THE DEBT-GROWTH NEXUS IN POOR COUNTRIES: A REASSESSMENT

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November 2005

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, underlines the presence of a negative and linear relationship between past values of the NPV of external 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 the negative effect of external debt on growth and investment, due to the instability and uncertainty it brings on the economy. As a results, debt relief initiatives should focus also on the budget constraint and on 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 recent 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. High debts could undermine the effectiveness of structural reforms aimed to enhance growth and poverty reduction. Permanent fiscal crisis and heavy administrative burdens – due to the number of rescheduling and different creditors (at least 31, in HIPCs) and to the large number of currencies (at least 26) in which debt is denominated – could undermine the development of sound institutions, capable of making strategic choices [Moss and Chiang, 2003].

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. In fact, even if the theoretical literature on this topic is well established, it was generally developed in the 1980s, in response to the Latin-American debt crisis. As a consequence, its basic arguments are not necessarily valid for Low Income countries, and especially for HIPCs, which face a different debt crisis and which could be affected in a different way by large external debts. Furthermore, the empirical evidence is mixed and lacks a general agreement on the real effects of debt on economic performance: in particular, apart form few recent contributions, there is a limited attention to debt effects in Low Income countries, which, instead, requires a specific analysis.

A first contribution of this work is that, contrary to recent empirical studies [Pattillo *et al*., 2002 and Clements *et al*., 2003], we do not find any evidence of an inverse U-shaped curve representing the debt-growth relation (the so-called Debt-Laffer curve). External 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.

A 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[2].

The remainder of the paper is as follows: next section briefly reviews the empirical and theoretical literature, specifying the different condition of LICs. Section 3 underlines the problem of the direction of causality between debt and growth, along with the role of institutions. Sections 4 and 5 present the dataset, its sources and its descriptive statistics in Low and Middle Income countries. Section 6 is about methodological issues and motivates the choice of System GMM as estimator. Section 7 and 8 discuss the results of the growth and investment models, while the last section wraps up, draws the main policy recommendations and presents some open questions. Summary Tables are presented in Annex A.

2. A Brief Review of Theoretical and Empirical Literature

High debts have an adverse effect on the rate of investment and on economic growth, because of disincentive, cash flow and moral hazard effects [Claessens *et al*., 1996]. One of the main channels through which external debts impair economic performance is the debt overhang effect [Krugman, 1988 and Sachs, 1989]: a large debt burden squeezes investments, because returns are "taxed away" by foreign creditors. This theory is reflected in the so-called Debt-Laffer curve, even if some early studies [Cline, 1995 and Cohen, 1993] reject the hypothesis that debt burden reduces investment. This theoretical argument was developed in response to the Latin American crisis of the 1980s, which affected Middle Income countries, whose debt was contracted mainly with private creditors. The current debt crisis is completely different, since it 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

[2] This is one of the reasons that make the G8 proposal on debt relief difficult to be accepted by the International Monetary Fund, which prefer a gradual reduction in debt, so that the process of economic reform could be taken under control and promoted.

keep on receiving large inflows of external credit at high concessional terms by multilateral institutions. As a consequence, 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 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].

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. Even if HIPCs borrow at high concessional terms, so that debt service is lower than in MICs, their revenues are much lower because of weak tax systems and scarce enforcements. As a consequence, even if external debt service is not always large as a share of GDP, it is nonetheless a relevant fraction of revenues, so that it could really be a constraint to the government budget.

The stock of debt has another effect on economic performance, due to uncertainty associated with the level of external debt (i.e. high and volatile inflation, interest rates). Risk of default, rescheduling and arrears are likely to increase the volatility of future inflows and additional lending. The outcome is a situation in which domestic and foreign investors are likely to exercise the "waiting" option [Serven, 1996]. Moreover, an unstable macroeconomic environment is likely to generate a misallocation of resources, maybe due to short-termism [Moss and Chiang, 2003], which reduces the efficiency and productivity of capital, leading to a slowdown of economic growth.

The empirical evidence on the debt-growth nexus (Elbadawi *et al*. [1997], Pattillo *et al.* [2002], Clements *et al.* [2003]) is consistent with a bell shaped curve, so that beyond a certain debt ratio[3] the impact of external debt on growth becomes negative. Pattillo *et al.* [2002] and Clements *et al.* [2003] estimate that debt relief, as designed by the HIPC Initiative, could contribute to roughly one percentage point increase in output growth. Contrary to these findings, Presbitero [2005a] find evidence of a negative linear relation. between debt and growth. The lack of an inverse U-shaped curve could be explained by the sample of countries: the left side of the curve, in which the effect of debt is positive, should be occupied by industrialized and low indebted countries, in which more debt leads to more growth, but these countries are generally excluded by the sample. In two recent papers, Cordella *et al.* [2005] and Imbs and Ranciere [2005] find evidence of non-linearities in the debt growth relation: the former move from the previous literature arguing that the relation is a "modified Debt-Laffer curve" because, over a certain threshold, the debt effect on growth is nil, creating a sort of debt irrelevance

[3] The main measures of external indebtedness are the ratios of external debt over GDP and over exports. The Net Present Value (NPV) of debt is a more informative measure of the real debt burden, since it takes into account the degree of concessionality embedded in the multilateral loans.

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. Furthermore, Cordella *et al.* [2005] look explicitly at debt effects on growth in HIPCs, finding that debt overhang is a valid hypothesis only for non-HIPC countries, in which the estimated Debt-Laffer curve turns negative when the NPV of external debt is beyond 35 percent of GDP[4]. They also argue that the HIPC Initiative is shifting Completion Point countries from the debt irrelevance zone (starting when the NPV of debt to GDP is above 50%-60%) to the downward sloping part of the curve, so that additional debt relief is doomed to spur economic growth.

Also the evidence on the crowding out effect is mixed[5]. Cohen [1993], in particular, rejects empirically the debt overhang hypothesis and supports the crowding out effect, whose magnitude is 0.35. Clements *et al.* [2003] calculate that a reduction in debt service from 8.7% of GDP to 3% will increase public investment by 0.7-0.8%, and this augmented investment will be translated in a per capita GDP growth increase of 0.1-0.2%.

Eventually, the evidence of a direct link between debt and growth remains unclear, since econometric results lack of robustness [Moss and Chiang, 2003]. Moreover, empirical works lack an accurate investigations of the real effects of indebtedness on economic performance in HIPCs (or LICs), a careful analysis of the debt effects on investment, and also the inclusion of a policy or institutional variable.

3. The Causality Issue and the Role of Institutions

The problem of causality is central for this kind of analysis, since it is not clear and necessary that high debt originates low growth. It could also be the other way round, with a huge debt burden being a symptom of slow economic growth. In fact, countries with a sluggish economy are likely to build up external debt to finance their current expenditures, given that low growth reduces revenues and does not generate enough foreign currency to meet debt obligations. Besides, lack of growth in poor countries is generally associated with poor governance and unsound macroeconomic policies, which are likely to be one of the sources of large external indebtedness. This aspect introduces the possibility that debt and growth could be both determined by policies and institutions. In particular, the institutional aspect is likely to be the

[4] Splitting the sample between low and severely indebted countries, the authors find that debt overhang is still valid in low indebted countries, but not in the second sample. In sum, Cordella *et al.* [2005] argue that is the level of indebtedness and not differences in policies or institutions which drives the evidence on debt overhang.

[5] Pattillo *et al.* [2002, 2004] do not support the liquidity constraint, while others Chowdhury [2004], Clements *et al.* [2003], Elbadawi *et al.*, [1997], Hansen [2004] and Presbitero [2005a] find that both debt burden and debt service obligations squeeze investment and economic performance

reason of low growth, as claimed by the large body of literature on institutions and growth[6], and also of high debt, since countries with weak or bad governance are likely to build up huge amount of debt, because of an unstable debt management.

In order to see if debt has an actual effect on economic growth, it is necessary to address these different problems: the endogeneity of debt and the institutional aspect. With respect to the causality issue, there is another point that must be addressed, related to the fact that the most common debt indicator is its ratio to GDP. This exacerbates the endogeneity problem, since country with slow growth will have higher debt ratios, because of a lower denominator, increasing the negative correlation. A possible solution to address this problem and the potential endogeneity of debt is to take the past, instead of the current, values of the debt ratio as explanatory variables. In this way, we investigate if a high debt ratio in the previous period is a significant determinant of a slowdown in the current period. Eventually, controlling for institutions and policies allows for determining if debt has a direct effect on growth. In fact, whether the inclusion of an institutional variable in the growth equation does not affect the significance of the debt ratio, we can be more confident on the authenticity of the relationship between debt and growth. If this is not the case, this could be evidence in support of the hypothesis that policies are the main determinants of both variables.

4. Data and Institutional Indicators

The dataset covers 121 developing countries over the period 1980-2004. The main sources are the World Development Indicators 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 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 dataset[7] with data from the WDI 2005. To take into account the institutional aspect we use the Country Policy

[6] See, among others, Rodrick *et al*. [2002], Acemoglu *et al.* [2004] and North [1990] (Presbitero [2005b] for a brief review). It is worth noting that for institution and policies we refer to those who promote economic liberalization and that are market oriented. The focus, in other words, is on economic freedom and not on political freedom. As recent evidence in Chine and Russia shows, in fact, economic growth could be reached even without any significant improvement in political freedom and democracy. For a discussion on democracy and development, see, among other the recent contribution by Bueno de Mesquita and Downs [2005].

[7] http://www.cid.harvard.edu/ciddata/ciddata.html (last accessed: December, 2005).

and Institutional Assessments (CPIA) score, which is a confidential indicator of the quality of policies and institutions developed by the World Bank[8].

The CPIA assesses the quality of a country's present policy and institutional framework. Their ratings measure the extent to which country policies and institutions create a good environment for growth and poverty reduction[IDA, 2004]. After an extensive review on their process and methodology, now the CPIA are made by 16 criteria, reflecting a balance between all key factors that foster pro-poor growth and poverty alleviation, which are divided in 4 clusters (Economic Management, Structural Policies, Policies for Social Inclusion/Equity, Public Sector Management and Institutions), equally weighted and rated from 1 (low) to 6 (high). Therefore, 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[9].

To wash out any business cycle variation, we take 5 year average of the data, ending with 5 observations in time[10]. Eventually, the plot of the data helped to highlight some outliers, generally related to the first observations in the former communist countries

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5. Descriptive Analysis

The sample includes both Low and Middle-Income countries, because data availability on LICs is too limited for an exhaustive econometric analysis. In this way, 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, showed in Table 1A (in Annex A), highlight large differences between sub-samples. Middle Income countries are characterized by larger investment and revenues, higher education, and stronger economic growth. The differences are large, because the average LIC has an investment rate of 18.6%, compared to 22.9% of the MICs, revenues are 10 percentage point of GDP lower, GDP growth is one percentage point below the growth rate of Middle Income countries, and the gap in primary and especially secondary education is huge. The quality of policies and institutions is better in the richest countries of the sample. The level of public investment

[8] The datasets on the NPV of 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 authors thanks L. Bandiera and V. Nehru for the provision of the data.

[9] An alternative source of institutional data that could be used in the analysis is the *International Country Risk Guide* (ICRG), by the PRS Group, which rates political, economic, and financial risks. However, the coverage is less broad than the CPIA, so that it implies a reduction in the sample size and in the time horizon.

[10] 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.

is, instead, larger in the poorest countries, even if the difference is small. The macroeconomic structure in HIPCs 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 is 55.2 in MICs and 96.6 in LICs at nominal values and 35 and 59 respectively in Present Value terms. The NPV of debt to export ratio, 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 HIPCs (391)[11]. Debt service, instead, is larger in Middle Income than in Low-Income countries (6.2% of GDP versus 4.5%). In the HIPCs, 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-5A) shows that past values of external debt are negatively and significantly associated with current economic growth, while public and total investment and education are positively related to GDP growth. There is also a negative correlation between the past level of GDP and current growth, even if it is significant only in the two sub-sample (LIC and MIC), suggesting the possibility of convergence in these two groups of countries. The variability of inflation and the exchange rate are instead associated with lower economic growth. If we look at the NPV of debt to exports ratio, we can see that the negative correlation is much stronger in Middle Income than in Low Income and HIPC countries. Debt service is positively correlated with GDP growth, even if the correlation becomes not significant and close to zero (negative) in LICs (HIPC). With respect to investment, we observe a positive and significant correlation between the logarithm of investment and debt service, and the latter is positively correlated also with public investment, even if in this case the correlation is not significant. Turning to the different sub-samples, we can see that there is not any significant correlation between investment (total and public) and debt service in MICs, while it turns out to be significant and positive in LICs and even stronger in HIPCs. The same pattern is observable for revenues, which are positively associated with total and public investment, especially in LICs and HIPCs.

This simple description of the data underlines great differences in the macroeconomic environment between Low and Middle Income countries: in particular, the debt effects in the poorest countries should be affected by the continuous concessional borrowing and by debt rescheduling, which could

[11] If we look at the median value, which is probably a more sensible indicator, we observe lower values, but still large differences between the different sets of countries.

reduce the liquidity constraint. On the other hand, lower fiscal revenues could exacerbate the effect of debt service on the government budget balance. 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.

6. Methodology[12]

The growth equation[13] that has to be estimated (1) is:

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

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, that should capture the conditional convergence of income across countries, x_{itj} is a set of control variables, $debt_{ith}$ are different indicators of the external 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.

The dynamic structure of the model 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

[12] This part is based on Presbitero [2005a], who stresses the advantages of System GMM.

[13] We present the methodological issues referring to the growth model, since they can be easily extended at the investment equation, discussed in section 8.

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 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 models[14], 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 [2005a] 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 valid[15].

7. The Growth Model

To investigate the potential effects on debt on growth, we estimate the growth equation (1), which moves from the standard augmented Solow model [Mankiw, Romer and Weil, 1992] and includes debt variables – the logarithm

[14] 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.

[15] 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].

of debt service and the log of the debt-to-GDP ratio in the previous period - and the institutional variable, the CPIA index. The other control variables include 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[16] and the variability of inflation[17]. In particular, this last indicator, defined as the standard deviation of inflation in the five-year period, could be thought as an indicator of macroeconomic instability, and it is more informative than the level of inflation. We do not explicitly control for foreign assistance, which we found to be not significant, on the basis of recent empirical evidence supporting the not effectiveness of aid in spur economic growth [Rajan and Subramanian, 2005].

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 exports[18].

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 larger. Therefore, we can confirm that the partial negative correlation between debt and growth remain significant even after controlling for institutions and using past values of debt.

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 correlation[19], supporting the model specification.

[16] Defined as national currency per US dollar.

[17] The main variables are expressed in logarithms, in order to preserve the multiplicative form of the production function.

[18] Since column 1 is the preferred specification, thereafter we take the NPV of debt-to-GDP ratio as main debt indicator.

[19] 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).

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

Dependent variable: **GDP growth**	(1)	(2)	(3)	(4)	(5)	(6)
Log of per capita GDP (-1)	-1.68**	-1.38**	-1.77**	-1.50**	-2.69**	-2.45**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log NPVExDebt/GDP(-1)	-0.83**					
	(0.01)					
Log NPV ExDebt/XTS(-1)		-0.45*				
		(0.06)				
Log ExDebt/GDP (-1)			-0.91**			
			(0.01)			
Log ExDebt/XTS (-1)				-0.34		
				(0.32)		
Log ExDebt/GDP					-0.99**	
					(0.05)	
Log ExDebt/Export						-1.10**
						(0.02)
Log Debt Service (%GDP)	0.48	-0.15	0.27	-0.27	2.12**	2.43**
	(0.37)	(0.78)	(0.62)	(0.63)	(0.00)	(0.00)
Log Investment	2.67**	2.40**	2.68**	2.46**	4.18**	4.36**
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)
Log Primary Education	3.83**	3.52**	3.68**	3.54**	3.10**	2.40*
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.09)
Terms of trade	0.06**	0.06**	0.05**	0.05*	0.04	0.04
	(0.03)	(0.05)	(0.05)	(0.07)	(0.25)	(0.19)
Log Openness	-0.60	-0.67	-0.73	-0.42	-0.89	-2.44**
	(0.43)	(0.33)	(0.35)	(0.64)	(0.33)	(0.02)
Inflation (St. Dev.)	-0.0004**	-0.0005**	-0.0005**	-0.0005**	-0.0003	-0.0002
	(0.02)	(0.01)	(0.01)	(0.00)	(0.26)	(0.32)
CPIA	1.23**	1.29**	1.31**	1.38**	0.81**	0.94**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.01)
Constant	-8.15	-7.80	-5.31	-8.52	-1.67	6.38
	(0.23)	(0.33)	(0.46)	(0.29)	(0.79)	(0.45)
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. P-values are in brackets. Time dummies not shown.

Table 2: *The Growth Model: different specifications*

Dependent variable: **GDP growth**	(1)	(2)	(3)	(4)	(5)	(6)
Log of per capita GDP (-1)	-2.35**	-1.67**	-1.81**	-2.38**	-2.63**	-2.06**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log NPVExDebt/GDP (-1)	-1.18**	-0.80**	-0.85**	-0.60*	-0.69**	-0.90**
	(0.00)	(0.00)	(0.02)	(0.07)	(0.03)	(0.00)
Log Debt Service (%GDP)	1.78**	0.30	0.54	0.37		
	(0.00)	(0.56)	(0.33)	(0.49)		
Log Investment	4.01**	2.51**	2.13**	3.16**	2.65**	2.04**
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.02)
Log Primary Education	4.80**	3.77**	4.87**			3.66**
	(0.00)	(0.01)	(0.00)			(0.01)
Log Secondary Education				1.61**	1.54**	
				(0.01)	(0.00)	
Terms of trade	0.06**	0.06**	0.05**	0.06**	0.05**	0.06**
	(0.03)	(0.03)	(0.05)	(0.02)	(0.01)	(0.01)
Log Openness	-0.93		-0.68	-0.18	0.78	
	(0.32)		(0.34)	(0.81)	(0.33)	
Inflation (St. Dev.)	-0.0005**	-0.0004**		-0.0004*	-0.0003	-0.0004*
	(0.00)	(0.03)		(0.07)	(0.13)	(0.06)
Log Exchange Rate (%change)			-0.42*			
			(0.07)			
CPIA		1.24**	1.04**	1.27**	1.29**	
		(0.00)	(0.00)	(0.00)	(0.00)	
Constant	-7.76	-9.86	-7.97	4.81	5.37	1.25**
	(0.26)	(0.11)	(0.13)	(0.31)	(0.20)	(0.00)
OIR test (p-value)	0.479	0.377	0.594	0.333	0.466	0.328
AB(1)	0.003	0.003	0.003	0.004	0.004	0.002
AB(2)	0.931	0.899	0.795	0.651	0.665	0.900
No. Obs.	417	410	406	406	406	410
No. Obs. Per group	3.48	3.42	3.41	3.41	3.41	3.42
F-test	21.62	16.88	13.89	11.84	14.72	16.24

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

Table 2 illustrates the estimates of different specifications of the growth model: 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 rate. The exclusion of the CPIA index raises the magnitude of the debt coefficient, without affecting its significance, suggesting the importance of sound institutions and good policies for debt management and for its dynamics. 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[20], 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.

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 3. 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. 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 growth model for the entire sample underlines that there is a linear and negative relation between external debt in the previous period and current economic growth, even if we take into account the role of institutions. External debt shrinks growth because of the uncertainty that it creates in the country and because a possible misallocation of resources given to short-termism, in accord with an extensive interpretation of debt overhang. The robustness of the CPIA score confirms the relevance of sound fiscal and monetary policies, as well as a careful management of public sector, and it supports the call for conditionality for debt relief programs.

As already argued, the estimation of the debt growth nexus in the entire sample may not be very informative because of the heterogeneity of the countries analyzed. The channels through which external debt affects the economy and its subsequent effects varies between Low and Middle Income countries, because of the different degree of access to international capital markets, to the development of the private sector and to the presence of basic infrastructures and to their macroeconomic environment.

[20] The change in the exchange rate remains significant even across different specification of the growth equation. Results are not shown for reason of space.

Table 3: *The Growth Model: without investment and non-linearities.*

Dependent variable: **GDP growth**	(1)	(2)	(3)	(4)	(5)	(6)
Log of per capita GDP (-1)	-1.34**	-1.13**	-3.32**	-2.50**	-2.43**	-1.71**
	(0.02)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)
Log NPV ExDebt/GDP (-1)	-0.83**				0.09	-0.35
	(0.01)				(0.92)	(0.70)
[Log NPV ExDebt/GDP (-1)]^2					-0.20	-0.07
					(0.14)	(0.58)
Log NPV ExDebt/Export (-1)		-0.44**				
		(0.05)				
Log NPV ExDebt/GDP			3.08*	2.39		
			(0.08)	(0.28)		
[Log NPV ExDebt/GDP]^2			-0.66**	-0.48*		
			(0.01)	(0.09)		
Log Debt Service (%GDP)	0.51	0.22	3.27**	1.89**	1.38**	0.45
	(0.46)	(0.78)	(0.00)	(0.00)	(0.01)	(0.34)
Log Investment			4.31**	3.54**	3.69**	2.48**
			(0.00)	(0.00)	(0.00)	(0.00)
Log Primary Education	5.30**	4.97	5.24**	4.03**	5.25**	4.10**
	(0.00)	(0.19)	(0.00)	(0.00)	(0.00)	(0.00)
Terms of trade	0.06**	0.05	0.00	0.03	0.05*	0.05**
	(0.05)	(0.11)	(0.98)	(0.42)	(0.07)	(0.03)
Log Openness	-0.06	-0.22	-1.39	-0.95	-0.30	-0.50
	(0.95)	(0.82)	0.11)	(0.26)	(0.70)	(0.52)
Inflation (St. Dev.)	-0.0005**	-0.0006**	-0.0002	-0.0002	-0.0005**	-0.0004**
	(0.02)	(0.01)	0.64)	(0.49)	(0.01)	(0.01)
CPIA	1.24**	1.32**		0.76*		1.25**
	(0.00)	(0.02)		(0.07)		(0.00)
Constant	-11.92	-11.74	-8.51	-10.18	-11.92*	-9.68
	(0.18)	(0.52)	(0.29)	(0.13)	(0.09)	(0.16)
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. P-values are in brackets. Time dummies not shown.

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:

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

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: φ = 0 and ρ = 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 4 shows the results obtained following the first strategy[21]. 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, providing further support to the necessity of stressing the importance of good economic policies. The comparison between columns 2 and 6 suggests that external debt is a harsher constraint to economic growth in MICs[22]. 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 section[23]. On the other hand, in the poorest countries we observe a reduction of the debt effect, which is, however, not always significant. Nonetheless, the point estimates are

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

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

[23] Results not shown for reason of space.

lower than in the overall sample and in MICs[24]. Both these results could be consistent with a sort of debt irrelevance zone.

Table 4: *Growth Equation, Low and Middle Income countries*.

Dependent variable: **GDP growth**	ALL	ALL	LIC	LIC	MIC	MIC
Log of per capita GDP (-1)	-3.19**	-3.10**	-3.79**	-4.78**	-2.50**	-3.32**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log NPV ExDebt/GDP (-1)	-0.95**	-0.61*	-0.51	-0.83*	-1.17**	-0.98**
	(0.00)	(0.07)	(0.26)	(0.06)	(0.00)	(0.00)
LIC dummy	-3.03**	-2.51**				
	(0.01)	(0.05)				
Log Debt Service (%GDP)	0.33	0.17	-0.72		0.78	1.06*
	(0.57)	(0.76)	(0.46)		(0.29)	(0.09)
Log Investment	2.22**	2.86**	2.30**	2.57**	1.88	2.76**
	(0.01)	(0.00)	(0.01)	(0.00)	(0.20)	(0.00)
Log Primary Education	2.49		4.07**	3.47**	1.36	
	(0.14)		(0.01)	(0.01)	(0.60)	
Log Secondary Education		1.35*				2.25**
		(0.07)				(0.00)
Terms of trade	0.06**	0.05**	0.02	0.04	0.07*	0.07*
	(0.01)	(0.01)	(0.46)	(0.24)	(0.08)	(0.10)
Inflation (St. Dev.)	-0.0002	-0.0003	-0.0003	-0.0002	-0.0004	-0.0003
	(0.30)	(0.32)	(0.27)	(0.43)	(0.14)	(0.11)
CPIA	1.20**	1.12**	1.12**	1.09**	1.30**	1.07**
	(0.00)	(0.00)	(0.01)	(0.05)	(0.00)	(0.00)
Constant	10.75	13.59*	4.34	12.45	11.07	11.88*
	(0.27)	(0.08)	(0.64)	(0.22)	(0.37)	(0.06)
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. P-values are in brackets. Time dummies not shown.

[24] 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.

Diagram 1: External Debt and Growth in LIC

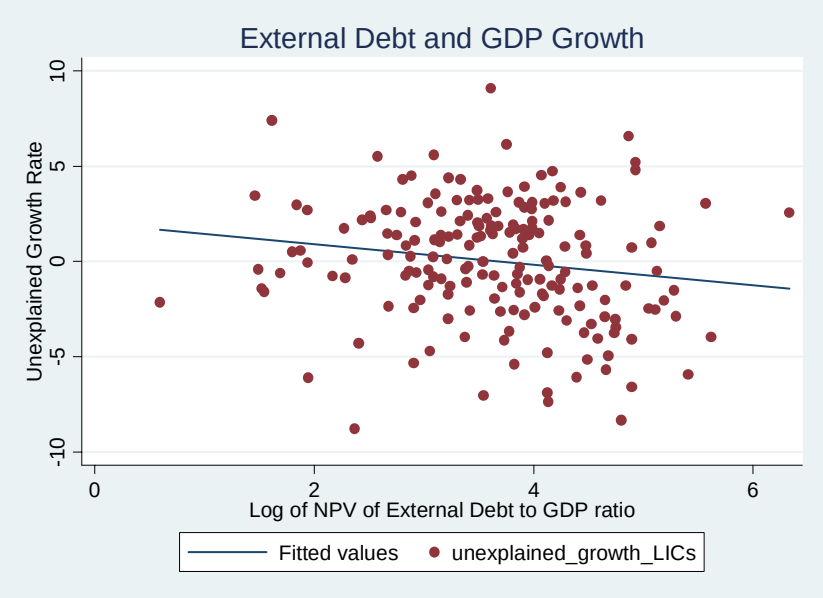
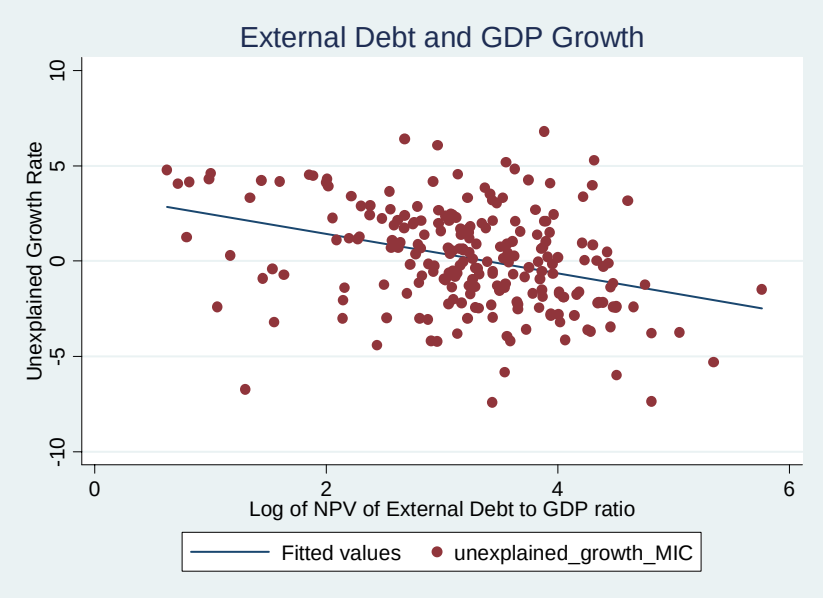


Diagram 2: External Debt and Growth in MIC



A visual analysis of the debt-growth nexus underlines the presence of a linear and negative relationship between past debt and current growth, which is driven mainly by MICs. We have constructed diagrams 1 and 2 plotting on the horizontal axis the log of the debt ratio, while on the vertical axis the unexplained growth, obtained as a residual from the growth equation,

estimated excluding the external debt variable[25]. We can observe how the negative correlation between the GDP growth unexplained by the model and the past values of external debt is stronger in MICs than in LICs, where the debt growth nexus seems to be almost irrelevant.

Results from Table 5 provides a slightly different picture. The inclusion of both the LIC dummy and the interaction term between the dummy and past values of the debt ratio does not provide any evidence of a different 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. 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.

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 points[26]. 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.

[25] We have constructed the diagrams on the ground of the estimates showed in Table 4, using respectively column 4 and 6 for the LICs and MICs.

[26] 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.

Table 5: *Growth Equation, Interaction term and LIC dummy*.

Dependent variable: **GDP growth**	(1)	(2)	(3)	(4)
Log of per capita GDP (-1)	-2.82**	-2.91**	-2.95**	-2.77**
	(0.00)	(0.00)	(0.00)	(0.00)
Log NPV ExDebt/GDP (-1)	-1.00**	-0.54	-0.93**	-0.86*
	(0.02)	(0.23)	(0.03)	(0.06)
Interaction Term	-0.05	-0.19	-0.05	-0.02
	(0.93)	(0.77)	(0.92)	(0.97)
LIC Dummy	-2.23	-1.52	-2.43	-2.11
	(0.41)	(0.57)	(0.32)	(0.37)
Log Debt Service (%GDP)	0.34	0.25	0.58	0.71
	(0.51)	(0.65)	(0.26)	(0.24)
Log Investment	2.12**	2.88**	2.32**	2.09**
	(0.01)	(0.00)	(0.00)	(0.01)
Log Openness			-0.96	-1.12
			(0.18)	(0.19)
Log Primary Education	2.97*		3.48**	4.50**
	(0.10)		(0.03)	(0.00)
Log Secondary Education		1.51**		
		(0.03)		
Terms of trade	0.06**	0.05**	0.05**	0.05*
	(0.01)	(0.03)	(0.03)	(0.06)
Inflation (St. Dev.)	-0.0003	-0.0003	-0.0003	
	(0.26)	(0.20)	(0.19)	
Log exchange rate				-0.33
				(0.13)
CPIA	1.18**	1.06**	1.16**	0.95**
	(0.00)	(0.00)	(0.00)	(0.00)
Constant	6.08	11.26	7.73	3.95
	(0.65)	(0.15)	(0.46)	(0.72)
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. P-values 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.

8. 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 follow the same strategy adopted in the growth model 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 $debt_{ith}$):

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

In order to keep the model as simple as possible, we include some basic control variables: the growth rate of GDP, which captures the "accelerator effect" [Agenor, 2005][27], the revenues rate, the institutional quality index 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[28] 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 tariffs[29].

The estimates show a strong and significant crowding out of total investment in Low Income countries (Table 6 and Diagram 3, based on estimates reported in column 2 and constructed as the previous diagrams), while there is no evidence that debt obligations reduce the level of investment in MICs. The stock of external debt, in present value terms, in positively associated with total investment, even if 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 are very similar controlling for the nominal and NPV of debt ratios to

[27] 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.

[28] Besides, the effect of aid inflows is uncertain because of its fungibility: more aid not necessarily implies more investment [Easterly, 2001 and Erixon, 2005].

[29] 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.

GDP and exports[30] and they pass the tests of autocorrelation and over-identifying restrictions. 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 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.

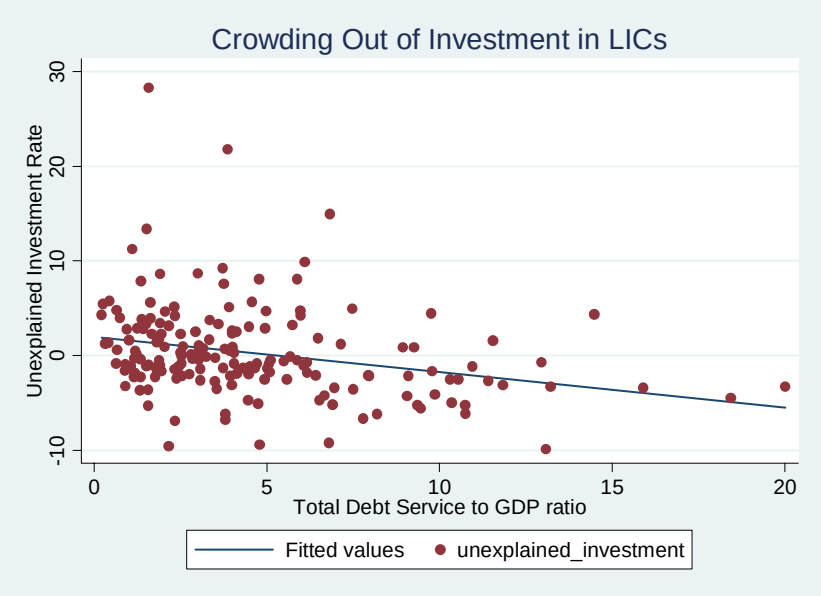
Table 6: *Total Investment Equation*

Dependent variable: **Total Investment**	All sample	LIC	MIC	All sample	LIC	MIC
Investment (-1)	0.48**	0.50**	0.33**	0.49**	0.50**	0.37**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log NPVEx Debt / GDP(-1)	0.80*	0.20	0.59			
	(0.07)	(0.71)	(0.26)			
Log NPVEx Debt/XTS(-1)				0.39	0.19	0.44
				(0.21)	(0.72)	(0.21)
Total Debt Service (%GDP)	-0.21*	-0.38**	0.09	-0.17	-0.36*	0.10
	(0.09)	(0.02)	(0.53)	(0.16)	(0.06)	(0.34)
Revenues (%GDP)	0.30**	0.32**	0.15*	0.37**	0.29**	0.19**
	(0.00)	(0.01)	(0.06)	(0.00)	(0.04)	(0.03)
GDP growth	0.36**	0.36**	0.20	0.34**	0.39	0.15
	(0.03)	(0.02)	(0.17)	(0.01)	(0.14)	(0.33)
CPIA	0.90*	1.95**	0.46	0.83*	2.22**	0.59
	(0.08)	(0.01)	(0.43)	(0.06)	(0.02)	(0.31)
Constant	-1.48	-4.05	6.90*	-1.94	-3.59	4.77
	(0.55)	(0.11)	(0.08)	(0.49)	(0.41)	(0.19)
OIR test (p-value)	0.116	0.999	0.674	0.474	0.996	0.814
AB(1)	0.005	0.105	0.027	0.007	0.086	0.018
AB(2)	0.270	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. P-values are in brackets. Time dummies not shown.

[30] Results not shown for reason of space and because of their less informative power (they are available from the author on request).

Diagram 3: Liquidity Constraint in LIC



The analysis of the determinants of public investments shows a completely different picture, confirming the necessity of looking at the distinction between private and public investment (Table 7). Contrary to the dynamics of total investment, public investment are more path dependant in MICs than in LICs, which are affected by the variability of external finance, revenues and foreign assistance. We do not find any evidence of liquidity constraint and debt overhang, even controlling for the possible presence of non-linearities[31], both in Low and Middle Income countries. Large debts in the previous period are associated with subsequent higher investment ratios in the public sector, both in the entire sample and in market access economies[32], but not in LICs. 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.

In Low Income countries there is no debt overhang effect because the continuous mechanism of new concessional borrowing, debt relief and rescheduling reduces the implicit tax perceived by the investor. What really

[31] We have included a quadratic term in order to control for the presence of a sort of Debt-Laffer curve, without finding any significant result. Estimates not shown for reasons of space and available from the author on request.

[32] The coefficient on the debt ratio is not significant in the last column: however, debt to GDP ratios, in nominal and NPV terms, confirm the positive partial correlation. This finding is consistent with the estimates of the growth equation, in which the exclusion of investment reduces the debt coefficient.

matters, as suggested also by the negative relation between external debt and growth, is the quality and the efficiency of investment. As a consequence, according to the "extended debt overhang" effect, high debts do not lower the level of investment in physical capital but affect other kind of investment (i.e. human capital) and the government willingness to adopt structural reforms and fiscal adjustments.

Table 7: *Public Investment Equation*

Dependent variable: **Public Investment**	All sample	LIC	MIC	All sample	LIC	MIC
Public investment (-1)	0.43**	0.42**	0.59**	0.44**	0.38**	0.58**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log NPVEx Debt / GDP (-1)	0.85**	-0.19	0.86**			
	(0.00)	(0.75)	(0.00)			
Log NPVEx Debt / Export (-1)				0.71**	-0.05	0.39
				(0.00)	(0.94)	(0.14)
Total Debt Service (%GDP)	-0.10	-0.13	-0.001	-0.08	-0.13	0.03
	(0.161)	(0.38)	(0.98)	(0.30)	(0.33)	(0.62)
Revenues (%GDP)	0.25**	0.19**	0.10**	0.28**	0.20**	0.13**
	(0.00)	(0.02)	(0.03)	(0.00)	(0.01)	(0.02)
GDP growth	0.07	0.02	0.21**	0.06	0.00	0.15**
	(0.21)	(0.80)	(0.00)	(0.40)	(0.99)	(0.02)
CPIA	0.59	1.78**	0.57	0.74**	1.89**	0.61
	(0.13)	(0.01)	(0.15)	(0.05)	(0.01)	(0.12)
Constant	-6.21**	-4.21*	-5.66**	-8.00**	-4.48	-4.98*
	(0.00)	(0.06)	(0.00)	(0.00)	(0.22)	(0.06)
OIR test (p-value)	0.318	0.999	0.764	0.249	0.994	0.926
AB(1)	0.010	0.026	0.023	0.005	0.027	0.021
AB(2)	0.635	0.524	0.741	0.616	0.546	0.698
No. Obs.	360	168	192	357	166	191
No. Obs. Per group	3.36	3.65	3.15	3.34	3.61	3.13
F-test	15.04	10.69	23.45	13.90	8.44	38.17

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

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 renounce at their projects[33].

The crowding out effect is limited to total investment in LICs. The difference in revenues between Low and Middle Income countries could offset the larger debt service payments owed by MICs. As a consequence, 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 have access to international market and the dependence of banking system on government is lower.

Eventually, we would like to stress the potential future risks that Low Income countries will face because of the rising domestic debt: its level is still low, but its cost is much higher than the cost of concessional external lending, so that 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[34].

9. 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. We discuss and try to address the problem of causality: 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, as illustrated also by Diagram 4[35], supporting the adoption of selectivity and conditionality in debt relief

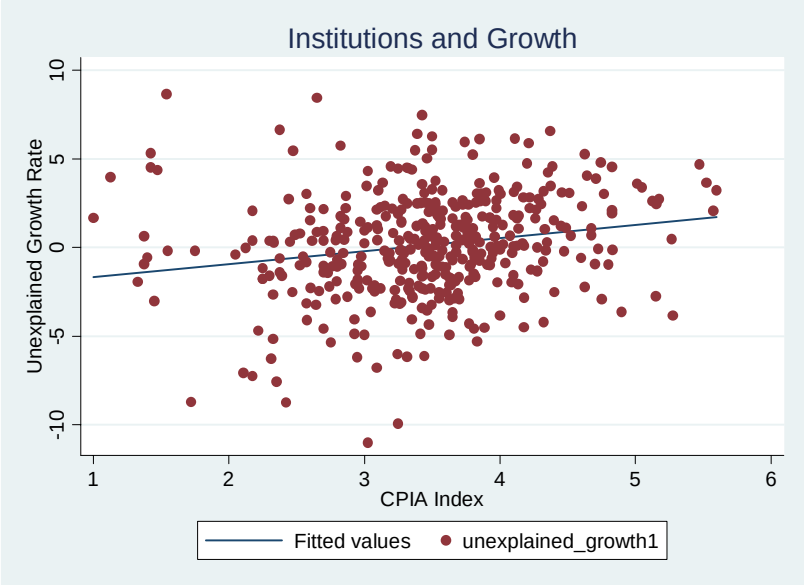
[33] This indications have to be taken with caution, since the point estimate of the debt coefficient in the total investment equation is still positive and close to the one on public investment, even if not significant.

[34] The rise in domestic debt stocks and the more dramatic increase in interest payments, especially in some HIPCs, is discussed in the author's Ph.D. dissertation (available on request), which present data on domestic debt in developing countries.

[35] It is constructed like the other diagrams, starting from the growth model in the first column of Table 4. We observe a positive correlation between the share of GDP growth unexplained by the model (without including the CPIA rating) and the institutional variable.

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.

Diagram 4: Institutions and Growth



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, the availability of data on domestic debt is a valuable instrument in order to validate empirically 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, we should analyze its impact on government expenditures, 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.

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Annex A: Tables

Table 1A: **Summary Statistics**

		growth	Exd/exp	Exd/gdp	NPVd/gdp	NPVd/exp	Tds/gdp	Tot_inv	Pub_inv	revenue	Prim_enr	Sec_enr	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

Table 2A: **Pairwise correlations, entire sample**

All sample	growth	lag_lgdp	ltds	laglnpvdexp	laglnpvdgdp	linv	lpubinv	lineduc	totgrowth	lrev	lexr	sdcpi	cpia
Growth rate	1 575												
lag_lgdp	-0.0192 455	1 459											
ltds	0.1807* 542	0.2502* 450	1 545										
laglnpvdexp	-0.1860* 422	-0.4176* 424	0.0451 423	1 424									
lag_lnpvdgdp	-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							
lpubinv	0.2347* 527	-0.2230* 430	0.0491 510	0.0424 405	0.0799 409	0.4081* 528	1 529						
lineduc	0.1310* 559	0.4793* 453	0.1444* 535	-0.2156* 420	-0.0932 425	0.3256* 563	-0.0492 517	1 584					
totgrowth	-0.0522 570	0.0512 455	-0.1243* 540	-0.0538 420	-0.0277 425	0.0226 573	0.0032 524	0.0225 579	1 598				
lrev	0.0568 533	0.2606* 427	0.2266* 509	-0.2346* 396	0.0339 401	0.4685* 534	0.3456* 489	0.0890* 535	-0.0053 547	1 552			
lexr	-0.4656* 570	0.0061 453	-0.2110* 539	0.1524* 420	0.0604 425	-0.1380* 570	-0.2004* 524	0.0435 576	0.0916* 590	-0.1664* 551	1 595		
sdcpi	-0.2736* 573	0.0438 458	-0.1409* 545	0.1159* 424	0.1101* 429	-0.0984* 576	-0.0914* 527	0.0139 582	0.0358 596	-0.1184* 550	0.5579* 593	1 601	
cpia	0.2311* 530	0.3460* 439	0.2757* 523	-0.2526* 416	-0.1846* 421	0.2935* 531	0.1289* 497	0.2237* 521	-0.0443 527	0.2110* 499	-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, MICs**

MIC	growth	lag_lgdp	ltds	laglnpvdexp	laglnpvdgdp	linv	lpubinv	lineduc	totgrowth	lrev	lexr	sdcpi	cpia
growth	1 327												
lag_lgdp	-0.2308* 258	1 262											
ltds	0.2477* 305	0.1263* 255	1 308										
laglnpvdexp	-0.1594* 238	-0.2254* 240	0.3279* 239	1 240									
lag_lnpvdgdp	-0.1483* 241	-0.1590* 243	0.4484* 242	0.8541* 239	1 243								
linv	0.3088* 325	-0.1669* 261	0.0506 307	-0.0225 239	0.0985 242	1 330							
lpubinv	0.2913* 294	-0.2576* 240	0.0165 281	-0.0076 225	0.1202 227	0.3642* 295	1 296						
lineduc	0.0963 317	0.0174 257	0.0188 301	0.1147 236	0.0411 239	0.2388* 321	0.0207 287	1 338					
totgrowth	0.0023 322	0.0174 258	-0.1017 303	-0.077 236	-0.053 239	0.0803 325	-0.0336 291	0.06 333	1 345				
lrev	0.0071 303	0.0583 243	-0.0051 286	-0.1882* 222	0.057 225	0.3116* 304	0.2795* 272	-0.1781* 310	0.0271 315	1 320			
lexr	-0.5356* 327	0.0392 260	-0.2464* 307	0.1893* 240	0.0423 243	-0.1497* 327	-0.1707* 296	-0.0117 335	0.0538 342	-0.1622* 319	1 347		
sdcpi	-0.3304* 325	-0.0109 261	-0.1978* 308	0.1716* 240	0.1245 243	-0.1411* 328	-0.0785 294	-0.0303 336	0.0913 343	-0.1281* 318	0.6349* 345	1 348	
cpia	0.2355* 293	0.2676* 245	0.1255* 291	-0.2039* 232	-0.1643* 235	0.1115 294	0.0599 271	0.1621* 288	-0.02 290	0.0017 274	-0.1850* 295	-0.1180* 295	1 295

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

Table 4A: **Pairwise correlations, LICs**

LIC	growth	lag_lgdp	ltds	laglnpvdexp	laglnpvdgdp	linv	lpubinv	lineduc	totgrowth	lrev	lexr	sdcpi	cpia
growth	1 248												
lag_lgdp	-0.2866* 197	1 197											
ltds	0.039 237	0.0917 195	1 237										
laglnpvdexp	-0.0554 184	-0.1768* 184	-0.0701 184	1 184									
lag_lnpvdgdp	-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							
lpubinv	0.2016* 233	-0.1677* 190	0.1322* 229	0.0127 180	-0.0117 182	0.5600* 233	1 233						
lineduc	0.0834 242	0.3349* 196	0.0596 234	-0.1119 184	0.0032 186	0.1941* 242	-0.0245 230	1 246					
totgrowth	-0.1133 248	0.1512* 197	-0.1462* 237	0.0032 184	0.0203 186	0.002 248	0.0324 233	0.0385 246	1 253				
lrev	0.0481 230	0.0061 184	0.3803* 223	-0.0786 174	0.1683* 176	0.4825* 230	0.5166* 217	0.0228 225	-0.0285 232	1 232			
lexr	-0.3638* 243	0.1019 193	-0.1733* 232	0.1133 180	0.0781 182	-0.1504* 243	-0.2518* 228	0.1072 241	0.1457* 248	-0.1913* 232	1 248		
sdcpi	-0.2549* 248	0.1762* 197	-0.1019 237	0.0876 184	0.105 186	-0.0879 248	-0.1043 233	0.0307 246	-0.0131 253	-0.1269 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	0.3123* 226	0.0374 233	-0.0679 237	0.3016* 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.

Table 5A: **Pairwise correlations, HIPCs**

HIPC	growth	lag_lgdp	ltds	laglnpvdexp	laglnpvdgdp	linv	lpubinv	lineduc	totgrowth	lrev	lexr	sdcpi	cpia
growth	1 170												
lag_lgdp	-0.1552 136	1 136											
ltds	-0.054 168	0.2725* 136	1 168										
laglnpvdexp	-0.0516 132	-0.0195 132	-0.0855 132	1 132									
lag_lnpvdgdp	-0.1733* 134	0.3416* 134	0.3589* 134	0.7066* 132	1 134								
linv	0.2829* 170	0.2205* 136	0.3186* 168	0.1548 132	0.3024* 134	1 170							
lpubinv	0.1405 166	-0.0236 134	0.2948* 164	0.0287 130	0.0729 132	0.5732* 166	1 166						
lineduc	0.0583 168	0.4085* 136	0.2107* 166	0.0085 132	0.2155* 134	0.1543* 168	-0.0277 164	1 168					
totgrowth	0.0983 170	0.0379 136	-0.1349 168	0.0071 132	0.0064 134	-0.071 170	-0.0169 166	-0.0682 168	1 170				
lrev	0.1477 165	0.1273 132	0.4739* 163	0.0463 128	0.2666* 130	0.5574* 165	0.6285* 161	0.1333 163	-0.0823 165	1 165			
lexr	-0.1511* 170	0.103 136	0.0033 168	0.2283* 132	0.1623 134	-0.1836* 170	-0.2306* 166	0.1246 168	0.0069 170	-0.3230* 165	1 170		
sdcpi	-0.2876* 170	0.2038* 136	-0.0663 168	0.0766 132	0.0995 134	-0.0982 170	-0.0959 166	0.0687 168	-0.0438 170	-0.1878* 165	0.6678* 170	1 170	
cpia	0.1004 169	0.0197 136	0.3246* 167	-0.0611 132	-0.0178 134	0.3017* 169	0.3343* 165	0.0642 167	-0.1161 169	0.3064* 164	-0.3019* 169	-0.2360* 169	1 169

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