in Table 2.1 and contains 4 states, two in the positive range and two in the negative range of growth. The ranges were chosen so as to have approximately the same number of transitions on each side of the zero point. Accordingly, the growth rate that marks the border between moderate and severe decline corresponded to -2.7% (-2.78% in the HIPC subsample), while the one that separates moderate from rapid growth was found to be 2.5% (2.24% in the HIPC subsample).

The first row of Table 2.1 shows the probabilities that an LDC, which initially exhibited severe decline, would move to another state in the following 3-year period. For example, an LDC that was initially in severe economic decline had a 31% chance of achieving rapid growth of more than 2.5% in the next 3-year period. The remaining three rows are interpreted in a similar fashion. Those countries that recorded moderate or rapid growth in the initial period had more than a 60% chance of remaining in the positive range of growth in the following period. Countries in severe decline were only slightly more likely to experience positive growth than to remain in decline in the future. The countries in moderate decline are the exception because the likelihood that they will exhibit positive growth was less than 40%. Overall, the transition probabilities for the LDCs and the HIPC subsample are very similar.

The average levels of initial total and PPG debt corresponding to the states of the transition matrix are displayed in Tables 2.2 and 2.3, respectively. In general, PPG debt follows a clear pattern: the lower the levels of initial PPG debt, the closer a country moves towards higher growth levels regardless of the initial state of the economy. In other words, higher growth rates are generally associated with lower levels of PPG debt. Moreover, higher (lower) transition probabilities (see Table 2.1) are linked to lower (higher) levels of debt. Another interesting aspect is the difference in the thresholds between negative and positive growth. LDCs that started off in severe decline had to achieve levels of indebtedness of less than 90% of GDP to be able to move to positive growth in the future. For those in moderate decline, the corresponding number was 83% of GDP. For HIPC subsamples in severe or moderate decline, the thresholds for reaching positive growth in the next period were even lower at 78% of GDP. The thresholds for persistence in the positive range of growth are less clearly defined but vary between 64% and 72% of GDP for the LDCs and between 64% and 69% of GDP for the HIPC subsamples.

Total debt in Table 2.2 follows a pattern similar to PPG debt except that thresholds are higher, which is the result of the more encompassing nature of total debt. LDCs in severe to moderate decline needed total debt levels of less than 95% of GDP to achieve positive growth in the next period.<sup>5</sup> For the HIPC subsample this number drops to between 84% and 93% of GDP. The required debt levels for persistence in the positive range of growth vary between 75% and 82% of GDP (between 71% and 76% in the case of HIPC subsamples). These thresholds appear much higher than those reported in previous studies. For instance, Pattillo et al. (2011) found that the average impact of debt becomes negative at between 35% and 40% of GDP, which is about half of our estimated levels. This is most likely the result of differences in methodology (non/parametric), sample choice (developing countries vs. LDCs), and sample period (1969-1998 vs. 1970-2010).

**TABLE 2. TRANSITION MATRIX AND DEBT LEVELS, 1970-2010****TABLE 2.1. TRANSITION MATRIX**

	<b>[-20; -2.78)</b>	<b>[-2.78; 0)</b>	<b>[0; 2.24)</b>	<b>[2.24; 20]</b>	<b>Nr. transitions</b>
<b>[-20; -2.78)</b>	0.20 (0.19)	0.25 (0.26)	0.25 (0.26)	0.31 (0.30)	<b>65</b> <b>(74)</b>
<b>[-2.78; 0)</b>	0.30 (0.29)	0.36 (0.33)	0.16 (0.18)	0.19 (0.20)	<b>64</b> <b>(76)</b>
<b>[0; 2.24)</b>	0.15 (0.15)	0.21 (0.18)	0.35 (0.36)	0.29 (0.31)	<b>75</b> <b>(103)</b>
<b>[2.24; 20]</b>	0.18 (0.13)	0.17 (0.15)	0.30 (0.30)	0.34 (0.41)	<b>76</b> <b>(105)</b>

*Note: Reported numbers represent the probability that a HIPC moves from an initial state to a final state of growth over the following 3 years. Probabilities for the entire LDC sample are in parenthesis.*

**TABLE 2.2. AVERAGE INITIAL LEVELS OF TOTAL DEBT**

	<b>[-20; -2.78)</b>	<b>[-2.78; 0)</b>	<b>[0; 2.24)</b>	<b>[2.24; 20]</b>
<b>[-20; -2.78)</b>	144.3 (135.4)	110.3 (100.7)	93.1 (92.9)	134.8 (122.4)
<b>[-2.78; 0)</b>	106.9 (99.9)	98.9 (92.2)	94.8 (85.4)	90.4 (74.6)
<b>[0; 2.24)</b>	171.7 (149.4)	69.1 (60.6)	70.8 (63.9)	74.4 (70.9)
<b>[2.24; 20]</b>	120.1 (106.7)	85.3 (71.9)	81.4 (76.6)	60.4 (60.5)

**TABLE 2.3. AVERAGE INITIAL LEVELS OF PPG DEBT**

	<b>[-20; -2.78)</b>	<b>[-2.78; 0)</b>	<b>[0; 2.24)</b>	<b>[2.24; 20]</b>
<b>[-20; -2.78)</b>	112.1 (105.3)	95.8 (88.9)	70.6 (72.3)	85.0 (77.7)
<b>[-2.78; 0)</b>	88.5 (83.4)	83.9 (79.8)	76.7 (77.9)	81.1 (66.9)
<b>[0; 2.24)</b>	115.0 (105.4)	56.2 (50.2)	64.0 (57.6)	62.1 (64.3)
<b>[2.24; 20]</b>	73.6 (62.5)	75.0 (62.8)	71.5 (69.4)	46.9 (52.8)

*Note: Tables 2.2. and 2.3 report the initial levels of debt for HIPCs (and for LDCs in parenthesis) corresponding to the states of the transition matrix in Table 2.1.*

The transition probabilities for the HIPCs subsample are presented in Table 3.1. Before joining the debt relief efforts, the probability of achieving or maintaining positive growth



was slightly higher (between 52% and 58%) than slipping into or persisting in economic decline. Only those HIPC countries that were initially in moderate decline were significantly more likely to remain in the negative range of growth. Once the HIPC countries reached the decision point and qualified for debt relief, transition probabilities change dramatically across all states of the matrix without exception. In particular, the likelihood of achieving or maintaining positive growth increases significantly to between 60% and 82%, while the probability of moving to or persisting in the state of severe decline is almost entirely eliminated. Although at this point in the analysis we cannot control for other factors, these results suggest that the debt relief initiatives had a very stimulating effect on growth in HIPC countries. The parametric analysis in the next section provides further evidence in support of this conclusion.

The corresponding levels of total and PPG debt are displayed in Tables 3.2 and 3.3, respectively. For the purpose of evaluating the effect of debt relief on the link between debt and growth, we compare the debt levels before and after reaching the decision point. This is done across the positive range of growth because stimulating economic activity complies with the goal of the debt relief initiatives. The results indicate that PPG as well as total debt levels after the decision point are much lower than before reaching this point. HIPC countries that initially experienced moderate to rapid growth exhibit the largest reductions in debt levels of up to 50%, which also correspond to the highest transition probabilities towards positive growth in the matrix in Table 3.1. These findings suggest that debt relief was successful in reducing indebtedness and stimulating growth in most but not all cases. In the states associated with negative initial growth the gains from debt relief appear much smaller. In the case of moderate growth, the effect is even reversed as lower debt levels after the decision point are correlated with persistence in the negative range of growth. In other words, those HIPC countries that recorded initial decline of up to -2.78% had a higher likelihood of moving towards positive growth in the next period after reaching the decision point but this was not related to lower debt levels as a result of debt relief.

We test the robustness of the above results in continuous space by creating three-dimensional graphs for the LDC sample and the HIPC countries subsample shown in Figure 1, which allow us to study the marginal effect of debt on growth given the initial level of indebtedness.<sup>6</sup> We also display two-dimensional plots that represent the relationship between debt and growth for three specific levels of initial debt (50%, 100%, and 200% of GDP).

The peaks in the three-dimensional plots clearly show that lower levels of average debt are associated with higher (positive) growth. The more indebted a country becomes, the slower it grows as illustrated by the increasingly smaller peaks that eventually reverse into the negative range of growth. The two-dimensional plots further visualize this relationship and suggest that it is robust across the different initial levels of indebtedness. Moreover, the marginal effect of debt on growth, represented by the slope of the lines, seems to be almost the same regardless of the initial level of debt. Interestingly, the hump-shaped line at the 100% level of initial debt corresponds almost exactly to the nonlinear relationship between debt and growth graphed by Pattillo et al. (2011) [see Figure 4 in their paper].

**TABLE 3. TRANSITION MATRIX AND DEBT LEVELS, 1970-2010****TABLE 3.1. TRANSITION PROBABILITIES**

	<b>[-16; -2)</b>	<b>[-2; 0)</b>	<b>[0; 2)</b>	<b>[2; 20]</b>	<b>Nr. transitions</b>
<b>[-16; -2)</b>	0.20 (0.00)	0.25 (0.20)	0.15 (0.40)	0.40 (0.40)	<b>40</b> <b>(5)</b>
<b>[-2; 0)</b>	0.30 (0.20)	0.39 (0.20)	0.12 (0.40)	0.19 (0.20)	<b>43</b> <b>(5)</b>
<b>[0; 2)</b>	0.17 (0.00)	0.26 (0.23)	0.29 (0.32)	0.29 (0.46)	<b>35</b> <b>(22)</b>
<b>[2; 20]</b>	0.23 (0.09)	0.26 (0.09)	0.29 (0.35)	0.23 (0.48)	<b>35</b> <b>(23)</b>

*Note: Reported numbers represent the probability that a HIPC moves from an initial state to a final state of growth over the following 3 years. Probabilities for the entire LDC sample are in parenthesis.*

**TABLE 3.2. AVERAGE INITIAL LEVELS OF TOTAL DEBT**

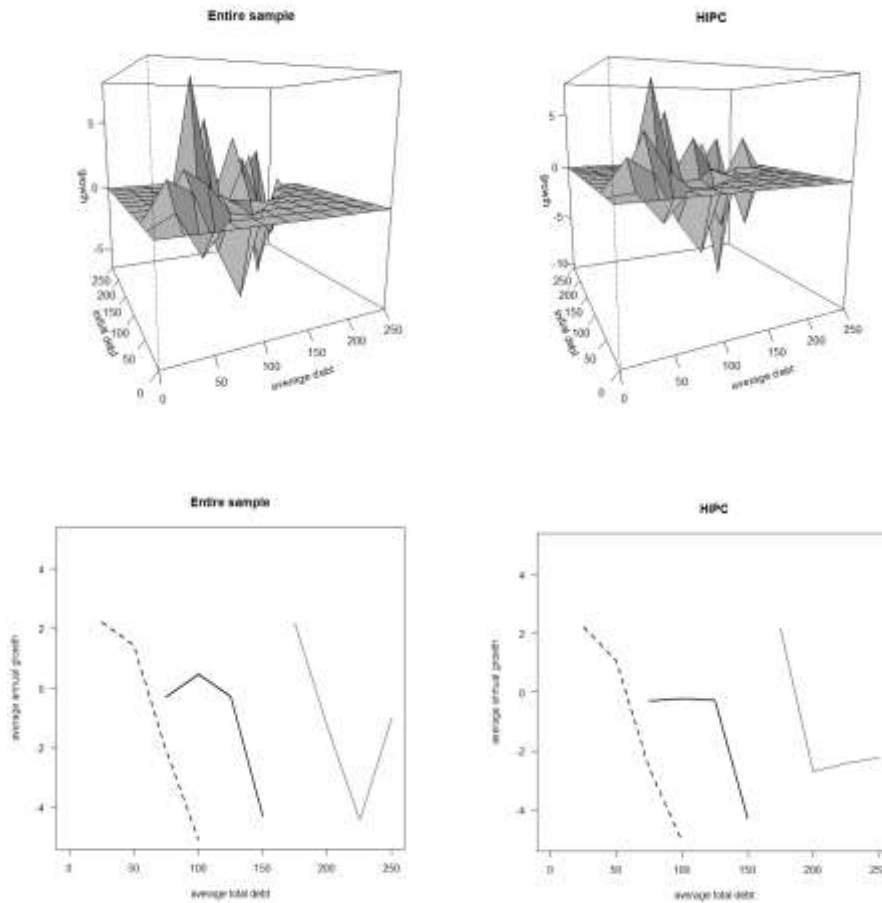
	<b>[-16; -2)</b>	<b>[-2; 0)</b>	<b>[0; 2)</b>	<b>[2; 20]</b>
<b>[-16; -2)</b>	126.9 (0.00)	100.2 (304.3)	73.6 (67.0)	88.8 (72.1)
<b>[-2; 0)</b>	109.4 (76.3)	97.3 (88.2)	57.3 (160.1)	108.1 (132.8)
<b>[0; 2)</b>	103.9 (0.00)	72.2 (56.9)	91.5 (44.7)	63.1 (46.3)
<b>[2; 20]</b>	68.2 (70.5)	93.5 (42.7)	87.9 (62.3)	85.5 (43.2)

**TABLE 3.3. AVERAGE INITIAL LEVELS OF PPG DEBT**

	<b>[-16; -2)</b>	<b>[-2; 0)</b>	<b>[0; 2)</b>	<b>[2; 20]</b>
<b>[-16; -2)</b>	95.3 ( - )	86.7 (263.0)	53.2 (51.7)	72.7 (68.6)
<b>[-2; 0)</b>	87.4 (69.1)	82.6 (81.6)	49.5 (139.2)	97.6 (117.4)
<b>[0; 2)</b>	89.7 ( - )	55.3 (50.3)	84.1 (40.9)	56.2 (41.1)
<b>[2; 20]</b>	60.4 (64.1)	81.9 (37.9)	77.5 (55.2)	72.2 (35.7)

*Note: Tables 2.2 and 2.3 report the initial levels of debt for HIPCs (and for LDCs in parenthesis) corresponding to the states of the transition matrix in Table 2.1.*

**FIGURE 1. THE RELATIONSHIP BETWEEN GROWTH AND TOTAL DEBT  
CONDITIONAL ON INITIAL LEVEL OF DEBT, 1970-2010**



*Note: The bottom plots represent snapshots of the 3-dimensional plots and show the change in average growth in response to a change in total debt conditional on an initial level of debt of 50% (dashed), 100% (solid), and 200% (dotted).*

Lastly, the plots in Figure 1 enable us to determine the thresholds for the negative effect of debt on growth. Countries with initial debt of 50% of GDP needed average debt levels of less than 70% of GDP to achieve or maintain positive growth, which is approximately the same as the threshold estimated in Table 3.2. Moreover, the average impact of debt turns negative at about 120% of GDP for initial levels of debt of 100% of GDP.

### Growth Regressions

The results of the SGMM regressions are reported in Table 4. For each estimation technique, we run two sets of regressions corresponding to the external public and publicly guaranteed (PPG) debt and total external debt. Additionally, for each type of debt, we estimate two models to take into account the unconditional and conditional effects of the debt relief programs. The unconditional effects are captured by the dummy variables (*d1996* and *dd*) entered as standalone arguments (columns 1 and 3). The conditional effects on the other hand, are measured by the interaction terms of the debt and dummy variables (*d1996\*debt* and *dd\*debt*). The results for the latter are reported in columns 2 and 4.

Evidence of the debt overhang in HIPCs, low-income and other developing countries has been established in the literature (Clements et al. 2003; Fosu 1999; Elbadawi et al. 1997; Chowdhury 2001; Desphande 1997; Pattillo et al. 2011). Yet, Arslanalp and Henry (2005) argue that relative to middle-income countries, low-income countries do not suffer from a ‘genuine’ debt overhang. Our results, however, confirm the presence of debt overhang in LDCs, though it is only under the PPG specification that these effects are significant. A 10% increase in initial PPG debt for example, leads to approximately 0.2% decline in per capita real GDP growth for the subsequent 3-year period (column 1).

The presence of the debt overhang is key to justifying the debt relief programs that have been ongoing in developing countries, especially the low-income and least developed countries. A few studies have engaged in rigorous empirical analysis of direct effects of the debt relief programs on growth (Johansson 2010). The challenge, nonetheless, is finding a precise measure that accurately captures the benefits accrued from these programs. Johansson (2010) for example, uses two measures. A present value measure of debt relief (PVDR) developed by Chauvin and Kraay (2005) and the market value of debt relief (MVDR) adopted from Cohen (2001). As these measures are author calculated/estimated, they bear their own biases. Johansson (2010) particularly cautions about the use of the MVDR measure “because the time period and the sample of countries are different” (p. 1207).

In this study, we employ different proxies for the debt relief programs, focusing mainly on the recently introduced IMF/World bank debt relief initiatives. As previously noted, the *d1996* dummy measures the unconditional economic growth effects accruing in those countries committed to the debt relief initiatives process. The other dummy, *dd*, measures the post-decision point effects when a country becomes eligible to start receiving interim relief on its debt service falling due. Using a sample of HIPCs, Fonchamnyo (2009) reports positive and significant dummy variable for the period after 1996 in real GDP per capita. Our results in Table 4, columns 1 and 3, where *d1996* and *dd* are entered as separate arguments, confirm this finding, but, the effects are statistically insignificant.

With reference to the conditional marginal effects, we find robust growth effects from debt relief, regardless of the debt specification. For example, a 10% increase in initial PPG debt (total debt) after 1996 leads to a 0.4% (0.3 %) boost in economic growth. Upon reaching the decision point and qualifying for the interim relief on its debt service falling due, annual growth of these countries increased by 0.3% (0.2%) over consequent

**TABLE 4: DEBT EFFECTS ON GROWTH, 1984-2010 (SGMM ESTIMATION)**

	PPG debt		Total Debt	
	(1)	(2)	(3)	(4)
Real GDP per capita	-23.600*** (3.187)	-18.370*** (3.426)	-21.650*** (3.751)	-16.780*** (3.547)
Debt % of GDP	-0.023** (0.011)		-0.004 (0.007)	
Debt x <i>d1996</i>		0.042*** (0.008)		0.026*** (0.004)
Debt x <i>dd</i>		0.028** (0.012)		0.024*** (0.009)
Debt x <i>dtropics</i>		-0.039*** (0.010)		-0.020*** (0.005)
<i>d1996</i>	1.862 (2.079)		1.481 (2.165)	
<i>dd</i>	0.565 (1.701)		0.576 (1.776)	
Inflation	-0.555 (0.527)	-0.574 (0.493)	-0.674 (0.549)	-0.602 (0.465)
Fin. development	0.125 (0.097)	0.172** (0.084)	0.064 (0.100)	0.147* (0.078)
Openness	-0.013 (0.050)	0.008 (0.049)	-0.004 (0.052)	0.002 (0.046)
Governance	0.160 (0.135)	0.307** (0.125)	0.153 (0.142)	0.273** (0.113)
TOT growth	0.0303* (0.016)	0.013 (0.014)	0.0298* (0.017)	0.013 (0.013)
Gov. Consumption	0.065 (0.165)	0.075 (0.146)	0.095 (0.171)	0.097 (0.138)
Investment	0.051 (0.076)	0.060 (0.074)	0.064 (0.079)	0.052 (0.069)
Foreign aid	-0.462 (1.040)	0.500 (0.980)	-0.307 (1.092)	0.456 (0.914)
Constant	0.504 (0.602)	-0.508* (0.300)	0.754 (0.614)	-0.298 (0.268)
Observations	118	136	118	136
Number of countries	25	25	25	25
Sargan test (Prob >Chi <sup>2</sup> )	0.344	0.361	0.382	0.175
Arellano-Bond (Pr>z)	0.787	0.418	0.654	0.726
Time-fixed effects	Yes	Yes	Yes	Yes

*Note: The real GDP per capita growth and terms of trade (TOT) growth are averaged over 3-year period. All variables are measured as initial values at the beginning of the 3-year period. Standard errors are in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . *d1996* - dummy variable that takes the value of 1 for the years 1996-2010, and 0 otherwise. *dd* - decision point dummy that takes the value of 1 from the year a country reached its decision point to 2010, and 0 otherwise. *dtropic* - dummy variable that takes a value of 1 if a country is located in the tropics, and 0 otherwise. Arellano-Bond test that average autocovariance in residuals of order 2 is 0 has  $H_0$ : no autocorrelation. All values are based on one-step estimator.*

3-year period for every 10% increase in the initial share of PPG (total) debt in GDP. These results are contrary to the findings in Johansson (2010), which might be attributed to the differences in the proxies of the debt relief effects and the sample (uses 118 developing countries).

Generally, our findings in Table 4 suggest that the conditions imposed by the IFIs on the HIPCs for reaching the decision point and consequently receiving full debt relief once

the completion point is reached (see endnote 3), have played a positive role in enhancing economic growth in these countries. Also notice that the overall debt overhang effects are lower than the marginal debt effects due to participating in the debt relief process by, for example, 0.1%-0.2% in the case of PPG debt. These findings indicate that the debt relief programs may have actually mitigated the debt overhang effects in the beneficiary countries. Wamboye and Tochkov (2015) arrived at a similar conclusion using a sample of Sub-Saharan African countries.

The interaction term between debt and a dummy variable for tropical countries<sup>7</sup> (*dtropic\*debt*) is included in the estimated models in columns 2 and 4. It is evident that this interaction term has robust but negative effect on economic growth. In particular, we find that for every 10% increase in the initial level of external PPG debt (total debt) as a share of GDP, annual growth in real GDP per capita of LDCs in tropical climate declines by approximately 0.4 (0.2%) over the subsequent 3-year period. This finding suggests the importance of long lasting institutions, as proxied by the tropics dummy, in determining the impact of debt on growth.

The estimated coefficients of the control variables in Table 4 are largely consistent with the findings in the empirical growth literature. In most specification, we observe the presence of beta convergence within the sample as signified by the negative sign of the coefficient of the initial per capita GDP. Initial levels of financial market development, good governance, and terms of trade growth are found to stimulate growth over the 3-year period where significant.

## CONCLUSIONS

In the late 1990s, the World Bank and IMF initiated a series of debt relief programs for HIPCs based on the idea that high levels of indebtedness impede growth by discouraging domestic and foreign investment. This paper examines the relationship between external debt and growth in a sample of 33 LDCs over the period 1970-2010 for the non-parametric analysis and 1984-2010 (with 25 LDCs/HIPCs) for the parametric analysis, with a particular emphasis on the role of multilateral debt relief initiatives. In contrast to previous studies, we employ a combination of parametric and non-parametric methods to study the linear and non-linear aspects of the debt-growth relationship.

The results indicate that lower levels of debt are associated with higher probabilities of achieving or maintaining positive growth in the future. In particular, the positive range of growth for HIPCs corresponded to PPG debt levels that were lower than between 64% and 78% of GDP, depending on the initial growth conditions. In the period after joining the debt relief initiatives, HIPCs generally exhibited a higher chance of moving towards or persisting in the positive range of growth. However, this process was related to lower debt levels mostly in countries that had initially exhibited moderate to rapid growth, while debt relief seems to have been less relevant for future growth in countries that started off in a state of moderate economic decline.

Furthermore, the results of the regression analysis show that the marginal effect of PPG debt on growth is negative and significant. Debt relief programs were found to mitigate the negative impact of debt, both after their initiation in 1996 and after the HIPCs reached their decision point. Generally, the overarching policy that can be drawn from this paper is that LDCs and, HIPCs in particular, should strive to reduce their PPG debt levels

to at least below 64%-78% of GDP in order to experience and maintain positive growth rates, *ceteris paribus*. Notwithstanding, our findings also suggest that if HIPCs, and LDCs in general want to reduce or maintain their debt to sustainable levels, they should adopt as part of their macroeconomic policy framework, some of the conditions imposed by the IFS on HIPCs. For example, developing and implementing a poverty reduction strategy paper through a broad based participatory process.

## ENDNOTES

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<sup>1</sup> See Presbitero (2012), Kumar and Woo (2010), Reinhart and Rogoff (2010), Caner, Grennes and Koehler-Geib (2010).

<sup>2</sup> See Jalles (2011), Pattillo, Poirson and Ricci (2002, 2011), Cordella, Ricci and Ruiz-Arranz, (2005), Clements et.al. (2003), Chowdhury (2004).

<sup>3</sup> See Pattillo et. al. (2011), Clements et al. (2003), Chowdhury (2001), Fosu (1999), Deshpande (1997).

<sup>4</sup> In an earlier study of 93 developing countries, Pattillo et al. (2002) reported a threshold level of between 35-40% of GDP.

<sup>5</sup> A major exception are the LDCs in severe decline that moved to a state of rapid growth in the next period. Their debt levels exceeded 130%. The most likely explanation is that it was impossible to transition from the bottom of the range to the top from one 3-year period to the next without accumulating external debt.

<sup>6</sup> In Figure 1 we focus on total debt to allow for comparisons with previous studies. The graphs for PPG debt are very similar and therefore we choose not to include them to save space, but they are available from the authors upon request.

<sup>7</sup> 96% of the countries in our sample of the 25 LDCs are within the tropical climate. The only exception is Lesotho.

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