Recent debt relief agreements envisage extensive reductions of the debt owed by most of the heavily indebted poor countries (HIPCs) to international institutions.[1] Since other creditors had already forgiven almost all other HIPCs debt, the implementation of these agreements would make HIPCs virtually debt free. Would it also make them grow more?

To answer this important question, this article takes a new look at the empirical relation between debt and growth, allowing it to vary with different debt levels and with the quality of policies and institutions (throughout the article our indicator of indebtedness would be the debt-to-GDP ratio and we will often use interchangeably debt or indebtedness). The main findings are that the debt-growth relation is highly nonlinear and it depends on countries' characteristics. In countries with good policies and institutions, evidence of debt overhang (that is, of a negative marginal relation between debt and growth) can be found at intermediate debt levels; when debt is above a "debt overhang" threshold of about 20–25 percent of GDP, and below a "debt irrelevance" threshold of about 70–80 percent of GDP. In countries with bad policies and institutions, the thresholds seem to be much lower, but the evidence of a negative debt-growth relationship is weaker. These results can be explained by the fact that only in countries with low debt levels and relatively good policies and institutions, the quantity and quality of investment is reactive to indebtedness levels.

The idea of a debt overhang rose from few influential articles motivated by the emerging market debt crisis, such as those by Sachs (1988) and Krugman (1988), which applied Myer's (1977) insights to sovereign lending. Although standard macroeconomic textbooks suggest that poor countries should borrow to finance their development path, these authors pointed out that once indebtedness becomes large, it would reduce the incentive to invest in the country, as the returns on such investments would be expected to be taxed away. The success of the Brady plan for the resolution of the 1980s debt crisis seemed to validate the debt overhang theory.

The subsequent empirical literature, however, presented more mixed results. Claessens and others (1990) found only a few indebted countries on the wrong side of the debt Laffer curve.[2] In the same negative vein, Borenzstein (1990) argued that debt relief does not have major quantitative effects on growth. Warner (1992) cast doubt on the debt overhang hypothesis, and Depetris, Chauvin, and Kraay (2005) found no evidence

[1]The HIPC initiative and Multilateral Debt Relief Initiative (MDRI) offer a comprehensive approach to debt reduction for heavily indebted poor countries pursuing IMF- and World Bank-supported adjustment and reform programs. As of September 2008, assistance in the amount of $117 billion (in nominal terms) had been committed to the 33 post-decision point HIPCs, mostly under the HIPC initiative and through the MDRI. This represents on average about 50 percent of these countries' 2007 GDP. After the full delivery of debt relief, their debt burden is expected to be reduced by about 90 percent. See www.imf.org/external/pp/longres.aspx?id=4278.

[2]Husain (1997) maintains that the disincentive effects associated with debt overhang have to be implausibly high for a country to be on the negative side of the debt Laffer curve.

that debt relief fosters growth. A more nuanced picture was provided by Cohen (1993 and 1997), who showed that while debt levels have little explanatory power in general, they negatively affect growth in Latin American countries, but not in African countries. Hansen (2001) also found inconclusive evidence on the effects of debt on growth looking at a sample of 54 developing countries.

Stronger evidence in support of the debt overhang hypothesis is found in Kaminsky and Pereira (1996); Desphande (1997), and Elbadawi, Ndulu, and Ndung'u (1997), who infer an overhang threshold level of debt at about 100 percent of GDP, beyond which the marginal impact of debt on per capita growth turns negative. Pattillo, Poirson, and Ricci (2002) studied the debt-growth relation using various nonlinear specifications and identified a much lower threshold, of about 20 percent of GDP. More recently, Imbs and Ranciere (2005) found some evidence of debt overhang occurring when the net present value (NPV) of debt to GDP reaches a threshold of about 30–35 percent.

A few articles have focused on the channels through which indebtedness influences growth, and uncovered that the traditional story of indebtedness—inducing a decline in the amount of investment—is only part of the explanation. Pattillo, Poirson, and Ricci (2003), in a panel encompassing a large number of developing countries, find that debt overhang operates not only through the level of investment, but also—actually mainly—through total factor productivity (in line with the evidence that growth can mainly be ascribed to productivity see Easterly and Levine, 2001). Clements, Bhattacharya, and Nguyen (2003), focusing on low-income countries, decompose private and public investments and find that the negative effects of indebtedness are stronger for the latter.

This evidence is consistent with more nuanced explanations of the effect of indebtedness, operating through the quality of investment and of policies (which would be reflected in total factor productivity), rather than just through the level of investment. Indeed, high indebtedness levels create uncertainty about the terms, condition, and timing of both debt repayment and domestic taxation. The literature of investment under uncertainty indicates that investors would prefer to exercise their option of waiting, thus shifting toward more short-term—even if potentially less productive—investment opportunities (Servén, 1997). Policymakers may also have less of an incentive to undertake politically difficult reforms (such as fiscal consolidations) if the growth benefits of such reforms are likely to accrue in large part to foreign investors in the presence of high indebtedness (Corden, 1989).

Other contributions offer additional considerations regarding the effect of debt. For instance, one might think that at very high levels, debt is no longer expected to be repaid and thus becomes "fictitious" (which would explain why high debt would not matter for growth). Indeed, Birdsall, Claessens, and Diwan (2002), studying the determinants of net transfers in a panel of 37 poor countries (mostly HIPCs), found that bilateral donors

provide low-income countries with the resources necessary to repay their obligation *vis-à-vis* multilateral organization. In a similar vein, Marchesi and Missale (2004), investigating the determinants of net transfers towards HIPCs and non-HIPCs, find that while in the latter a higher stock of debt tends to reduce the amount of transfers, the opposite occurs in HIPCs.[3] Alternatively, one can argue that debt relief may foster growth in countries with good policies and institutions. This is the argument that Arslanap and Henry (2005) use to support their view that debt relief works for relatively developed highly indebted emerging economies but not for HIPCs that lack much of those critical infrastructures that form the basis for profitable economic activity.

This article takes stocks of these sets of contributions and suggests a coherent way to encompass them. The fact that different studies found different results regarding the sign and the magnitude of the debt-growth relation might just suggest that the latter is sample dependent and highly nonlinear. Indeed, the main contribution of this article to the vast literature on debt and growth is to allow the debt-growth relation to vary according to debt levels and countries' characteristics, such as the quality of policies and institutions. Additional novelties include the fact that we employ threshold estimations, in addition to the usual quadratic and spline specifications; that we make use of a recent measure[4] of the NPV of debt—firstly employed in Kraay and Nehru (2004), and that we include among the regressor's official aid, in addition to debt service, to explicitly control for the ''additionality'' of debt relief (Hansen, 2000). Our results are consistent with recent findings by Presbitero (2008), who finds an effect of debt on growth mainly for countries with good policies.

I. Data and Methodology

Our data set is an unbalanced panel of 79 developing countries over the period 1970–2002. To smooth short-run fluctuations, we use three-year averages of all the variables. This leaves us with 11 time periods, from 1970–72 to 2000–02. We measure per capita GDP growth by the log difference of per capita GDP in constant 1995 U.S. dollars from the World Development Indicators (WDIs) database of the World Bank. Population growth and secondary school enrollment are also from WDI. The other non debt macroeconomic variables—investment, central government balance, terms of trade growth, inflation, net private capital flows, and the openness indicator—are from the World Economic Outlook (WEO) database of the IMF. Current GDP in national currency (the denominator of the investment and fiscal balance ratios) is from WEO, and GDP in U.S. dollars is from

[3]See also Cordella, Ricci, and Ruiz-Arranz (2005).

[4]The few other previous studies that relied on net present value calculations of debt were employing Easterly's data set, which ends in late 1990s (http://www.nyu.edu/fas/institute/dri/index.html).

WDI. Appendix Table A1 describes all the variables used in the econometric analysis and the corresponding data sources. Summary statistics of all the variables are reported in Appendix Table A2.[5]

Given the high level of concessionality granted to many of the countries in the sample, nominal debt overestimates the extent of indebtedness. The main debt variables we use is, therefore, a proxy for the NPV of total external debt (NPV), derived as the sum of public and private NPV. For theNPV of public debt, we use the same series used in Kraay and Nehru (2004), updated through 2002. This series excludes private debt and is based on aggregating discounted public and publicly guaranteed loans, available at the loan level in the Debtor Reporting System (DRS) of the World Bank.[6] For private debt, in the absence of data on its NPV, and since its degree of concessionality is substantially lower than that of public debt, we use its nominal value as a proxy. Debt service, net transfers, and the variables on grants and concessional loans used to construct our aid variable are also from the World Bank's *Global Development Finance* report.

The cross-sectional variables used to account for time-invariant country effects are common in the empirical growth literature and include rule of law from Kaufmann, Kraay, and Zoido-Lobatón (2002); dummies for legal origin from La Porta and others (1997); ethnic fractionalization, and distance from the equator from Easterly and Levine (1997). To assess whether the debt-growth relationship is influenced by country characteristics, we use the country policy and institutional assessment index (CPIA) from the World Bank. This index ranges from 1 to 5, and higher values are associated with a better policy environment.

In estimating our panel growth model, we start with ordinary least square (OLS) regressions including the cross-sectional variables that have been traditionally used in cross-countries growth regressions. To the extent that these variables will absorb the country specific component of the growth patterns (which is the presumption in cross-country growth regressions), this would reduce the dynamic panel bias associated with the country-specific component in the error term. Although such regressions shed some light on the main forces at work, following the recent empirical growth literature, we also present regressions based on the generalized methods of moments system estimator (SGMM; Arellano and Bover, 1995; Blundell and Bond, 1998). This dynamic panel data technique reduces the dynamic panel bias associated with unobservable country-specific factors. At the same time, it controls for

[5]As data for secondary education for the first part of the sample are available only every five years and our regression observations are based on three-year averages, we interpolated the missing observations.

[6]DRS is maintained by the financial data team of the Development Data Group. Aggregate statistics from DRS are published in Global Development Finance. We thank the team leader Ibrahim Levent for providing us with the series (please note that the World Bank does not guarantee the accuracy of the data and accepts no responsibility for any consequence of their use).

the potential endogeneity of some of the explanatory variables—in general, second to fourth lags of the debt variables as well as all of the other endogenous variables are used as instruments for all nonstrictly exogenous variables (lagged changes are used as instrument for variables in levels, and lagged levels as instruments for changes). Hansen and Sargan tests of overindentifying restrictions are performed to assess the validity of the instruments employed.[7]

Although SGMM should be able to address Easterly's (2001) critique that the negative relationship between indebtedness and growth might be due to causality running from growth to the measure of indebtedness, in all our regression, we also smooth the dollar GDP series—which deflates debt, aid, and net transfer ratios—using a Hodrick-Prescott filter. Although the use of filtered GDP does not change substantially the behavior of the indebtedness indicators or their magnitude, it alleviates the mechanical correlation between growth and the debt ratios. Regressions using nonfiltered data yield qualitatively similar results.[8]

II. Debt-Investment Relation

In our introduction, we discussed the two main channels through which high levels of indebtedness might affect growth. The first one is a resource/investment channel in which high indebtedness reduces the amount of domestic and foreign investment in the country. The second is related to deterioration of the quality of investment and policies associated with high indebtedness. This section provides indicative evidence that the investment channel matters, whereas the second channel will be explored in the next section.

In order to assess whether indeed indebtedness affects investment, we estimate the following equation:

$$Z_{it} = \alpha_t + \beta_1 W_{it} + \beta_2 H_i + \beta_3 D_{it-1} + \beta_4 H_i D_{it-1} + \beta_5 P_{\mathrm{i}} + \varepsilon_{it}, \qquad (1)$$

where Z_{it} denotes investments, W_{iI} is a vector of regressors including per capita GDP growth, terms of trade growth, openness, D_{it} denotes (the logarithm of) the stock of external debt to GDP in NPV terms; H_i is a dummy variable equal to one if country i's stock of debt is above the median and zero otherwise, in the first two columns; and P_t (in the OLS specification) is the set of cross-sectional variables discussed above. We estimate equation (1) by OLS including cross-sectional variables and by SGMM without the latter variables. Indeed, the latter methodology implicitly accounts for fixed effects.

The results presented in Table 1 indicate that an increase in indebtedness negatively affects investment at low levels of debt, but not at high ones. This

[7]We used the "xtabond2" Stata routine developed by David Roodman.

[8]We find some evidence that the use of filtered data helps alleviate the endogeneity problem. For instance, the aid estimates appear negative and significant in the nonfiltered regressions, but they turn insignificant in the filtered regressions.

Table 1. Determinants of Total Investment
Dependent Variable: Total Investment (INV/GDP)

	H = High-Debt Dummy		H = High CPIA Dummy	
	OLS	SGMM	OLS	SGMM
Investment to GDP (−1)	0.657***	0.581***	0.649***	0.576***
	(0.032)	(0.058)	(0.032)	(0.048)
Per capita GDP growth (−1)	0.438***	0.586***	0.43***	0.539***
	(0.049)	(0.093)	(0.049)	(0.085)
Terms of trade growth (−1)	−0.008	−0.032**	−0.015	−0.037**
	(0.018)	(0.016)	(0.018)	(0.016)
Openness	0.032***	0.026**	0.035***	0.028**
	(0.007)	(0.011)	(0.007)	(0.012)
(β_3) Log NPV of debt to GDP (−1)	−0.704***	−1.458***	−0.119	−0.213
	(0.218)	(0.471)	(0.237)	(0.407)
(β_4) H* Log NPV of debt to GDP (−1)	0.613*	1.412**	−0.529	−0.997
	(0.359)	(0.632)	(0.338)	(0.623)
H	−1.841	−4.457*	2.509**	3.695*
	(1.346)	(2.312)	(1.243)	(2.232)
Observations	628	655	628	655
R^2	0.73	0.71	0.73	0.71
Coef. $\beta_3 + \beta_4$	−0.091	−0.046	−0.648**	−1.21***
p-value: $\beta_3 + \beta_4 = 0$	0.76	0.92	0.01	0.01
Number of countries		79		79
Sargan/Hansen *p*-value		1.00		1.00
AR(2) test: *p*-value		0.82		0.76

Note: Robust standard errors in parentheses. * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. NPV = net present value; CPIA = country policy and institutional assessment index.

is evident from the fact that the coefficient of debt is significantly negative for countries with debt below median. However, when debt exceeds median levels, the debt is not longer significant, as indicated by the *p*-value of the sum of $\beta_3 + \beta_4$.

The last two columns show that the same result holds when we allow for different coefficients of debt for countries that enjoy quality of policies and institutions below median (as defined by the CPIA) or above. While for countries below the median the coefficient of debt is insignificant, it turns negative and significant for countries with policies and institutions above median, as indicated again by the *p*-value of the sum of $\beta_3 + \beta_4$.

How this relates to the overall relation between debt and growth? How do quality and quantity of investment interrelate? This is what we do next investigating the determinants of growth in more and less indebted countries

with better and worse policies and do so by controlling for investment to avoid an important omitted variable bias.[9]

III. What Affects the Debt-Growth Relation?

Does the Standard Relation Hold at High Debt?

In order to shed some light on whether the debt-growth relation (and thus the effects of debt relief) is the same in countries with different levels of indebtedness, we first run standard growth regressions where the quadratic effect of debt on growth is allowed to differ between more and less indebted countries. We also allow for nonlinearities in the debt-growth relation in each of the two indebtedness groups. Our main specification is the following:

$$y_{it} = \alpha_t + \beta_1 X_{it} + \beta_2 H_i + \beta_3 D_{it} + \beta_4 H_i D_{it} + \beta_5 D_{it}^2 + \beta_6 H_i D_{it}^2 + \beta_7 T_{it} + \beta_8 H_i T_{it} + \beta_9 P_i + \varepsilon_{it}, \quad (2)$$

where y_{it} is the average growth rate in real GDP per capita over three-year periods in country i at time period t; α_t denotes time-fixed effects; X_{it} is a vector of standard control variables including (the logarithm of) initial GDP per capita, (the logarithm of) population growth, growth of terms of trade, (the logarithm of) secondary school enrollment, (the logarithm of) investment to GDP, central government balance to GDP, inflation, and trade openness; D_{it} denotes (the logarithm of) the stock of external debt to GDP in NPV terms; H_i is a dummy variable equal to one if country i's stock of debt is above the median, and zero otherwise; D_{it} denotes (the logarithm of) the stock of external debt to GDP in NPV terms; T_{it} is a vector that contains aid to GDP and debt service to exports (to control for net official resources); and P_i denotes the vector of time-invariant cross-sectional variables.

We estimate equation (2) by OLS including cross-sectional variables and by SGMM without these variables. Our results are summarized in Table 2. Results across econometric techniques yield similar results, and the coefficient estimates for the control variables are consistent with those in the growth regression literature. We find some evidence of debt overhang (in the OLS estimation if debt overhang threshold is around 10 percent), consistent with existing literature, but the effect is absent in the high-debt country group. As a robustness check, we perform separate growth regressions for the two subsamples implied by the median level of debt. The results are presented in Table 3 and provide again evidence that, at the margin, debt does not seem to matter in high-debt countries, while it hampers growth beyond a threshold in low-debt countries.

[9]Results are robust to the exclusion of investment (available from the authors upon request).

Table 2. Effect of Debt on Growth: Different in Low-vs. High-Debt Countries
Dependent Variable: Per Capita GDP Growth (PCGDP Gr)

	OLS	SGMM
Log initial GDP per capita	−0.801***	−0.72***
	(0.233)	(0.218)
Terms of trade growth	0.028*	0.019
	(0.015)	(0.014)
Log population growth	−0.467	−1.27***
	(0.311)	(0.391)
Log secondary school enrollment	0.47	0.51
	(0.305)	(0.366)
Log investment to GDP	3.111***	2.956***
	(0.440)	(0.525)
Budget to GDP	0.094***	0.13***
	(0.032)	(0.040)
Openness	−0.011	0
	(0.006)	(0.007)
Inflation	−0.022***	−0.013**
	(0.004)	(0.005)
Aid to GDP	−0.018	−0.011
	(0.051)	(0.050)
Debt service to exports	0.009	0.016
	(0.014)	(0.021)
High-debt dummy (H)	2.228	1.221
	(1.711)	(4.297)
H* Aid to GDP	−0.02	−0.061
	(0.049)	(0.049)
H* Debt service to exports	−0.017	−0.01
	(0.018)	(0.022)
(β_3) Log NPV of debt to GDP (NPV/GDP)	1.596***	1.564
	(0.495)	(2.691)
(β_5) (Log NPV/GDP)^2	−0.355***	−0.434
	(0.105)	(0.433)
(β_4) H* (Log NPV/GDP)	−2.253***	−1.519
	(0.926)	(2.844)
(β_6) H* (Log NPV/GDP)^2	0.458***	0.39
	(0.146)	(0.457)
Observations	703	734
R^2	0.34	0.27
Coef. $\beta_3+\beta_4$	−0.657	0.045
p-value: $\beta_3+\beta_4=0$	0.42	0.98
Coef. $\beta_5+\beta_6$	0.103	−0.044
p-value: $\beta_5+\beta_6=0$	0.37	0.83
Number of countries	79	79
Hansen/Sargan *p*-value		0.95
AR(2) test: *p*-value		0.77

Note: Robust standard errors in parentheses; * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. All regressions include time dummies. NPV = net present value; CPIA = country policy and institutional assessment index; OLS = ordinary least square; SGMM = generalized methods of moments system estimator.

Table 3. Effect of Debt on Growth: Different in Low-vs. High-Debt countries (Splitting the Sample according to Debt)

Dependent Variable: Per Capita GDP Growth (PCGDP Gr)

	Low Debt		High Debt	
	OLS	SGMM	OLS	SGMM
Log initial GDP per capita	−0.874**	−1.093***	−0.551	−0.605*
	(0.384)	(0.320)	(0.345)	(0.353)
Terms of trade growth	0.031	0.011	0.032	0.027
	(0.020)	(0.021)	(0.020)	(0.018)
Log population growth	0.144	−0.552	−1.57***	−2.159***
	(0.422)	(0.459)	(0.452)	(0.578)
Log secondary school enrollment	0.257	1.156**	0.614	0.957***
	(0.444)	(0.533)	(0.411)	(0.442)
Log investment to GDP	3.14***	2.827***	2.775***	3.2***
	(0.757)	(0.706)	(0.564)	(0.722)
Budget to GDP	0.032	0.075	0.144***	0.15***
	(0.039)	(0.049)	(0.042)	(0.047)
Openness	−0.005	0.005	−0.021*	−0.02**
	(0.008)	(0.009)	(0.011)	(0.009)
Inflation	−0.009*	−0.006	−0.03***	−0.029***
	(0.005)	(0.005)	(0.006)	(0.005)
Aid to GDP	−0.055	−0.053	−0.011	−0.007
	(0.067)	(0.058)	(0.032)	(0.026)
Debt service to exports	0.015	0.011	−0.026	−0.025*
	(0.015)	(0.018)	(0.018)	(0.014)
(β_3) Log NPV of debt to GDP (NPV/GDP)	1.719***	1.78	−0.559	−0.96
	(0.492)	(1.415)	(0.834)	(0.968)
(β_5) (Log NPV/GDP)^2	−0.387***	−0.406*	0.105	0.109
	(0.101)	(0.236)	(0.121)	(0.129)
Observations	347	370	356	364
R^2	0.35	0.28	0.37	0.34
Number of countries	38	38	41	41
Hansen/Sargan *p*-value		0.31		0.2
AR(2) test: *p*-value		0.44		0.84

Note: Robust standard errors in parentheses; * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. All regressions include time dummies. NPV = net present value; OLS = ordinary least square; SGMM = generalized methods of moments system estimator.

Note that in order to estimate the impact of a marginal debt reduction when net flows remain unchanged, we control for net transfers. We do not find evidence that aid flows have an effect on growth—despite having allowed for a differential impact across countries with different levels of indebtedness—a result consistent with recent literature (Easterly, Levine,

and Roodman, 2003; Rajan and Subramanian, 2005). We also do not find evidence that debt service is detrimental for growth.[10]

The main conclusion we can derive from the above analysis is that the debt-growth relationship appears to be different in countries with different levels of indebtedness. In order to better understand the reason, we now depart from the standard debt-growth analysis in two ways.

First, we allow for more than one break in the debt-growth relationship. The fact that in highly indebted countries debt seems to have no effects on growth might suggest that (in addition to a debt overhang threshold) there can be a second indebtedness threshold above which debt levels just do not matter (debt irrelevance threshold). This would imply that the specifications employed so far in the literature—linear, quadratic, and spline with one break—would impose the wrong functional form, inducing a poor fit, and thus low significance of the debt coefficients. To overcome such a problem, we employ a spline specification with two breaks, and a threshold regression approach (Hansen, 1996, 2000). Both approaches have advantages and disadvantages. By choosing the breaks that provide the best fit, the spline methodology allows us to identify the debt overhang and irrelevance thresholds, while retaining the possibility to employ SGMM estimators. The main shortcoming of Hansen's (1996, 2000) methodology, the state of the art to identify thresholds, is that it does not allow controlling for endogeneity (unlike SGMM) as it employs OLS estimators.

Second, we break the sample according to the quality of policies and institutions. Indeed, the lack of a relationship at high debt level maybe due not only to the level of debt but also to other factors that are highly correlated with debt and are likely to affect the relationship of debt on growth, such as the quality of policies; indeed, Appendix Table A3 shows a clear pattern relating high indebtedness and the quality of policies. As a proxy for such a variable, we use the CPIA index of the World Bank, and we separate countries according to whether their average value over the sample is above or below the median (of the countries' averages).

Spline Specification

A spline specification with two breaks allows for the effect of debt on growth to be different at low, medium, and high levels of debt. The model we estimate is the following:

$$y_{it} = \alpha_t + \beta_1 X_{it} + \beta_2 D_{it} + \beta_3 (D_{it} - D_1) I_1 + \beta_4 (D_{it} - D_2) I_2 + \beta_5 T_{it} + \beta_6 P_{\mathrm{i}} + \varepsilon_{it}, \quad (3)$$

where X_{it} is the same vector of controls as in the growth regressions of the previous section, D_{it} is the logarithm of the NPV of debt, T_{it} is the vector of

[10]We cannot a priori rule out the possibility that the patterns of aid and debt service may be different between countries with different indebtedness levels. We thus allow for different slopes for these variables as well.

net transfer variables, P_i is the usual vector of cross-sectional variables included in the OLS regressions, and I_j $(j=1,2)$ is an indicator function such that:

$$I_j = 0, \quad if \quad D_{it} < D_j, \quad and \quad I_j = 1, \quad if \quad D_{it} > D_j. \tag{3a}$$

In order to derive the threshold D_1 and D_2 in a nonarbitrary way, we tried all possible combinations of D_1 and D_2, between about 10 and 80 percent of GDP separated by multiples of approximately 15 percentage points of GDP, such that $D_1 < D_2$.[11] We then chose the pair D_1 and D_2 delivering the best fit, as measured by the ratio of the explained sum of squares to the total sum of squares.

Table 4 reports the results of equation (3) estimated for countries with good or bad policies and institutions respectively (that is, with a CPIA below or above the median). The coefficients of the nondebt variables are similar to the ones of the quadratic specification presented in the previous section. For the debt variable, in addition to the three spline coefficients, β_2, β_3, and β_4, at the bottom of the table, we also report the overall coefficient for debt at medium levels $(\beta_2 + \beta_3)$, and at high levels $(\beta_2 + \beta_3 + \beta_4)$, and the associated *p*-values. The endogenously determined spline thresholds appear just further below in the table.

Countries with good policies and institutions are found to experience an extensive debt overhang zone. The relationship between indebtedness and growth is strongly negative at intermediate levels (the *p*-values of $\beta_2 + \beta_3$ are less than 0.01). The debt overhang threshold at which the marginal effect of debt turns negative is situated about 23 percent of GDP (in NPV terms). The debt irrelevance threshold (where the marginal effect of debt on growth stops being negative) is instead identified all the way at the top of the range (80 percent of GDP). It is, therefore, not clear whether countries with good policies and institutions actually face a debt irrelevance zone where debt is marginally irrelevant for growth.[12]

Countries with poor policies and institutions, instead, seem to start suffering from debt overhang at very low levels of debt (10 percent of GDP, or possibly below, as 10 percent is the lower bound), as summarized in Table 5. However, the negative marginal effect of debt on growth disappears quickly as debt rises; the debt irrelevance threshold for these countries lies about 15 percent.

[11]The approximation of the interval is due to the fact that calculations are performed on a logarithmic basis. Results based on equally spaced intervals calculated on the level of debt delivered qualitatively similar results. The range of 10–80 percent of GDP covers about 70–80 percent of the debt ratio distributions.

[12]As very few observations lie beyond the irrelevance threshold, and this threshold is identified at the top of the range, the positive coefficient at high levels of debt, $\beta_2 + \beta_3 + \beta_4$, is not particularly meaningful. Similarly, the effect of debt is somewhat positive below the overhang threshold, but not significant, which is not surprising as there are few observations in that range as well.

Table 4. Effect of Debt on Growth: Changing with Levels of Debt and Quality of Policies and Institutions, Spline Regressions

Dependent Variable: Per Capita GDP Growth (PCGDP Gr)

	Good Policies and Institutions		Bad Policies and Institutions	
	OLS	SGMM	OLS	SGMM
Log initial GDP per capita	−0.855***	−0.904***	−0.66*	−0.931***
	(0.244)	(0.273)	(0.379)	(0.320)
Terms of trade growth	0.011	0.004	0.035	0.022
	(0.017)	(0.017)	(0.024)	(0.021)
Log population growth	−0.776**	−1.186***	−0.303	−1.811**
	(0.336)	(0.357)	(0.751)	(0.701)
Log secondary school enrollment	−0.103	0.139	0.667	1.357***
	(0.371)	(0.374)	(0.511)	(0.454)
Log investment to GDP	4.617***	3.821***	2.709***	2.738***
	(0.652)	(0.565)	(0.569)	(0.597)
Budget to GDP	0.109***	0.148***	0.085*	0.058
	(0.040)	(0.047)	(0.043)	(0.041)
Openness	−0.003	0.006	−0.025**	−0.012
	(0.006)	(0.007)	(0.010)	(0.007)
Inflation	−0.011	−0.005	−0.027***	−0.029***
	(0.007)	(0.005)	(0.005)	(0.005)
Aid to GDP	−0.033	−0.073**	−0.017	−0.019
	(0.036)	(0.032)	(0.037)	(0.037)
Debt service to exports	0.011	−0.004	−0.008	−0.001
	(0.014)	(0.017)	(0.020)	(0.015)
(β_2) Log NPV of debt to GDP (NPV/GDP)	0.367	0.012	1.4**	1.091
	(0.399)	(0.542)	(0.668)	(1.600)
(β_3) Log NPV/GDP*D1	−2.36***	−1.459*	−6.586***	−6.415*
	(0.706)	(0.802)	(2.504)	(3.792)
(β_4) Log NPV/GDP*D2	4.626***	3.88***	5.487**	5.261*
	(1.053)	(1.029)	(2.219)	(2.814)
Observations	346	360	357	374
R^2	0.40	0.32	0.32	0.27
Coef. $\beta_2+\beta_3$	−1.993***	−1.446***	−5.185**	−5.324*
p-value test: $\beta_2+\beta_3=0$	0	0.01	0.02	0.05
Coef. $\beta_2+\beta_3+\beta_4$	2.634***	2.434***	0.302	−0.063
p-value test: $\beta_2+\beta_3+\beta_4=0$	0	0.01	0.44	0.89
Debt overhang threshold	23	23	(10)	(10)
Debt irrelevance threshold	(80)	(80)	15	15
Number of countries		36		43
Sargan/Hansen p-value		0.79		0.46
AR(2) test: p-value		0.66		0.95

Note: Robust standard errors in parentheses. * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. Thresholds in brackets relate to values at the limit of the range. NPV = net present value; OLS = ordinary least square; SGMM = generalized methods of moments system estimator.

Table 5. Debt Overhang and Irrelevance Thresholds (from Table 4)

	Country Group	
	"High" CPIA	"Low" CPIA
NPV of Debt to GDP		
Debt overhang threshold	23	(10)
Debt irrelevance threshold	(80)	15

Note: Numbers in parenthesis relate to thresholds at the limits of the range. NPV = net present value; CPIA = country policy and institutional assessment index.

One result that is independent of the split is the significance of the overhang effect $(\beta_2 + \beta_3)$ for all groups of countries. For the countries with good conditions, the estimate of $(\beta_2 + \beta_3)$ ranges between -1.5 and -2 (OLS with cross-sectional variables and SGMM, respectively); this suggests that reducing debt by half (within the range of debt overhang and debt irrelevance thresholds) could enhance per capita growth by 1 to 1½ percentage points. For countries with bad conditions the estimates of $(\beta_2 + \beta_3)$ are larger, about -5.

Threshold Estimation

The spline specification in the previous section does not allow us to assess the statistical significance of the thresholds we determined. To overcome such a problem, in this section, we follow Hansen (1996, 2000) and look for a nonlinear debt-growth relationship by applying threshold estimation.[13]

Threshold estimation takes the form:

$$y_{it} = \beta_1' X_{it} + \beta_2 D_{it} + \varepsilon_{it} \qquad D_{it} \leq \gamma, \tag{4}$$

$$y_{it} = \alpha' X_{it} + \alpha_2 D_{it} + \varepsilon_{it} \qquad D_{it} > \gamma, \tag{4a}$$

where (NPV) debt (D_{it}) is used both in the regression and as the threshold variable that splits the sample into two groups;[14] γ is the endogenously determined threshold level and X_{it} is the vector of the control variables listed in the previous section, including time effects and cross-sectional variables to

[13]Threshold estimation has been applied for nonparametric function estimation, as well as for empirical sample splitting of a continuously distributed variable. Applying such a methodology, we can endogenously determine the threshold levels of debt (and their confidence intervals) at which the relationship between debt and growth changes. We adapted to our analysis the Gauss programs kindly made available by Hansen at http://www.ssc.wisc.edu/~bhansen.

[14]The threshold variable could be the dependent variable, a regressor or a third variable, not included in the regression, and it is assumed to have a continuous distribution.

account for time invariant effects. The main feature of the model is that it allows the regression parameters to differ depending on the value of D_{it}.

Hansen (2000) derives an asymptotic approximation to the distribution of the least squares estimates of the threshold parameter, which allows testing for the existence of a threshold. We are not aware of any attempt to find such a distribution for SGMM estimates. Thus, the main shortcoming of this approach, compared with the one presented in the previous section, is that it does not allow correcting for endogeneity. This also implies that we cannot rely too much on the point estimates and the significance of the coefficients. Another shortcoming is that we cannot identify two thresholds directly, but only sequentially (see below).

As the previous analysis indicated the presence of two debt thresholds, we perform multiple threshold regressions proceeding in a sequential way. First, we fit the model to the data to estimate a first debt threshold, split the sample according to such thresholds, and compute the least-square coefficients of each of the subsamples. We then compute confidence intervals for the parameters, including the debt threshold coefficient, and provide an asymptotic simulation test of the null of linearity against the alternative of the existence of a debt threshold. If we find evidence of a first debt threshold, we proceed to the second stage: drop the subsample below the threshold and repeat the procedure described above but applying it to the rest of the sample in search for a second debt threshold. This allows us to compute estimates for the two remaining subsamples and test the null hypothesis of no second debt threshold.

Tables 6 and 7 report the results for countries with good or bad policies and institutions, respectively. In each table, the three columns reflect the regressions for the different ranges of debt identified by the endogenously determined debt thresholds.

Running this specification on the countries with CPIA above the median (Table 6), we find results that are similar to those derived with the spline methodology. First, we find evidence of two significant debt thresholds.[15] Second, debt overhang is present in the intermediate range of debt levels (significantly negative coefficient of debt in column 2). The overhang and irrelevance thresholds delimiting the range are identified at about 20 and 70 percent of GDP, with confidence intervals of [14, 30] and [69,77], respectively. The extent of the overhang effect is very close to the lower bound identified with the spline methodology (−1.5). In the first and third debt segments, the debt coefficients are not statistically different from zero. Pair-wise *t*-tests of the equality of coefficients across regressions related to different debt segments can be rejected. In the case of good policy conditions, therefore, there is clear evidence that the effect of debt on growth varies with the level of indebtedness.

[15]The test of the null hypothesis of no threshold against the alternative of threshold is performed using a Wald test under the assumption of homoskedastic errors. Using 1,000 bootstrap replications, the *p*-value for the threshold model was 0. This suggests that there is evidence of a regime change at the specified levels of debt.

Table 6. Effect of Debt on Growth: Changing with Levels of Debt, for Countries with Good Quality of Policies and Institutions, Threshold Estimation Regressions (OLS)

Dependent Variable: Per Capita GDP Growth (PCGDP Gr)

	Log	2.87 > Log	Log
	NPV/ GDP < 2.87	NPV/ GDP > 4.27	NPV/ GDP > 4.273
	(NPV/ GDP < 17.6)	(17.6 > NPV/ GDP > 71.71)	(NPV/ GDP > 71.7)
Log initial GDP per capita	0.29	−1.343***	−0.464
	(0.831)	(0.300)	(0.982)
Terms of trade growth	−0.01	0.043*	0.019
	(0.043)	(0.023)	(0.042)
Log population growth	0.747	−1.409***	−3.015
	(1.392)	(0.455)	(2.553)
Log secondary school enrollment	−0.454	0.382	−1.475
	(1.307)	(0.487)	(2.127)
Log investment to GDP	4.91	4.637***	3.897
	(3.009)	(0.611)	(2.592)
Budget to GDP	−0.076	0.152***	−0.024
	(0.162)	(0.043)	(0.098)
Openness	0.024	0	−0.037
	(0.038)	(0.008)	(0.025)
Inflation	0.038	−0.008	−0.04
	(0.100)	(0.008)	(0.066)
Aid to GDP	−0.001	−0.081*	−0.003
	(0.437)	(0.043)	(0.088)
Debt service to exports	0.041	0.028	−0.136**
	(0.050)	(0.019)	(0.055)
Log NPV of debt to GDP (NPV/ GDP)	0.297	−1.472*	2.409
	(0.976)	(0.754)	(2.768)
Observations	65	226	55
R^2	0.52	0.47	0.68

Note: Robust standard errors in parentheses; * significant at 10 percent; ** significant at 5 percent; *** significant at 1°percent. All regressions include time dummies. NPV = net present value; OLS = ordinary least square.

For the group of countries with bad policies and institutions (Table 7), the overhang and irrelevance thresholds are found at lower levels of debt, at 17.3 and 35.1 percent of GDP, respectively.[16] However, unlike in countries

[16]The 95 percent confidence intervals are (5, 37) and (34, 39) , for the debt overhang and debt irrelevance thresholds, respectively.

Table 7. Effect of Debt on Growth: Changing with Levels of Debt, for Countries with Bad Quality of Policies and Institutions, Threshold Estimation Regressions (OLS)

Dependent Variable: Per Capita GDP Growth (PCGDP Gr)

	Log	2.85 > Log	Log
	NPV/ GDP < 2.85	NPV/ GDP > 3.56	NPV/ GDP > 3.56
	(NPV/ GDP < 17.3)	(17.3 < NPV/ GDP < 35.1)	(NPV/ GDP > 35.1)
Log initial GDP per capita	−0.364	−2.651***	−0.7
	(1.686)	(0.742)	(0.542)
Terms of trade growth	0.149**	−0.037	0.027
	(0.059)	(0.042)	(0.034)
Log population growth	−2.023	−2.733***	−0.34
	(1.864)	(0.888)	(0.909)
Log secondary school enrollment	1.56	1.966**	0.542
	(1.287)	(0.779)	(0.855)
Log investment to GDP	−2.497	2.62***	3.18***
	(1.615)	(0.964)	(0.753)
Budget to GDP	−0.072	0.123	0.16**
	(0.052)	(0.106)	(0.066)
Openness	0.017	0.038**	−0.045***
	(0.026)	(0.019)	(0.015)
Inflation	0.038	−0.039	−0.029***
	(0.060)	(0.026)	(0.005)
Aid to GDP	0.039	−0.347***	0.011
	(0.192)	(0.095)	(0.046)
Debt service to exports	−0.179**	0.21***	−0.039*
	(0.086)	(0.069)	(0.021)
Log NPV of debt to GDP (NPV/ GDP)	0.901	−0.559	0.99
	(1.324)	(2.040)	(0.612)
Observations	66	97	194
R^2	0.42	0.59	0.45

Note: Robust standard errors in parentheses; * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. All regressions include time dummies. NPV = net present value; OLS = ordinary least square.

with a CPIA above the median, in this group, the negative debt coefficient in the intermediate region is not significant. Hence, despite the evidence of regime changes at these two debt levels, it is questionable whether the relationship between debt and growth for countries with bad policies is actually nonlinear (with marginal overhang at intermediate levels of debt) or it is simply flat at all levels of debt.

Summarizing our results, we found evidence that countries with good policies face a debt overhang threshold at about 20–25 percent of GDP, beyond which debt has a marginal negative impact on growth, and a debt irrelevance threshold at very high levels of debt (about 70–80 percent of GDP). In countries with bad policies, there is some evidence indicating that the two thresholds are lower, especially the irrelevance one (about 10–15 and 15–35 percent of GDP, respectively). However, for such countries, the estimated debt coefficients do not appear to be significantly different from zero, although the coefficient sign patterns are consistent with that of countries with good policies and institutions.[17]

IV. Conclusions and Policy Implications

The idea that debt relief may help low-income countries move toward the Millennium Development Goals is highly popular. Many questions, however, remain unanswered: is debt relief going to foster growth? Is there evidence that highly indebted countries suffer from a debt overhang, and that more debt relief is needed? The underlying question is to what extent and under which conditions can debt be an impediment to growth? To shed some light on these important questions, in this article, we looked at how indebtedness has affected growth and investment patterns in countries with different levels of indebtedness and with different quality of policies and institutions.

Our analysis starts by pointing out that in countries with high indebtedness levels or low quality of policies and institutions, investments are not affected by debt. Instead, the effect of debt on investment is significantly negative in countries with low indebtedness levels or high quality of policies and institutions. This can contribute to explaining the subsequent results, that is, that the relation between debt and growth is robust only in the latter group of countries, the more creditworthy ones.

Indeed, we find that in highly indebted countries indebtedness does not seem to affect growth in the sample period, whereas in less indebted countries, there is evidence of a quadratic debt-growth relation. Indeed, when debt rises to sufficiently high levels, it starts having a negative marginal effect on per capita growth.

In a quest to investigate which of the characteristics that distinguish the two groups of countries are driving the different results, we inspected how the debt-growth relationship is affected by indebtedness levels and quality of policies and institutions. Our findings suggest that countries with good policies and institutions face overhang when NPV of debt rises above 20–25 percent of GDP. Once such level is reached, the marginal effect of debt on

[17]Although observations tend to be concentrated in particular indebtedness ranges, all intervals are reasonably populated. Indeed, Table 6 indicates that 19, 65, and 16 percent of all good policy observations fall within the low-, medium-, and high-debt regions, respectively. Table 7 shows that the distribution of bad policy observations is 18, 27, and 54 percent for low-, medium-, and high-debt regions, respectively.

growth becomes negative. However, debt becomes irrelevant when it rises above 70–80 percent of GDP. In countries with bad policies and institutions, overhang and irrelevance thresholds seem to be substantially lower (10–15 and 15–35 percent of GDP, respectively), but the results are not robust to alternative specifications; thus, we cannot rule out that for these countries debt does not matter altogether.

Although our analysis sheds new light on the circumstances under which debt matter for growth in developing countries, it is less conclusive regarding the effectiveness of debt relief as an instrument to foster growth in highly indebted countries. Can then one dismiss debt relief as an effective way of providing resources to poor highly indebted countries? The answer is a nuanced "not necessarily". Indeed, our results indicate that the effect of debt relief on growth depends on the quality of policies and institutions, as well as on countries' indebtedness levels. Hence, the fact that debt did not matter for highly indebted countries over the sample period does not imply that debt does not matter nowadays. On the contrary, those highly indebted countries that have improved the quality of their policy and institutions may now be in the marginal debt overhang region, where debt relief could be most effective in fostering growth.[18]

It should also be noted that, to the extent that the effectiveness of debt relief depends on countries' characteristics, a one-size-fits-all debt relief policy might not be appropriate. If the effect of debt on growth depends on the quality of policies and institutions, the choice of providing debt relief should depend on the same factors. Moreover, the results in the article would suggest that, once debt relief is granted, new lending to these countries should be made contingent on improvement in the quality of the policy environment.

[18]One supportive piece of evidence is the increase in litigation by commercial creditors in HIPCs. It suggests that creditors are recognizing that conditions have improved, and expect that there may now be some possibility of repayment.

APPENDIX

Table A1. List and Sources of Variables

Variable	Variable Name	Definitions/Explanations	Source
Per capita real GDP		GDP per capita in constant 2000 U.S. dollars	World Bank, the World Development Indicators (WDI)
Per capita real GDP growth	L PCGDP Gr	Log difference of per capita real GDP	World Bank, WDI
Population growth	L PopGr	Annual population growth (in %)	World Bank, WDI
Secondary school enrollment	L SecEnr	Secondary school enrollment (in % gross)	World Bank, WDI
Terms of trade growth	ToT Gr	Log difference of terms of trade	IMF, World Economic Outlook (WEO)
Investment to GDP	LINV/GDP	The ratio of gross fixed capital formation to GDP, both in local currency	IMF, WEO
Central government balance to GDP	Budget/GDP	The ratio of central government balance to GDP, both in local currency	IMF, WEO
Inflation	Inflation	Log difference of consumer price index	IMF, WEO
Openness	Open	Exports and imports of goods and services divided by GDP, all in U.S. dollars	WEO for the trade series and WDI for GDP
NPV debt to GDP	LNPV/GDP	The ratio of net present value of debt to GDP, both in U.S. dollars	World Bank data for NPV debt and WDI for GDP
Debt service to exports	DebtSer/EXP	The ratio of total debt service paid to exports of goods and services, both in U.S. dollars	World Bank, *Global Development Finance* (GDF) for the debt series and WEO for the exports series
Aid to GDP	Aid/GDP	The sum of grants (excluding technical cooperation), multilateral and bilateral concessional disbursements and IMF purchases divided by GDP. All in U.S. dollars	GDF for all series except for GDP, and WDI for GDP
Aggregate net transfers to GDP	ANT/GDP	The ratio of aggregate net transfers to GDP, both in U.S. dollars	GDF for the transfer series and WDI for GDP

CPIA index	CPIA	Country policy and institutional assessment index. It ranges from 0 to 1, with higher values indicating better policies	World Bank
Grant element	GREL	The grant equivalent of the loan expressed as a percentage of the amount committed	GDF
Rule of law	Rule	Index that measures the extent to which property rights are protected, and the perception of the incidence of crime, the effectiveness of the judiciary, and the enforceability of contracts	Kaufmann, Kraay, and Zoido-Lobatón (2002)
Legal origin		Dummies for English, French, socialist, German and Scandinavian legal origin	La Porta and others (1997)
Ethnic fractionalization	Ef	Probability that any two people in the same country will not be from the same religious or ethnic group	Easterly and Levine (1997)
Distance to equator	Disteq	Distance to equator from capital city	Rodrik, Subramanian, and Trebbi (2004)

Note: NPV = net present value; CPIA = country policy and institutional assessment index.

Table A2. Summary Statistics

	1970–79	1980–89	1990–95	1996–2002	1970–2002
Aggregate net transfer to GDP	5.5	6.0	5.7	3.7	5.4
Central government balance to GDP	−5.2	−5.7	−3.6	−3.2	−4.8
CPIA	2.6	2.9	3.0	3.3	2.9
Grants to GDP	3.6	5.5	7.0	4.1	4.9
Growth per capita	1.9	0.2	0.6	1.2	1.0
Inflation	13.6	22.6	25.3	9.4	17.9
Investment to GDP	20.2	19.8	19.9	20.3	20.0
NPV of debt to GDP	12.6	40.8	59.3	44.8	35.8
Official net transfers to GDP	4.2	6.6	6.0	2.8	5.1
Openness to GDP	57.3	56.7	62.5	69.1	59.9
Population growth	2.5	2.5	2.2	2.0	2.4
Secondary school enrollment	20.5	30.8	37.7	47.6	36.1
Terms of trade growth	1.3	−0.8	−0.4	−0.9	0.0
Total NPV of debt to GDP	19.7	55.5	76.7	60.4	48.7
Total debt service to GDP	3.1	6.0	6.3	5.8	5.1

Note: NPV = net present value; CPIA = country policy and institutional assessment index.

Table A3. Country Classification by Debt Levels and Country Policy and Institutional Assessment Index (CPIA)

	Debt below median	Debt above median
CPIA above median	Algeria, Botswana, Brazil, Cape Verde, Colombia, Ghana, India, Iran, Kenya, Malaysia, Malawi, Mauritius, Mexico, Paraguay, Rwanda, South Africa, Sri Lanka, Togo, Trinidad and Tobago, Tunisia, Turkey, Uruguay, Venezuela	Cameroon, Chile, Costa Rica, Côte d'Ivoire, Gambia, Indonesia, Jamaica, Morocco, Panama, Philippines, Senegal, Vietnam
CPIA below median	Argentina, Bangladesh, Benin, Burkina Faso, Central African Republic, Chad, Djibouti, Dominican Republic, El Salvador, Guatemala, Haiti, Lesotho, Nepal, Niger, Pakistan, Swaziland, Uganda, Zimbabwe	Burundi, Cambodia, Comoros, Congo, Dem. Republic of, Congo, Republic of, Egypt, Ethiopia, Guinea, Guinea-Bissau, Guyana, Honduras, Lao People's Dem. Republic, Lebanon, Madagascar, Mali, Mauritania, Mozambique, Nigeria Nicaragua, Papua New Guinea, Peru, Sierra Leone, Sudan, Syrian Arab Republic, Yemen, Zambia

REFERENCES

Arellano, M., and O. Bover, 1995, "Another Look at the Instrumental Variable Estimation of Error-Components Models," *Journal of Econometrics*, Vol. 68, No. 1, pp. 29–51.

Arslanap, S., and P.B. Henry, 2005, "Debt Relief: What Do Markets Think?" *Journal of Finance*, Vol. 60, No. 2, pp. 1021–55.

Birdsall, N., S. Claessens, and I. Diwan, 2003, "Policy Selectivity Foregone: Debt and Donor Behavior in Africa," *The World Bank Economic Review*, Vol. 17, No. 3, pp. 409–35.

Blundell, R., and S. Bond, 1998, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics*, Vol. 87, No. 1, pp. 115–43.

Borenzstein, E., 1990, "Debt Overhang, Credit Rationing and Investment," *Journal of Development Economics*, Vol. 32, No. 2, pp. 315–35.

Claessens, Stijn, Ishac Diwan, Kenneth Froot, and Paul Krugman, 1990, "Market-Based Debt Reduction for Developing Countries: Principles and Prospects," *The World Bank Policy and Research Series*, No. 16, Working Paper (Washington, World Bank).

Clements, B.J., R. Bhattacharya, and T.Q. Nguyen, 2003, "External Debt, Public Investment, and Growth in Low-Income Countries," IMF Working Paper 03/249 (Washington, International Monetary Fund).

Cohen, D., 1993, "Low Investment and Large LDC Debt in the 1980s," *American Economic Review*, Vol. 83, No. 3, pp. 437–49.

———, 1997, "Growth and External Debt: A New Perspective on the African and Latin American Tragedies," CEPR Discussion Paper No. 1753 (London, Centre for Economic Policy Research).

Cordella, T., L.A. Ricci, and M. Ruiz-Arranz, 2005, "Debt Overhang or Debt Irrelevance? Revisiting the Debt-Growth Link," IMF Working Paper 05/223 (Washington, International Monetary Fund).

Corden, W.M, 1989, "Debt Relief and Adjustment Incentives," in *Analytical Issues in Debt*, ed. by Jacob A. Frenkel, Michael P. Dooley, and Peter Wickham (Washington, International Monetary Fund), pp. 242–257.

Depetris Chauvin, N., and A. Kraay, 2005, *What has 100 Billion Dollars Worth of Debt Relief Done for Low-Income Countries?* Available via the Internet: www.ssrn.com/abstract=818504.

Desphande, A., 1997, "The Debt Overhang and the Disincentive to Invest," *Journal of Development Economics*, Vol. 52, No. 1, pp. 169–87.

Easterly, W.R., 2001, "Growth Implosions and Debt Explosions: Do Growth Slowdowns Cause Public Debt Crises?" *Contributions to Macroeconomics*, Vol. 1, No. 1, pp. 1–24.

Easterly, W.R., and R. Levine, 1997, "Africa's Growth Tragedy: Policies and Ethnic Divisions," *Quarterly Journal of Economic*, Vol. 62, No. 4, pp. 1203–50.

———, 2001, "It's Not Factor Accumulation: Stylized Facts and Growth Models," *World Bank Economic Review*, Vol. 15, No. 2, pp. 177–19.

Easterly, W.R., R. Levine, and D. Roodman, 2003, "New Data, New Doubts: A Comment on Burnside and Dollar's 'Aid, Policies, and Growth'," *American Economic Review*, Vol. 94, No. 3, pp. 774–80.

Elbadawi, Ibrahim, Benno Ndulu, and Njuguna Ndung'u, 1997, "Debt Overhang and Economic Growth in Sub-Saharan Africa," in *External Finance for Low-Income Countries*, ed. by Zubair Iqbal and Ravi Kanbur (Washington, International Monetary Fund Institute), pp. 49–76.

Hansen, B., 1996, "Inference When a Nuisance Parameter is Not Identified Under the Null Hypothesis," *Econometrica*, Vol. 64, No. 2, pp. 413–30.

———, 2000, "Sample Splitting and Threshold Estimation," *Econometrica*, Vol. 68, No. 3, pp. 575–603.

Hansen, H., 2001, "The Impact of Aid and External Debt on Growth and Investment: Insights from Cross-Country Regression Analysis," paper presented at the WIDER Conference on Debt Relief, United Nations University, Helsinki, Finland, August 17.

Husain, A., 1997, "Domestic Taxes and External Debt Laffer Curve," *Economica*, Vol. 64, No. 255, pp. 519–25.

Imbs, J., and R. Ranciere, 2005, "The Overhang Hangover," World Bank Policy Research Working Paper No. 3673 (Washington, World Bank).

Kaminsky, G., and A. Pereira, 1996, "The Debt Crisis: Lessons of the 1980s for the 1990s," *Journal of Development Economics*, Vol. 50, No. 1, pp. 1–24.

Kaufmann, D., A. Kraay, and P. Zoido-Lobatón, 2002, "Governance Matters, III: Updated Indicators for 2001/02," Available via the Internet: www.worldbank.org/wbi/governance/govdata2001.

Kraay, A., and V. Nehru, 2004, "When is External Debt Sustainable?" World Bank Policy Research Paper 3200 (Washington, World Bank).

Krugman, P., 1988, "Financing Versus Forgiving a Debt Overhang," *Journal of Development Economics*, Vol. 29, No. 3, pp. 253–68.

La Porta, R., F. Lopez-De-Silanes, A. Shleifer, and R. Vishny, 1997, "Legal Determinants of External Finance," *Journal of Finance*, Vol. 52, No. 3, pp. 1131–50.

Marchesi, S, and A. Missale, 2004, "What Does Motivate Lending and Aid to the HIPCs?" Centro Studi Luca D'Agliano Development Working Paper No. 189 (Italy, Milano, University of Milano).

Myers, S., 1977, "Determinants of Corporate Borrowing," *Journal of Financial Economics*, Vol. 5, No. 2 (November), pp. 147–75.

Pattillo, C., H. Poirson, and L.A. Ricci, 2002, "External Debt and Growth?," IMF Working Paper 02/69 (Washington, International Monetary Fund).

———, 2003, "Through What Channels Does External Debt Affects Growth?" *Brookings Trade Forum* (Washington, The Brookings Institution), pp. 229–58.

Presbitero, A.F, 2008, "The Debt-Growth Nexus in Poor Countries: A Reassessment," in Economics: The Open-Access, Open-Assessment E-Journal, Kiel Institute for the World Economy, Vol. 2 (30). Available via the Internet: www.economics-ejournal.org/economics/journalarticles/2008-30.

Rajan, R., and A. Subramanian, 2005, *Aid and Growth: What Does the Cross-Country Evidence Really Show?* (unpublished; Washington, International Monetary Fund).

Rodrik, D., A. Subramanian, and F. Trebbi, 2004, "Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development," *Journal of Economic Growth*, Vol. 9, No. 2, pp. 131–65.

Sachs, J.D., 1988, "The Debt Overhang of Developing Countries," in *Debt Stabilization and Development: Essays in Memory of Carlos Diaz-Alejandro*, ed. by G. Calvo, R. Findlay, P. Kouri, and J. Braga de Macedo (Oxford, United Kingdom, Basil Blackwell).

Servén, Luis, 1997, "Uncertainty, Instability, and Irreversible Investment: Theory, Evidence, and Lessons for Africa," World Bank Policy Research Working Paper No. 1722 (Washington, World Bank), pp. 1–44.

Warner, A.M., 1992, "Did the Debt Crisis Cause the Investment Crisis?" *Quarterly Journal of Economics*, Vol. 107, No. 4, pp. 1161–86.