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THE DEBT-GROWTH NEXUS IN POOR COUNTRIES: A REASSESSMENT

Andrea F. Presbitero[§]

April, 12nd 2006

Preliminary Version, please do not quote without author's permission

Abstract

This paper investigates the relationship between external indebtedness and economic growth, with a particular attention to LICs, for which the theoretical arguments of debt overhang and liquidity constraint have to be reconsidered. The estimation of a growth model, with a panel of 121 developing countries, supports a negative and linear relationship between past values of the NPV of external public debt and current economic growth. This is due to the “extended debt overhang”, according to which a large indebtedness leads to misallocation of capital and discourage long-term investment and structural reforms. This work underlines the critical role of economic policies and institutions, the necessity of focusing on LICs and fostering macroeconomic stability.

Keywords: External Debt, HIPC, Debt Relief, Economic Growth

JEL Classification: C33, F34, H63, O11

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1. Introduction

Debt relief is nowadays one of the critical issues on the policy agenda of governments and international institutions. At the G8 summit at Gleneagles and at the following meetings donors and the international community agreed to further debt cancellation to the Highly Indebted Poor Countries (HIPC), and the debate is now on the possibility of granting debt relief to other poor countries that might be included in the HIPC Initiative. The presence of a large indebtedness has different effects on poor countries, not only related to their macroeconomic performance, but also to political and institutional aspects. Nevertheless, this paper focuses exclusively on the economic consequences of high debts in poor countries, providing a re-examination of the channels through which external debt impinges on investment and on economic growth, in order to improve the reliability of policy recommendations.

According to the debt overhang effect (Krugman, 1988 and Sachs, 1989) a large debt burden squeezes investments, because returns are “taxed away” by foreign creditors. This theoretical argument was developed in response to the Latin American crisis of the 1980s, which affected Middle Income countries and debts contracted mainly with private creditors. However, the current debt crisis involves Low Income countries, mainly located in Sub-Saharan African, without market access and highly dependant on concessional external lending. Notwithstanding bilateral and multilateral debt relief, they keep on receiving large inflows of external credit at high concessional terms by multilateral institutions. Hence, the lack of sudden stops in external assistance and the continuous process of debt rescheduling and restructuring is expected to reduce the disincentive effect of external public debt. The current situation seems to adapt better to an extensive interpretation of debt overhang, which implies a disincentive on investments in human capital and new technologies, and the government’s willingness to adopt structural reforms and fiscal adjustments, leading to a poverty trap (Sachs, 2002). Besides, the uncertainty associated with the level of external public debt (i.e. risk of default, rescheduling and arrears) increases the volatility of future inflows, leading to a situation in which investors are likely to exercise the “waiting” option (Serven, 1996). Thus, an unstable macroeconomic environment (i.e. high and volatile inflation and interest rates) is likely to generate a misallocation of resources, maybe due to short-termism, which reduces the efficiency and productivity of capital, leading to a slowdown of economic growth.

Some earlier papers¹ suggest that the debt-growth relationship follows a bell-shaped curve, since, beyond a certain debt ratio², the impact of the stock of external debt on growth becomes negative. Two recent papers, Cordella *et al.* (2005) and Imbs and Ranciere (2005), move from the previous literature and extend the analysis: the former argue that the relation is a “modified Debt-Laffer curve” because, over a certain threshold, the debt effect on growth is nil, creating

¹ See: Elbadawi *et al.* (1997), Pattillo *et al.* (2002 and 2004), Clements *et al.* (2003).

² The main measures of external indebtedness are the ratios of external debt over GDP and over exports.

a sort of debt irrelevance zone; the latter use a non parametric technique to support the bell shaped curve, arguing that better institutions reduce the magnitude of the debt overhang.

Also debt flows could affect economic performance, if a reduction in current debt service increases the current level of investments, for any given level of future indebtedness (liquidity constraint effect). However, empirical findings on the effectiveness the crowding out of investment are debatable³.

In sum, the empirical evidence on the debt-growth nexus is unclear, since econometric results lack of robustness (Moss and Chiang, 2003). This field of research has to deal with the issues of omitted variables and causality, since it is not clear and necessary that high debt causes low growth. It could or the other way round, or debt and growth could be both determined by policies and institutions. We try to address the problem of causation taking past, instead of current, values of the debt ratio as explanatory variables and we include an institutional indicator to verify if debt has a direct effect on growth⁴.

The first contribution of this work is that we do not find any evidence of an inverse U-shaped curve representing the debt-growth relation. External public debt in the previous period is negatively associated with current economic growth, even controlling for policies and institutions. A further step aims to disentangle the negative debt effect in Low and Middle Income countries, on the ground that debt overhang could be reduced or avoided in LICs thanks to the continuous external borrowing. Our results are not conclusive, but they suggest the possibility that the negative effect of debt on growth is lower in the poorest countries.

The second contribution of the paper concerns the discussion on the channels through which external debt affects economic growth, The estimation of a total investment and a public investment equations does not find any relationship between external debt and investment rate, providing additional support to the extensive interpretation of debt overhang. A lower GDP growth is not due to lower, but to less efficient investment and to the lack of structural reforms, because of the uncertainty and instability created by a large external debt. We also find that debt service obligations crowd out total (and not public) investment, only in Low Income countries. Thus, we could guess that debt service soaks up resources and reduces the credit from the banking system to private sector.

Eventually, the paper underlines the great relevance of macroeconomic management and market oriented policies to trigger economic growth. Therefore, in order to reap of the benefit from a reduction in external debt, it is necessary that governments have the incentives to keep on pursuing structural adjustments and reforms. On the contrary, without conditionality, moral hazard issues could prevent these improvements and hinder economic growth.

³ Pattillo *et al.* (2002, 2004) do not support the liquidity constraint, while Chowdhury (2004), Clements *et al.* (2003), Elbadawi *et al.*, (1997) and Hansen (2004) find that both debt burden and debt service obligations squeeze investment and economic performance. Cohen (1993), instead, rejects the debt overhang hypothesis and supports the crowding out effect.

⁴ If the inclusion of an institutional variable does not affect the significance of the debt ratio, we can be more confident on the authenticity of the relationship between debt and growth.

The remainder of the paper is as follows: next section presents the dataset, its sources and its descriptive statistics in Low and Middle Income countries. Section 3 deals with the growth model and discusses some methodological issues (sub-section 3.1) and the results. Section 4 is about the investment models, while the last section wraps up, draws the main policy recommendations and presents some open questions. Summary Tables and the list of variables are presented in the Annexes.

2. Institutional Indicators and Descriptive Statistics

The dataset covers 121 developing countries over the period 1980-2004. The main sources are the World Development Indicators (WDI) and the Global Development Finance 2005 of the World Bank. Other data comes from the World Economic Outlook (IMF) and from a number of IMF Country Report Staff Papers. The historical series on the Net Present Value of Public and Public-Guaranteed (PPG) external debt is an internal dataset of The World Bank constructed by Yuri Dikhanov (2004). The educational indicators – the gross primary and secondary enrolment rates – are constructed updating the Barro-Lee dataset⁵ with data from the WDI 2005. To take into account the institutional aspect we use the Country Policy and Institutional Assessments (CPIA) score, which is a confidential indicator of the quality of policies and institutions developed by the World Bank⁶. The CPIA assesses the quality of a country's present policy and institutional framework. Their ratings, ranging from 1 (low) to 6 (high), are based on all key factors that foster pro-poor growth and poverty alleviation (Economic Management, Structural Policies, Policies for Social Inclusion/Equity, Public Sector Management and Institutions). The broad coverage – the CPIA index is available for 136 countries – and the long time horizon (1977-2004) makes this indicator very useful for this panel analysis, since it overcome the usually lack of historical data for institutional indicators.

To wash out any business cycle variation, we take 5 year average of the data, ending with 5 observations in time⁷. Eventually, the plot of the data helped to highlight some outliers, generally related to the first observations in the former communist countries.

The sample includes both Low and Middle-Income countries, so that we end up with an heterogeneous sample of countries, which are likely to be affected in different ways by debt dynamics. The summary statistics of the main variables, (Table 1A, in Annex A), highlight large differences between sub-samples. Middle Income countries are characterized by larger investment (INV) and revenues (REV), higher education (PEDUC and SEDUC), and stronger economic growth

⁵ <http://www.cid.harvard.edu/ciddata/ciddata.html> (last accessed: February, 2006).

⁶ The datasets on the NPV of PPG external debt and on the CPIA ratings were given to the author when he was an intern at the PRMED (Economic Policy and Debt Department) at The World Bank. The author thanks L. Bandiera and V. Nehru for the provision of the data.

⁷ For the education variable, instead of taking the five year average, we consider the enrolment rate in the first year of the 5-year period.

(GROWTH). The quality of policies and institutions (CPIA) is better in the richest countries of the sample. The level of public investment (PUBINV) is, instead, larger in the poorest countries, even if the difference is small. The macroeconomic structure in HICs present the worst scenario, with an average annual growth rate of 2.9%, lower levels of investment, education, and worse institutional quality.

The comparison of the debt indicators shows differences even larger: the external debt to GDP ratio (DGDP) is 55.2 in MICs and 96.6 in LICs at nominal values and 35 and 59 respectively in Present Value terms (NPVDGDP). The NPV of debt to export ratio (NPVDXTS), which is the basic indicator implemented in the HIPC Initiative, is below the threshold of 150 for MICs (123.8), while it is above in LICs (315) and HICs (391). Debt service (TDSGDP), instead, is larger in Middle Income than in Low-Income countries (6.2% of GDP versus 4.5%). In the HICs, debt service is larger than in the overall sample of LICs, because of the larger stock of external debt, but still below the level reached in MICs, thanks to concessional lending. Nevertheless, since the crowding out effect concerns the budget constraint, what really matters is the share of revenues designed to repay debt obligations: given their poor revenues, in Low Income countries even a smaller debt service might crowd out investment.

The correlation analysis (Tables 2A-3A) shows that past values of external debt, the variability of inflation and the exchange are significantly associated with lower economic growth, while public and total investment, debt service and education are positively related to GDP growth, even if, for education and debt service, the correlations are smaller and not significant in LICs. We observe a positive and significant correlation between the logarithm of investment (LINV) and debt service, revenues, CPIA, primary education, economic growth and GDP, both in the entire sample and in LICs, while the correlation with external debt ratios is generally not significant. With respect to public investments (PUBINV), they are positively correlated with GDP growth, revenues and the institutional indicator, negatively with the level of GDP, while the correlation with the external debt ratios is not significant.

This brief description of the data underlines great differences in the macroeconomic environment between Low and Middle Income countries: in order to provide more reliable indications of debt effects in the poorest countries, we try to address the heterogeneity in the data estimating the model in different sub-samples and also including dummies for different intercepts and slopes in LICs.

3. The Growth Model⁸

The growth equation that has to be estimated (1) is:

$$\Delta y_{it} = \alpha + (\beta - 1)y_{it-1} + \sum_{j=1}^k \delta_j x_{ij} + \sum_{h=1}^2 \gamma_h debt_{ith} + n_i + \varepsilon_{it} \quad (1)$$

⁸ This part is based on Presbitero (2005), who stresses the advantages of System GMM.

and it is equivalent to the dynamic panel model (2):

$$y_{it} = \alpha + \beta y_{it-1} + \sum_{j=1}^k \delta_j x_{itj} + \sum_{h=1}^2 \gamma_h debt_{ith} + n_i + \varepsilon_{it} \quad (2)$$

where y_{it} is the logarithm of per capita GDP at Purchasing Power Parity of country i at time t (and Δy is the GDP growth rate calculated as log difference), y_{it-1} is the log of lagged income, x_{itj} is a set of control variables, $debt_{ith}$ are different indicators of the external public debt stocks and flows, n_i captures the effects of the country i that are time invariant, and the classical error term ε_{it} is referred to the variability across time and countries. We move from the standard augmented Solow model (Mankiw *et al.* 1992) and we add debt variables – the logarithm of debt service and the log of the external public debt-to-GDP ratio in the previous period - and the institutional variable, the CPIA index. The other control variables are the log of investments, the log of the primary enrolment rate, the rate of growth of terms of trade, and some financial indicators – the log of the change in the exchange rate and the variability of inflation⁹.

Methodology

The dynamic structure of the model¹⁰ makes the OLS estimator upwards biased and inconsistent, since the lagged level of income is correlated with the error term. The within transformation does not solve the problem, because of a downward bias (Nickel, 1981) and inconsistency. A possible solution is represented by the Generalized Method of Moments (GMM) technique. Blundell and Bond (1997) show that when β approaches to one, so that the dependent variable follows a path close to a random walk, the differenced-GMM (Arellano and Bond, 1991) has poor finite sample properties, and it is downwards biased, especially when T is small. Bond *et al.* (2001) argue that this is likely to be a serious issue for autoregressive model, like the growth equation (2), when the per capita GDP is observed in 3 or 5 years averages and T is necessarily small. Therefore, Blundell and Bond (1997) propose another estimator – the System-GMM (thereafter, BB) – derived from the estimation of a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). In multivariate dynamic panel models, the BB estimator is shown to perform better than the differenced-GMM when series are persistent (β close to unity) and there is a dramatic reduction in the finite sample bias due to the exploitation of additional moment conditions (Blundell *et al.* 2000). In presence of heteroscedasticity and serial correlation, the two-step System-GMM uses a

⁹ The exchange rate is defined as national currency per US dollar, while the variability of inflation - defined as the standard deviation of inflation in the five-year period - could be thought as a measure of macroeconomic instability.

¹⁰ We present the methodological issues referring to the growth model, since they can be easily extended at the investment equation, discussed in section 4.

consistent estimate of the weighting matrix, taking the residuals from the one-step estimate (Davidson and MacKinnon, 2004). Though asymptotically more efficient, the two-step GMM presents estimates of the standard errors that tend to be severely downward biased. However, it is possible to solve this problem using the finite-sample correction to the two-step covariance matrix derived by Windmeijer, which can make two-step robust GMM estimates more efficient than one-step robust ones, especially for system GMM (Roodman, 2003).

Bond *et al.* (2001) provide a useful insight in the GMM estimation of dynamic growth models¹¹, arguing that the pooled OLS and the LSDV estimators should be considered respectively as the upper and lower bound. As a result, whether the differenced GMM coefficient is close to or lower than the within group one, this is likely a sign that the estimates are biased downward (maybe because of a weak instrument problem). Thus, if this is the case, the use of System-GMM is highly recommended, and its estimates should lie between OLS and LSDV. This conclusion is supported by the empirical testing of the augmented Solow model (Hoeffler, 2002 and Nkurunziza and Bates, 2002). Presbitero (2005) estimates a model similar to (2) showing that the System-GMM is a good estimator, at least better than the differenced-GMM, which is severely downward biased. In particular, there is evidence that using results obtained with the System GMM confirm that:

- the system-GMM lies between the upper and lower bound represented by OLS and LSDV,
- there is a gain in efficiency, and
- the instrument set is valid¹².

Empirical results

The results (Table 1) are consistent with the augmented Solow model, showing conditional convergence and a positive effect of education and investment on economic growth. Terms of trade have generally a positive impact too, while openness is not significant. The higher the volatility of the inflation rate, the more unstable is the macroeconomic environment and the lower is the growth rate. Policies and institutions have a strong impact on growth, since a one point increase in the CPIA score is associated with an increase in GDP growth of around 1.3 percentage points. The estimates support the existence of a negative relation between the past debt values and current growth, while debt service is not significant. We check and validate this relevant results with different debt indicators – face and discounted values and their ratios over GDP and exports¹³.

¹¹ One of the main problems of using the GMM estimators with macroeconomic and cross country data is that they are generally developed for micro data, in which the spatial dimension is very large, and their properties are valid asymptotically.

¹² Whether these three conditions are met, the two-step system-GMM results can be taken as a benchmark for growth regressions (Bond *et al.*, 2001, 2004, Nkurunzita and Bates, 2003, Hoeffler, 2002).

¹³ The last two columns of Table 1 report the estimates obtained using current instead of past values of the debt ratio: the linear negative relationship is still significant and its magnitude is

Table 1: *The Growth Model: different debt indicators*

Dependent variable: GDP growth	(1)	(2)	(3)	(4)	(5)	(6)
GDP (-1)	-1.68** (0.41)	-1.38** (0.46)	-1.77** (0.39)	-1.50** (0.53)	-2.69** (0.54)	-2.45** (0.48)
NPVDGDP (-1)	-0.83** (0.31)					
NPVDXTS (-1)		-0.45* (0.27)				
DGDP (-1)			-0.91** (0.37)			
DXTS (-1)				-0.34 (0.34)		
DGDP					-0.99** (0.51)	
DXTS						-1.10** (0.45)
LTDSGDP	0.48 (0.53)	-0.15 (0.55)	0.27 (0.54)	-0.27 (0.57)	2.12** (0.67)	2.43** (0.75)
LINV	2.67** (0.85)	2.40** (0.95)	2.68** (0.87)	2.46** (0.88)	4.18** (1.27)	4.36** (1.00)
PEDUC	3.83** (1.35)	3.52** (1.48)	3.68** (1.37)	3.54** (1.29)	3.10** (1.30)	2.40* (1.40)
TOT	0.06** (0.03)	0.06** (0.03)	0.05** (0.03)	0.05* (0.03)	0.04 (0.04)	0.04 (0.03)
OPEN	-0.60 (0.75)	-0.67 (0.77)	-0.73 (0.68)	-0.42 (0.88)	-0.89 (0.92)	-2.44** (1.04)
INFL	-0.0004** (0.0002)	-0.0005** (0.0002)	-0.0005** (0.0002)	-0.0005** (0.0002)	-0.0003 (0.0002)	-0.0002 (0.0002)
CPIA	1.23** (0.30)	1.29** (0.30)	1.31** (0.32)	1.38** (0.30)	0.81** (0.39)	0.94** (0.34)
CONSTANT	-8.15 (6.72)	-7.80 (7.60)	-5.31 (6.91)	-8.52 (7.99)	-1.67 (6.19)	6.38 (8.40)
OIR test (p-value)	0.374	0.321	0.366	0.367	0.499	0.578
AB(1)	0.003	0.003	0.003	0.020	0.002	0.002
AB(2)	0.917	0.998	0.918	0.967	0.859	0.900
No. Obs.	410	405	409	412	427	421
No. Obs. Per group	3.42	3.38	3.41	3.43	3.56	3.51
F-test	14.64	18.77	15.4	17.46	28.29	21.07

Notes: All variables are five-year average. Double and stars mean respectively a 5% and 10% significance level. Corrected standard errors are in brackets. Time dummies not shown.

larger. Since column 1 is the preferred specification, thereafter we take the NPV of external public debt-to-GDP ratio as main debt indicator.

All the specifications pass the Hansen-J statistic test for Over-Identifying Restrictions (OIR), confirming that the instrument set can be considered valid, the F-test for the overall significance of the regression and the Arellano-Bond tests for serial correlation¹⁴, supporting the model specification. The main findings on the debt-growth nexus do not change if we exclude some variables or if we control for secondary education or for the exchange rate¹⁵.

The estimation of the growth equation without the investment variable shows that the exclusion of investment does not increase substantially the debt effect, since the coefficients on debt are not statistically different comparing columns 1 and 2 in Tables 1 and 2. Therefore, external indebtedness is not a constraint to the level of investment. Lower growth, thus, could be explained by a misallocation of resources, with agents preferring less efficient investment project, because of uncertainty and short-termism, in accord with an extensive interpretation of debt overhang. Eventually, there is no evidence of a bell shaped relation between debt and growth: the inclusion of the quadratic term in the preferred specification (column 6), in fact, does not change the impact of other variables on economic growth, but makes the debt ratios no more significant. In particular, we are able to show how the presence of the Debt-Laffer curve depends on the exclusion of the institutional control and on the use of current debt ratios (column 3). Nonetheless, the inclusion of the CPIA score (column 4) or the use of past instead of current debt ratios (column 5) makes the Debt-Laffer curve not significant.

The estimation of the debt growth nexus in the entire sample may not be very informative because of the heterogeneity of the countries analyzed. A first strategy to address this problem is the estimation of the model for the two sub-samples, allowing all the explanatory variables to have different effects on economic growth. An alternative consists in taking into account the specificity of LICs, allowing only for a shift of the regression line (including of a dummy for the LICs) and for a change in the coefficient on debt, using an interaction term constructed multiplying the LIC dummy with the debt variable (always related to the previous period). Thus, model (2) becomes:

$$y_{it} = \alpha + \beta \cdot y_{it-1} + \sum_{j=1}^k \delta_j x_{ij} + \gamma \cdot debt_t + \varphi(debt_t \cdot LIC) + \rho \cdot LIC + n_i + \varepsilon_{it} \quad (3)$$

¹⁴ If the model is well specified we expect to reject the null of not autocorrelation of the first order (AB1), and to not reject the hypothesis of no autocorrelation of the second order (AB2).

¹⁵ Secondary enrolment rate is a positive and significant determinant of the growth rate, while the change in the log of the exchange rate has a negative impact on GDP growth. In other words, a devaluation of the exchange rate reduces economic growth, according to a recent contribution by Frankel (2005), who stresses the contractionary effects of devaluation in developing countries, mainly due to balance sheet effects on financial sector. Results are not shown for reason of space and available from the author on request.

Table 2: *The Growth Model: without investment and non-linearities.*

Dependent variable: GDP growth	(1)	(2)	(3)	(4)	(5)	(6)
GDP (-1)	-1.34** (0.58)	-1.13** (0.66)	-3.32** (0.70)	-2.50** (0.54)	-2.43** (0.45)	-1.71** (0.42)
NPVDGDP (-1)	-0.83** (0.31)				0.09 (0.98)	-0.35 (0.91)
[NPVDGDP (-1)] ²					-0.20 (0.14)	-0.07 (0.13)
NPVDXTS (-1)		-0.44** (0.27)				
NPVDGDP			3.08* (1.77)	2.39 (2.22)		
[NPVDGDP] ²			-0.66** (0.24)	-0.48* (0.28)		
LTDSGDP	0.51 (0.69)	0.22 (0.72)	3.27** (0.80)	1.89** (0.61)	1.38** (0.51)	0.45 (0.46)
LINV			4.31** (0.98)	3.54** (1.09)	3.69** (0.87)	2.48** (0.75)
PEDUC	5.30** (1.63)	4.97 (1.59)	5.24** (1.74)	4.03** (1.41)	5.25** (1.36)	4.10** (1.37)
TOT	0.06** (0.03)	0.05 (0.03)	0.00 (0.04)	0.03 (0.04)	0.05* (0.03)	0.05** (0.02)
OPEN	-0.06 (0.90)	-0.22 (0.97)	-1.39 (0.87)	-0.95 (0.85)	-0.30 (0.72)	-0.50 (0.73)
INFL	-0.0005** (0.0002)	-0.0006** (0.0002)	-0.0002 (0.0003)	-0.0002 (0.0002)	-0.0005** (0.0002)	-0.0004** (0.0002)
CPIA	1.24** (0.32)	1.32** (0.31)		0.76* (0.42)		1.25** (0.31)
CONSTANT	-11.92 (8.80)	-11.74 (9.50)	-8.51 (8.00)	-10.18 (6.71)	-11.92* (6.44)	-9.68 (6.77)
OIR test (p-value)	0.428	0.372	0.329	0.448	0.430	0.402
AB(1)	0.003	0.003	0.009	0.002	0.004	0.003
AB(2)	0.638	0.749	0.650	0.698	0.981	0.938
No. Obs.	410	405	438	427	417	410
No. Obs. Per group	3.42	3.38	3.65	3.56	3.48	3.42
F-test	10.42	12.2	12.08	14.13	22.11	19.3

Notes: All variables are five-year average. Double and stars mean respectively a 5% and 10% significance level. Corrected standard errors are in brackets. Time dummies not shown.

We want to test if ϕ is different from zero, so that in LICs external debt effect has effectively a different magnitude than in the overall sample. Besides, we can test the joint hypothesis:

$$H_0: \phi = 0 \text{ and } \rho = 0$$

If we cannot reject the null, we can conclude that the heterogeneity of the data is already explained by all the other covariates, so that we could be more confident on the relation between past debt and current growth.

Table 3 shows the results obtained following the first strategy¹⁶. In the first two columns, we estimate the model over the entire sample, allowing for a shift in the intercept, which embed the slower rate of growth in LICs. All the other explanatory variables keep their signs and they are still significant, even if the inclusion of the secondary enrolment rate is preferable with respect to the usual measure of primary education. The estimation of the debt-growth nexus separately for Low and Middle Income countries underlines the differences in the two samples: as expected, economic growth is more volatile in the poorest countries, where primary education is the best proxy of human capital; in market access economies, instead, GDP is more path dependant and the secondary enrolment rate is more informative. The role of institutions and policies is strong and similar in both countries. The comparison between columns 2 and 6 suggests that external debt is a harsher constraint to economic growth in MICs than in the overall sample¹⁷. However, there is no support of debt overhang and the exclusion of investment reduces (in absolute terms) the coefficient from 0.98 to 0.91, suggesting a positive correlation between external debt and investment, as supported also by the investment model estimated in the next section¹⁸. On the other hand, in the poorest countries we observe a reduction of the debt effect, which is not always significant. Nonetheless, the point estimates are lower than in the overall sample and in MICs¹⁹, suggesting the existence of a sort of debt irrelevance zone.

The inclusion of both the LIC dummy and the interaction term between the dummy and past values of the debt ratio (Table 4) does not provide any evidence of a significant difference in the effect of external debt on GDP growth between Low and Middle Income countries. Point estimates on the debt ratio remain pretty stable and negative, and also all the other explanatory variables are significant and with the expected signs. The dummy for LICs and the interaction term are never significant, so that we cannot reject the null of both of them jointly equal to zero. In other words, since the heterogeneity of data is already embedded in the variability of the other covariates, we can be more confident on our previous estimates, in which we consider the entire sample altogether.

¹⁶ We have dropped the openness indicator, which is found not to be a significant determinant of GDP growth in previous regressions.

¹⁷ The debt coefficient increases (in absolute terms) from 0.61 to 0.98. A similar result is observable comparing column 1 and 5.

¹⁸ Results not shown for reason of space.

¹⁹ In particular, if we estimate the model of column 4 on the entire sample, we find that the coefficient on the debt ratio is -0.95. Larger standard errors could be due to reduced sample size. Moreover, since the debt effect is larger in MICs than in the entire sample, it is reasonable to assume that it should be lower in LICs.

Table 3: *Growth Equation, Low and Middle Income countries.*

Dependent variable: GDP growth	ALL	ALL	LIC	LIC	MIC	MIC
GDP (-1)	-3.19** (0.88)	-3.10** (0.82)	-3.79** (1.09)	-4.78** (1.46)	-2.50** (0.82)	-3.32** (0.84)
NPVDGDP (-1)	-0.95** (0.30)	-0.61* (0.34)	-0.51 (0.45)	-0.83* (0.44)	-1.17** (0.34)	-0.98** (0.33)
LIC	-3.03** (1.42)	-2.51** (1.26)				
LTDSGDP	0.33 (0.58)	0.17 (0.58)	-0.72 (0.98)		0.78 (0.74)	1.06* (0.62)
LINV	2.22** (0.84)	2.86** (0.91)	2.30** (0.83)	2.57** (0.87)	1.88 (1.46)	2.76** (0.94)
PEDUC	2.49 (1.68)		4.07** (1.65)	3.47** (1.38)	1.36 (2.61)	
SEDUC		1.35* (0.75)				2.25** (0.65)
TOT	0.06** (0.02)	0.05** (0.02)	0.02 (0.03)	0.04 (0.03)	0.07* (0.04)	0.07* (0.04)
INFL	-0.0002 (0.0002)	-0.0003 (0.0003)	-0.0003 (0.0003)	-0.0002 (0.0002)	-0.0004 (0.0002)	-0.0003 (0.0002)
CPIA	1.20** (0.27)	1.12** (0.24)	1.12** (0.43)	1.09** (0.55)	1.30** (0.38)	1.07** (0.27)
CONSTANT	10.75 (12.46)	13.59* (7.74)	4.34 (9.35)	12.45 (10.11)	11.07 (12.89)	11.88* (6.23)
OIR test (p-value)	0.434	0.219	1.000	0.997	0.877	0.949
AB(1)	0.003	0.004	0.048	0.053	0.009	0.009
AB(2)	0.978	0.733	0.915	0.848	0.942	0.588
No. Obs.	410	406	186	186	224	221
No. Obs. Per group	3.42	3.41	3.65	3.65	3.25	3.25
F-test	16.7	11.47	8.05	8.7	11.8	10.93

Notes: All variables are five-year average. Double and stars mean respectively a 5% and 10% significance level. Corrected standard errors are in brackets. Time dummies not shown.

Therefore, whether the target of the analysis are exclusively the poorest countries of the sample, we are not able to draw strong conclusions, even if it seems that the negative relation is still valid, although the magnitude might be lower and its significance need to be addressed carefully. Eventually, the possibility that external debt is not significantly partially correlated with GDP growth could be in line with the idea of the presence of a debt irrelevance zone (Cordella *et al.* 2005) when debt is too high.

Table 4: *Growth Equation, Interaction term and LIC dummy.*

Dependent variable: GDP growth	(1)	(2)	(3)	(4)
GDP (-1)	-2.82** (1.02)	-2.91** (0.80)	-2.95** (0.83)	-2.77** (0.74)
NPVDGDP (-1)	-1.00** (0.41)	-0.54 (0.45)	-0.93** (0.39)	-0.86* (0.43)
[NPVDGDP (-1)]*LIC	-0.05 (0.55)	-0.19 (0.66)	-0.05 (0.49)	-0.02 (0.51)
LIC	-2.23 (2.65)	-1.52 (2.65)	-2.43 (2.23)	-2.11 (2.12)
LTDSGDP	0.34 (0.51)	0.25 (0.54)	0.58 (0.51)	0.71 (0.48)
LINV	2.12** (0.80)	2.88** (0.75)	2.32** (0.80)	2.09** (0.84)
OPEN			-0.96 (0.68)	-1.12 (0.75)
PEDUC	2.97* (1.77)		3.48** (1.55)	4.50** (1.11)
SEDUC		1.51** (0.70)		
TOT	0.06** (0.02)	0.05** (0.02)	0.05** (0.02)	0.05* (0.03)
INFL	-0.0003 (0.0003)	-0.0003 (0.0002)	-0.0003 (0.0002)	
RER				-0.33 (0.22)
CPIA	1.18** (0.27)	1.06** (0.23)	1.16** (0.28)	0.95** (0.31)
CONSTANT	6.08 (14.70)	11.26 (7.89)	7.73 (10.53)	3.95 (8.73)
OIR test (p-value)	0.413	0.223	0.422	0.31
AB(1)	0.003	0.004	0.003	0.003
AB(2)	0.995	0.686	0.964	0.394
No. Obs.	410	406	410	406
No. Obs. Per group	3.42	3.41	3.42	3.41
Test LIC (p-value)	0.233	0.175	0.054	0.188
F-test	12.64	9.82	11.06	11.75

Notes: All variables are five-year average. Double and stars mean respectively a 5% and 10% significance level. Corrected standard errors are in brackets. Time dummies not shown. Test LIC is a t-test for joint hypothesis of the annulment of the coefficients on the LIC dummy and on the interaction term.

To have an idea of the growth impact of debt relief, we estimate that, according to different specifications of the model, a 10% reduction in the debt

ratio will foster per capita GDP growth by 0.08-0.1 percentage points²⁰. A previous reduction in the discounted debt ratio from 50 to 30, similar to what happened in Bolivia in the last decade, is associated with an increase of almost half percentage point in current GDP growth. This effect is not really large, but it is reasonable to assume that debt reduction has other positive effect on the macroeconomic environment, so that it could be the source of other positive contribution to economic growth.

4. The Investment Model

The estimation of the debt-growth relationship is instructive in order to understand if larger indebtedness is associated with slower economic growth, but it is not really informative about the channels through which this could happen. In order to have a more reliable picture of debt constraints on the economy, we look at the effects of external debt on public and total investment and we try to disentangle different effects in Low and Middle Income countries. We specify a very simple dynamic model – equation (4) – in which the investment rate y_{it} depends on its past value y_{it-1} and on a set of control and debt variables (x_{itj} and $debt_{it}$):

$$y_{it} = \alpha + \beta y_{it-1} + \sum_{j=1}^k \delta_j x_{itj} + \sum_{h=1}^2 \gamma_h debt_{it} + n_i + \varepsilon_{it} \quad (4)$$

In order to keep the model as simple as possible, we include some basic control variables: the growth rate of GDP (GROWTH), which captures the “accelerator effect” (Agenor, 2005)²¹, the revenues rate (REV), the institutional quality index (CPIA), private investment (PRINV, only in the public investment model), a dummy for LICs (column 1 and 4), and the time dummies to control for exogenous shock related to business cycle. We exclude the measure of aid, because the revenues already includes grants, and the standard indicator of openness (trade over GDP), because of its high correlation with revenues, especially in LICs, where a large share of tax revenues comes from tariffs²².

The estimates show a strong and significant crowding out of total investment in Low Income countries (Table 5), while there is no evidence that debt obligations reduce the level of investment in MICs. The stock of external debt, in present value terms, is positively associated with total investment, even if

²⁰ Following the preferred specification in the first column of Table 4, the elasticity of GDP growth with respect to the NPV of external debt to GDP ratio is -0.27.

²¹ A better specification of the investment model should consider also the variability of the real exchange rate and of inflation, which capture the macroeconomic instability better than the level of inflation. Further research will include those variables in order to capture the importance of uncertainty on investment and economic growth.

²² The correlation between revenues and openness is 0.47 in the entire sample and 0.61 in LICs. Nevertheless, we have run regressions including openness, without finding it a significant determinant of investment.

it is generally not significant, so that we do not find empirical evidence of debt overhang, even focusing on LIC and MIC. The other control variables included in the model are significant and with the expected sign: revenues, institutional quality and economic growth boost investments, which depend also on investment in the previous period (the autoregressive term explains half of current investment). Eventually, the results pass the tests of autocorrelation and over-identifying restrictions and are very similar controlling for the nominal and NPV of debt ratios to GDP and exports and for the presence of non linearity²³.

Table 5: *Total Investment Equation*

Dependent variable: Total Investment	All sample	LIC	MIC	All sample	LIC	MIC
INV (-1)	0.49** (0.08)	0.50** (0.10)	0.33** (0.10)	0.50** (0.07)	0.50** (0.09)	0.37** (0.00)
NPVDGDP (-1)	0.88** (0.42)	0.20 (0.54)	0.59 (0.53)			
NPVDXTS (-1)				0.39 (0.35)	0.19 (0.52)	0.44 (0.36)
LTDSGDP	-0.21 (0.13)	-0.38** (0.16)	0.09 (0.14)	-0.17 (0.12)	-0.36* (0.19)	0.10 (0.11)
REV	0.31** (0.09)	0.32** (0.12)	0.15* (0.08)	0.37** (0.08)	0.29** (0.14)	0.19** (0.09)
GROWTH	0.36** (0.17)	0.36** (0.15)	0.20 (0.14)	0.33** (0.14)	0.39 (0.26)	0.15 (0.15)
CPIA	0.86* (0.51)	1.95** (0.74)	0.46 (0.59)	0.83* (0.44)	2.22** (0.95)	0.59 (0.58)
LIC	-0.16 (0.81)			0.11 (0.69)		
CONSTANT	-1.66 (2.59)	-4.05 (2.54)	6.90* (3.91)	-2.19 (2.89)	-3.59 (4.32)	4.77 (3.84)
OIR test (p-value)	0.120	0.999	0.674	0.491	0.996	0.814
AB(1)	0.005	0.105	0.027	0.007	0.086	0.018
AB(2)	0.276	0.297	0.689	0.245	0.280	0.750
No. Obs.	391	176	215	386	174	212
No. Obs. Per group	3.49	3.74	3.31	3.45	3.7	3.26
F-test	12.03	25.42	3.83	16.31	27.60	7.07

Notes: All variables are five-year average. Double and stars mean respectively a 5% and 10% significance level. Corrected standard errors are in brackets. Time dummies not shown.

On average, a one percent increase in the debt service to GDP ratio reduces the total investment rate by almost 0.4 percentage points in Low Income

²³ We have included a quadratic term in order to control for the presence of a sort of Debt-Laffer curve, without finding any significant evidence. Results not shown for the sake of brevity and available from the author on request.

countries. It is worth noting the sensitivity on investment to economic policies, but only in LICs, where a one point upward shift in the CPIA score add about 2 percentage points to the investment rate. In MICs, the institutional indicator is not significant, suggesting that, probably, over a certain threshold, institutions and policies are no more likely to boost investment. This result underlines the relevance that should be given to economic and structural reforms in the poorest countries, in order to grant a minimum level of economic management to trigger investment and economic growth.

The analysis of the determinants of public investments shows a different picture (Table 6). Public investment are more path dependant in MICs than in LICs, which are affected by the variability of external finance, revenues and foreign assistance. Public and private investments (PRINV) are substitutes, both in Low and Middle income countries, suggesting that governments should increase the kind of investments, as infrastructure, which boost private investments. We do not find any evidence of liquidity constraint and debt overhang, even controlling for the possible presence of non-linearities²⁴, both in Low and Middle Income countries. Large debts in the previous period are associated with subsequent higher investment ratios in the public sector only in market access economies, in accordance with the estimates of the growth equation, in which the exclusion of investment reduces the debt coefficient. This finding could be consistent with the idea that debt spurs public investment until a certain threshold, above which its positive effect vanishes, even if it is not only the level of indebtedness which affect government decisions, but also the specificity of macroeconomic structure, institutions, and economic policies.

The comparison between the effects of external debt in MICs between public and total investment shows that a large external debt-to-GDP ratios in the previous period is significantly associated with current higher public investment but not with larger total investment. This finding suggests that debt overhang might be a valid theory for private agents, who, because of the uncertainty due to a large indebtedness, prefer to postpone or give up their projects²⁵.

The crowding out effect is limited to total investment in LICs, where, even considering the concessionality of external lending, interest payments on external debt are a constraint in the poorest because of their weak fiscal system. The fact that debt service does not reduce public investment, but total investment might seem counterintuitive, because service payments impinge on the budget constraint. However, the crowding out of private investment could be explained by the real cost of financing faced by private sector and by a credit squeeze associated with situation of debt distress, so that the banking system lends to the government in order to meet external obligations and cannot finance the private sector. In market access economies, instead, private investors can more easily

²⁴ We have also controlled the robustness of the estimates using debt ratios to GDP and exports, in nominal and Present Value terms. Estimates not shown for reasons of space and available from the author on request.

²⁵ This indications have to be taken with caution, since the point estimate of the debt coefficient in the total investment equation is still positive and close to the one on public investment, even if not significant.

have access to international market and the dependence of banking system on government is lower.

Table 6: *Public Investment Equation*

Dependent variable: Public Investment	All sample	LIC	MIC
PUBINV (-1)	0.42** (0.09)	0.36** (0.11)	0.46** (0.11)
NPVDGDP (-1)	0.48 (0.34)	-0.29 (0.66)	0.85** (0.28)
TDSGDP	-0.07 (0.07)	-0.20 (0.16)	0.02 (0.07)
PRINV	-0.07 (0.05)	-0.18** (0.09)	-0.19** (0.07)
REV	0.26** (0.07)	0.27** (0.06)	0.13** (0.06)
GROWTH	0.13** (0.05)	0.15** (0.07)	0.13 (0.10)
CPIA	0.79** (0.32)	1.29* (0.73)	0.70 (0.42)
LIC	1.88** (0.63)		
CONSTANT	-4.97** (1.49)	-1.62 (2.26)	-2.84 (2.93)
OIR test (p-value)	0.560	1.000	0.988
AB(1)	0.007	0.044	0.032
AB(2)	0.691	0.841	0.640
No. Obs.	360	168	192
No. Obs. Per group	3.36	3.65	3.15
F-test	15.04	10.69	23.45

Notes: All variables are five-year average. Double and stars mean respectively a 5% and 10% significance level. Corrected standard errors are in brackets. Time dummies not shown.

The presence of liquidity constraint in LICs stresses the potential future risks related to a rising domestic debt in many HIPC countries. The stock of public domestic debt is still generally low, but interest payments are larger than on domestic than on external public debt²⁶. As a consequence, domestic debt is likely to become a serious constraint to economic growth and poverty reduction in LICs, soaking up resources for investment and pro-poor and social spending

²⁶ For a discussion of the dynamics and potential risks for economic growth and debt sustainability of Central Government securitized domestic debt in HIPC, see Arnone *et al.* (2006). They show the rapid increase in debt stocks and in interest payments, which, in the last years, soak up budget resources than external debt service.

5. Concluding Remarks and Policy Implications

This analysis extends and deepens the study of the debt-growth nexus, taking into account the role of institutions and disentangling the debt effects on public and total investment, with a particular attention to Low Income countries. Using past instead of current values of the debt ratio we confirm the presence of a negative and linear relation between external debt and growth, even controlling for institutional quality, so that external indebtedness is effectively correlated with lower growth. The role of macroeconomic policies is found to be essential for economic growth, supporting the adoption of selectivity and conditionality in debt relief programs. Thus, international institutions and local government should encourage structural reforms and market oriented policies, in order to reap the benefits from external assistance and debt reduction.

Our findings suggest that external debt does not reduce the level of investment, but the “extended debt overhang” effect works in terms of misallocation of capital, short-termism, lack of structural reforms, and subsequent lower efficiency. Debt service crowds out total investment in LICs, while there is no evidence of a liquidity constraint in Middle Income countries. This result must be carefully taken into account, because the rapid increase in domestic debt in Low Income countries in the last years is associated with soaring interest rates and results in interest payments on domestic debt larger than on external debt. With respect to the presence of a Debt-Laffer curve, the paper argues that the basic relation between debt and growth is negative. However, we recognize that this link could become less strong or even not significant when debt is too large, so that there might be a debt irrelevance zone. The upward sloping part of the curve, instead, is not validated by the data, coherently with the reasonable assumption that rich and industrialized countries are the ones which occupy that portion of the bell curve. A careful estimation, based on total public debt and on a complete sample of countries, may provide evidence of a Debt-Laffer curve.

From a policy perspective, this work underlines the lack of theoretical and empirical grounds of the debt thresholds embedded in the HIPC Initiative, because of the linear relation between past external debt and current growth. The positive and strong impact of the institutional indicator requires to give great emphasis on economic policies, governance and structural reforms in poor countries. The presence of an actual liquidity constraint calls forth some sort of debt service threshold in the HIPC Initiative and it highlights the possible future risks of domestic debt in poor countries. Eventually, debt relief could trigger economic growth, even if its direct effect seems to be limited. However, reduced uncertainty and instability, together with an increased confidence on the countries which received debt relief could bring additional benefits in terms of investment and growth. If debt reduction goes hand in hand with selectivity and structural and economic adjustments, it could be viewed as a positive signal from the international community, so that this sort of “endorsement” may stimulate foreign investment, macroeconomic stability and economic growth.

Eventually, we recognize that this topic requires further research. In particular, domestic debt should be included in the analysis to validate the impression

that domestic debt service is becoming an harsh constraint on government in LICs. Then, in order to have a broader and more complete picture of debt effects on the economy, its impact on government expenditures should be analyzed, so that we can look at the possibility of a crowding out effect and also at the existence of a positive relation between debt and expenditures, providing additional evidence about the destination of external lending.

References

- Agenor, Pierre-Richard, 2005, *The Economics of Adjustment and Growth*, Harvard University Press, Cambridge, Mass.
- Arellano, Manuel, and Stephen R. Bond, 1991, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, Vol. 58, pp. 277-297.
- Arnone, Marco, Luca Bandiera, and Andrea F. Presbitero, 2006, "External Debt Sustainability: An Extended Framework for HIPC's?", *mimeo*.
- Blundell, Richard, and Stephen Bond, 1997, "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, Vol. 87, pp. 115-143.
- Blundell, Richard, Stephen Bond, and Frank Windmeijer, 2000, "Estimation in Dynamic Panel Data Models: Improving on the Performance of the Standard GMM Estimators", *The Institute of Fiscal Studies Working Paper*, No. 00/12.
- Bond, Stephen, Anke Hoeffler, and Jonathan Temple, 2001, "GMM Estimation of Empirical Growth Models", *mimeo*, September 2001.
- Bond, Stephen, Asli Leblebicioglu, and Fabio Schiantarelli, 2004, "Capital Accumulation and Growth: A New Look at the Empirical Evidence", *Boston College Working Paper in Economics*, No. 591.
- Chowdhury, Abdur R., 2004, "External Debt, Growth and the HIPC Initiative: Is the Country Choice Too Narrow?", chapter 8 in *Debt Relief for Poor Countries*, ed. by Addison, Hansen and Tarp.
- Clements, Benedict, Rina Bhattacharya, and Toan Q. Nguyen, 2003, "External Debt, Public Investment, and Growth in Low-Income Countries", *IMF Working Paper* No. 03/249.
- Cohen, Daniel, 1993, "Low Investment and Large LCD Debt in the 1980's", *The American Economic Review*, Vol. 83, No. 3.
- Cordella, Tito, Luca A. Ricci, and Marta Ruiz-Arranz, 2005, "Debt Overhang or Debt Irrelevance? Revisiting the Debt-Growth Link", *IMF Working Paper*, No. 05/223.
- Davidson, Russel, and James G. MacKinnon, 2004, *Econometric Theory and Methods*, Oxford University Press, Oxford.

- Dikhanov, Yuri, 2004, “Historical Present Value of Debt in Developing Economies: 1980-2002”, *manuscript*, The World Bank.
- Elbadawi, Ibrahim A., Benno J. Ndulu, and Njuguna Ndung’u, 1999, “Debt Overhang and Economic Growth in Sub-Saharan Africa”, chapter 5 in *External Finance for Low-Income Countries*, ed. by Iqbal, Zubair, and Ravi Kanbur (Washington D.C: IMF Institute).
- Frankel, Jeffrey A., 2005, “Mundell-Fleming Lecture: Contractionary Currency Crashes in Developing Countries”, *IMF Staff Papers*, Vol. 52, No. 2, September 2005.
- Hansen, Henrik, 2004, “The Impact of External Aid and External Debt on Growth and Investment”. chapter 7 in *Debt Relief for Poor Countries*, ed. by Addison, Hansen and Tarp.
- Hoeffler, Anke E., 2002, “The augmented Solow model and the African growth debate”, *Oxford Bulletin of Economics and Statistics*, Vol. 64, No. 2, pp. 135-158.
- Imbs, Jean, and Romain Ranciere, 2005, “The Overhang Hangover”, *World Bank Policy Research Working Paper*, No. 3673, August 2005.
- Krugman, Paul, 1988, “Financing vs. Forgiving a Debt Overhang”, *Journal of Development Economics*, No. 29, pp. 253-268.
- Mankiw, N. Gregory, David Romer, and David N. Weil, “A Contribution to the Empirics of Economic Growth”, *Quarterly Journal of Economics*, No. 107, May 1992, pp. 407-37.
- Moss, Todd J., and Hanley S. Chiang, 2003, *The Other Costs of High Debt in Poor Countries: Growth, Policy Dynamics, and Institutions*, *Issue Paper on Debt Sustainability*, Center for Global Development, Washington DC, August 2003.
- Nickell, Stephen, 1981, “Biases in Dynamic Models with Fixed Effects”. *Econometrica*, Vol. 49, No. 6, November 1981, pp. 1417 – 1426.
- Nkurunziza, Janvier D., and Robert H. Bates, 2003, “Political Institutions and Economic Growth in Africa”, *CSAE Working Paper*, No. 2003-03.
- Pattillo, Catherine, Helene Poirson, and Luca Ricci, 2002, “External Debt and Growth”, *IMF Working Paper*, No. 02/69.

- 2004, "What Are the Channels Through Which External Debt Affects Growth?", *IMF Working Paper*, No. 04/15.
- Presbitero, Andrea F., 2005, "The Debt-Growth Nexus: a Dynamic Panel Data Estimation", *Department of Economics Working Paper*, No. 243, Università Politecnica delle Marche, Ottobre 2005.
- Roodman, David, 2003, "XTABOND2: Stata module to extend xtabond dynamic panel data estimator," Statistical Software Components S435901, Boston College Department of Economics, revised 22 Apr 2005.
- Sachs, Jeffrey D., 1989, "The Debt Overhang of Developing Countries". In *Debt, Stabilization and Development*, by Calvo, Guillermo A., Ronald Findlay, Pentti Kouri, and Jorge Braga de Macedo, (Oxford: Basil Blackwell).
- 2002, "Resolving the Debt Crisis of Low-Income Countries", *Brookings Papers on Economic Activity*, Vol. 1, pp. 257-286.
- Serven, Luis, 1996, "Irreversibility, Uncertainty and Private Investment: Analytical Issues and Some Lessons for Africa", *The World Bank, Mimeo*, December 1999.

Annex A: List of Variables

Variable	Definition	Source
GDP	Logarithm of per capita GDP, measured at Purchasing Power Parity.	The World Bank
GROWTH	GDP growth rate, calculated as log difference.	The World Bank
NPVDGDP	Logarithm of the Net Present Value of PPG external debt-to-GDP ratio.	The World Bank, Dikhanov (2004)
NPVDXTS	Logarithm of the Net Present Value of PPG external debt-to-exports ratio.	The World Bank, Dikhanov (2004)
DGDP	Logarithm of PPG external debt-to-GDP ratio.	The World Bank
DXTS	Logarithm of PPG external debt-to-exports ratio.	The World Bank
LTDSGDP	Logarithm of Total Debt Service-to-GDP ratio.	The World Bank
TDSGDP	Total Debt Service-to-GDP ratio.	The World Bank
LINV	Logarithm of Gross Fixed Capital Formation, as percentage of GDP.	The World Bank and IMF
INV	Gross Fixed Capital Formation, as percentage of GDP.	The World Bank and IMF
PUBINV	Total Gross Public Capital Formation, as percentage of GDP.	The World Bank and IMF
PRINV	Total Gross Private Capital Formation, as percentage of GDP.	The World Bank and IMF
REV	Central Government Total Revenues, including grants, as percentage of GDP.	The World Bank and IMF
PEDUC	Logarithm of Gross Primary Enrolment Rate, in the first year of the 5-year period.	The World Bank and Barro-Lee dataset
SEDUC	Logarithm of Gross Secondary Enrolment Rate, in the first year of the 5-year period.	The World Bank and Barro-Lee dataset
TOT	The growth rate of the Terms of Trade.	The World Bank and IMF
OPEN	Logarithm of openness, defined as Exports plus Imports over GDP.	The World Bank
INFL	Standard Deviation of Inflation (consumer price) over the five-year period.	The World Bank and IMF
RER	Logarithm of the change in the real exchange rate, defined as national currency per US dollar.	The World Bank
CPIA	Country Policy and Institutional Assessments score.	The World Bank
LIC	Dummy for Low Income Countries, according to the GDF classification.	The World Bank

Notes: All variables, except PEDUC, SEDUC and LIC, are five-year averages

Annex B: Tables

Table 1A: Summary Statistics

		GROWTH	DXTS	DGDP	NPVDGDP	NPVDXTS	TDSGDP	INV	PUBINV	REV	PEDUC	SEDUC	CPIA
MIC	Mean	4.210465	194.0707	55.19176	35.42635	123.8681	6.182921	22.97128	7.251964	24.96846	103.616	64.09186	3.606392
	Median	4.343414	151.3348	44.85499	25.3587	87.85905	5.531419	22.15975	5.925061	23.28295	103.3027	66.72	3.6375
	Sd. Dev.	4.095351	248.4029	48.09289	33.75073	178.5734	4.443062	7.166159	4.891902	9.899317	15.43577	24.61565	0.789402
	obs.	327	303	308	313	308	308	330	296	317	338	329	295
HIPC	Mean	2.936606	650.2239	122.4667	75.40727	390.935	5.216383	17.32015	8.062695	19.32867	76.54697	22.04934	3.097056
	Median	3.184185	453.3207	100.5347	58.16979	259.4368	3.995039	16.20101	7.013128	18.47676	74.836	17.5025	3.1865
	Sd. Dev.	3.175678	592.7778	88.40223	68.68234	439.436	4.645291	7.180072	5.236216	7.272531	27.35326	17.5202	0.685727
	obs.	170	166	168	168	166	168	170	166	165	169	161	169
LIC	Mean	3.21908	527.801	96.63205	59.32402	315.3279	4.460259	18.62104	8.124525	19.43138	80.84227	28.55437	3.110183
	Median	3.771996	362.944	78.19771	44.11967	195.845	3.591579	17.01445	6.99377	18.09523	78.94	21.44	3.205
	Sd. Dev.	3.992074	545.45	75.69175	59.26672	394.1437	3.642276	8.446576	6.243141	8.620467	26.19487	23.7435	0.647655
	obs.	248	235	237	237	235	237	248	233	232	247	239	237
Total	Mean	3.782876	339.8451	73.21258	45.72407	206.7282	5.4338	21.10474	7.636287	22.62856	94.00044	49.13859	3.385337
	Median	4.061909	227.011	57.10055	32.28211	135.2018	4.339733	20.20491	6.642166	21.24626	99.548	46.82333	3.429125
	Sd. Dev.	4.077347	437.9443	64.91199	47.93343	306.8339	4.198369	8.029097	5.539364	9.763646	23.52167	29.92494	0.769668
	obs.	575	538	545	550	543	545	578	529	549	585	568	532

Notes: The debt ratios (NPVDGDP and NPVDXTS) refer to the original ratios, not to the logarithms.

Table 2A: Pairwise correlations, entire sample

All sample	GROWTH	GDP(-1)	LTDSGDP	NPVDXTS (-1)	NPVDGDP (-1)	LINV	PUBINV	PEDUC	TOT	REV	RER	INFL	CPIA
GROWTH	1 575												
GDP(-1)	-0.0192 455	1 459											
LTDSGDP	0.1807* 542	0.2502* 450	1 545										
NPVDXTS(-1)	-0.1860* 422	-0.4176* 424	0.0451 423	1 424									
NPVDGDP(-1)	-0.2058* 427	-0.2131* 429	0.2863* 428	0.8260* 423	1 429								
LINV	0.2704* 573	0.2587* 458	0.1923* 544	-0.1716* 423	-0.0241 428	1 578							
PUBINV	0.2058* 527	-0.1839* 430	-0.048 510	0.0347 405	0.0543 409	0.4321* 528	1 529						
PEDUC	0.1310* 559	0.4793* 453	0.1444* 535	-0.2156* 420	-0.0932 425	0.3256* 563	-0.0301 517	1 584					
TOT	-0.0522 570	0.0512 455	-0.1243* 540	-0.0538 420	-0.0277 425	0.0226 573	0.0031 524	0.0225 579	1 598				
REV	0.0834 532	0.2447* 427	0.1727* 509	-0.2547* 396	0.010 401	0.4428* 533	0.3673* 489	0.0956* 535	-0.0093 547	1 552			
RER	-0.4656* 570	0.0061 453	-0.2110* 539	0.1524* 420	0.0604 425	-0.1380* 570	-0.1400* 524	0.0435 576	0.0916* 590	-0.1467* 548	1 595		
INFL	-0.2736* 573	0.0438 458	-0.1409* 545	0.1159* 424	0.1101* 429	-0.0984* 576	-0.0652 527	0.0139 582	0.0358 596	-0.0800 547	0.5579* 593	1 601	
CPIA	0.2311* 530	0.3460* 439	0.2757* 523	-0.2526* 416	-0.1846* 421	0.2935* 531	0.0979* 497	0.2237* 521	-0.0443 527	0.1250* 498	-0.2129* 527	-0.1731* 532	1 532

Note: A star means a 5% level of significance, the second row shows the number of observations.

Table 3A: Pairwise correlations, LICs

LIC	GROWTH	GDP(-1)	LTDSGDP	NPVDXTS(-1)	NPVDGDP(-1)	LINV	PUBINV	PEDUC	TOT	REV	RER	INFL	CPIA
GROWTH	1 248												
GDP(-1)	-0.2866* 197	1 197											
LTDSGDP	0.0390 237	0.0917 195	1 237										
NPVDXTS(-1)	-0.0554 184	-0.1768* 184	-0.0701 184	1 184									
NPVDGDP(-1)	-0.1915* 186	0.0589 186	0.2474* 186	0.7894* 184	1 186								
LINV	0.2086* 248	0.2046* 197	0.1916* 237	-0.0796 184	0.0099 186	1 248							
PUBINV	0.1692* 233	-0.0936 190	0.0675 229	0.0236 180	-0.0014 182	0.5408* 233	1 233						
PEDUC	0.0834 242	0.3349* 196	0.0596 234	-0.1119 184	0.0032 186	0.1941* 242	-0.0053 230	1 246					
TOT	-0.1133 248	0.1512* 197	-0.1462* 237	0.0032 184	0.0203 186	0.002 248	0.0339 233	0.0385 246	1 253				
REV	0.0458 230	0.0414 184	0.3021* 223	-0.1260 174	0.1079* 176	0.4816* 230	0.5446* 217	0.0591 225	-0.0263 232	1 232			
RER	-0.3638* 243	0.1019 193	-0.1733* 232	0.1133 180	0.0781 182	0.1504* 243	-0.1752* 228	0.1072 241	0.1457* 248	-0.1185 232	1 248		
INFL	-0.2549* 248	0.1762* 197	-0.1019 237	0.0876 184	0.105 186	-0.0879 248	-0.0662 233	0.0307 246	-0.0131 253	-0.0612 232	0.5591* 248	1 253	
CPIA	0.1281* 237	-0.015 194	0.3400* 232	-0.0427 184	-0.064 186	0.3138* 237	0.2037* 226	0.0374 233	-0.0679 237	0.1953* 225	-0.2665* 232	-0.2522* 237	1 237

Note: A star means a 5% level of significance, the second row shows the number of observations.