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THE DEBT-GROWTH NEXUS IN POOR COUNTRIES: A REASSESSMENT

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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 could be 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.

JEL: C33, F34, H63, O11

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

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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): as a result, in March 2006, the Multilateral Debt Relief Initiative (MDRI) was introduced as a new policy tool to provide additional support and financing to the world's poorest and most indebted countries. Namely, all countries reaching completion point under the HIPC Initiative will receive up-front and irrevocable cancellation of their external debt owed to the World Bank, the African Development Bank and the IMF. 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. Besides, the HIPC Initiative and the MDRI deals with the critical issue of debt sustainability, given that one of their targets is avoiding the build up of a new stock of external debt. 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, building on a stream of literature that aims to assess the relationship between external debt and GDP growth.

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 papers[1] suggest that the debt-growth relationship follows a bell-shaped curve, since, beyond a certain debt ratio[2], 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 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 debatable[3].

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 growth[4].

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. A lower GDP growth is not due to lower capital accumulation, but to any factors responsible for total factor productivity growth (Pattillo *et al*. 2004). A possible interpretation could rely on the "extended debt overhang", according to which the uncertainty and the instability created by a large external debt cause less efficient and short term investment and the lack of structural reforms. We also find that debt service

[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.

[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.

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.

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 dataset[5] 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 Bank[6]. 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.

[5] http://www.cid.harvard.edu/ciddata/ciddata.html (last accessed: February, 2007).

[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.

To wash out any business cycle variation, we take 5 year average of the data, ending with 5 observations in time[7]. 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 could 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 (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 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 that 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 HIPCs (391). Debt service (TDSGDP), 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-3A) underlines 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 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

[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.

will control the robustness of our findings estimating the model in different sub-samples and allowing for heterogeneity in the debt effects on growth.

3. The Growth Model

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

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

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

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

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 growth model 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 inflation[8].

Methodology

The dynamic structure of the model[9] 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

[8] 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.

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

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 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[10], 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 (2006) 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[11].

Empirical results

The results (Table 1) show the presence of conditional convergence and a positive effect of education and investment on economic growth. Terms of trade

[10] 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.

[11] 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).

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 positive 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[12].

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[13], 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 rate[14].

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 not be explained by lower capital accumulation, but by other factors affecting total factor productivity (Pattillo *et al*., 2004). An extensive interpretation of debt overhang suggests that large debts would imply 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 debt growth nexus in the entire sample might not be truly 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

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

[13] 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).

[14] 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.

economic growth. However, the estimation by sub-samples cannot provide a statistical evidence of a significant difference in the coefficients across the two samples. 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:

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

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.

The inclusion of both the LIC dummy and the interaction term between the dummy and past values of the debt ratio (Table 3)[15] 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].

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, on the basis of sub-sample estimations. Eventually, the possibility that external debt is not significantly partially correlated with GDP growth could be in line with the idea

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

[16] The estimation of the debt-growth nexus separately for Low and Middle Income countries (results not shown, but available on request from the Author) underlines some small differences in the two samples: 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. Point estimates indicate that external debt is a harsher constraint to economic growth in MICs than in the overall sample. On the other hand, the point estimates are lower than in the overall sample and in MICs, suggesting the existence of a sort of debt irrelevance zone.

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[17]. 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 $debt_{ith}$):

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

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)[18], 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 tariffs[19].

[17] Following the preferred specification in the first column of Table 3, the elasticity of GDP growth with respect to the NPV of external debt to GDP ratio is -0.27.

[18] 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.

[19] 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.

The estimates show a strong and significant crowding out of total investment in Low Income countries (Table 4), 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 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 linearity[20].

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, while, in MICs, the institutional indicator is not significant.

The analysis of the determinants of public investments shows a different picture (Table 5). 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-linearities[21], 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 in MICs. 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, in Middle-Income countries, for private agents, who,

[20] 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.

[21] 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.

because of the uncertainty due to a large indebtedness, prefer to postpone or give up their projects[22].

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

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 debt[23]. 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

5. Concluding Remarks and Policy Implications

This analysis extends 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. Our findings suggest that external debt does not reduce the level of capital accumulation, but it impinge on other factors affecting TFP: a possible interpretation is related to the "extended debt overhang" effect, according to which large external debts generate misallocation of capital, short-termism, lack of structural reforms, and subsequent lower economic 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

[22] 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.

[23] 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 and Presbitero (2007). 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.

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 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 (Arnone *et al*., 2006). 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 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.

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

Dependent variable: **GDP growth**	(1)	(2)	(3)	(4)	(5)	(6)
GDP (-1)	-1.68**	-1.38**	-1.77**	-1.50**	-2.69**	-2.45**
	(0.41)	(0.46)	(0.39)	(0.53)	(0.54)	(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	-0.15	0.27	-0.27	2.12**	2.43**
	(0.53)	(0.55)	(0.54)	(0.57)	(0.67)	(0.75)
LINV	2.67**	2.40**	2.68**	2.46**	4.18**	4.36**
	(0.85)	(0.95)	(0.87)	(0.88)	(1.27)	(1.00)
PEDUC	3.83**	3.52**	3.68**	3.54**	3.10**	2.40*
	(1.35)	(1.48)	(1.37)	(1.29)	(1.30)	(1.40)
TOT	0.06**	0.06**	0.05**	0.05*	0.04	0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
OPEN	-0.60	-0.67	-0.73	-0.42	-0.89	-2.44**
	(0.75)	(0.77)	(0.68)	(0.88)	(0.92)	(1.04)
INFL	-0.0004**	-0.0005**	-0.0005**	-0.0005**	-0.0003	-0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
CPIA	1.23**	1.29**	1.31**	1.38**	0.81**	0.94**
	(0.30)	(0.30)	(0.32)	(0.30)	(0.39)	(0.34)
CONSTANT	-8.15	-7.80	-5.31	-8.52	-1.67	6.38
	(6.72)	(7.60)	(6.91)	(7.99)	(6.19)	(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: Robust standard errors are in brackets. Two and one star (*) mean, respectively, a 5% and 10% significance level. All variables are five-year average. All regressions include time dummies not shown for the sake of brevity. AR(1) and AR(2) are the Arellano and Bond autocorrelation tests of first and second order (the null is no autocorrelation), the F-test refers to the significance of the regression, and the OIR test is the Hansen test for over-identifying restrictions (the null is the validity of the instrument set).

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

Dependent variable: **GDP growth**	(1)	(2)	(3)	(4)	(5)	(6)
GDP (-1)	-1.34**	-1.13**	-3.32**	-2.50**	-2.43**	-1.71**
	(0.58)	(0.66)	(0.70)	(0.54)	(0.45)	(0.42)
NPVDGDP (-1)	-0.83**				0.09	-0.35
	(0.31)				(0.98)	(0.91)
[NPVDGDP (-1)]^2					-0.20	-0.07
					(0.14)	(0.13)
NPVDXTS (-1)		-0.44**				
		(0.27)				
NPVDGDP			3.08*	2.39		
			(1.77)	(2.22)		
[NPVDGDP]^2			-0.66**	-0.48*		
			(0.24)	(0.28)		
LTDSGDP	0.51	0.22	3.27**	1.89**	1.38**	0.45
	(0.69)	(0.72)	(0.80)	(0.61)	(0.51)	(0.46)
LINV			4.31**	3.54**	3.69**	2.48**
			(0.98)	(1.09)	(0.87)	(0.75)
PEDUC	5.30**	4.97	5.24**	4.03**	5.25**	4.10**
	(1.63)	(1.59)	(1.74)	(1.41)	(1.36)	(1.37)
TOT	0.06**	0.05	0.00	0.03	0.05*	0.05**
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.02)
OPEN	-0.06	-0.22	-1.39	-0.95	-0.30	-0.50
	(0.90)	(0.97)	(0.87)	(0.85)	(0.72)	(0.73)
INFL	-0.0005**	-0.0006**	-0.0002	-0.0002	-0.0005**	-0.0004**
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)
CPIA	1.24**	1.32**		0.76*		1.25**
	(0.32)	(0.31)		(0.42)		(0.31)
CONSTANT	-11.92	-11.74	-8.51	-10.18	-11.92*	-9.68
	(8.80)	(9.50)	(8.00)	(6.71)	(6.44)	(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: Robust standard errors are in brackets. Two and one star (*) mean, respectively, a 5% and 10% significance level. All variables are five-year average. All regressions include time dummies not shown for the sake of brevity. AR(1) and AR(2) are the Arellano and Bond autocorrelation tests of first and second order (the null is no autocorrelation), the F-test refers to the significance of the regression, and the OIR test is the Hansen test for over-identifying restrictions (the null is the validity of the instrument set).

Table 3: *Growth Equation, Interaction term and LIC dummy*.

Dependent variable: **GDP growth**	(1)	(2)	(3)	(4)
GDP (-1)	-2.82**	-2.91**	-2.95**	-2.77**
	(1.02)	(0.80)	(0.83)	(0.74)
NPVDGDP (-1)	-1.00**	-0.54	-0.93**	-0.86*
	(0.41)	(0.45)	(0.39)	(0.43)
[NPVDGDP (-1)]*LIC	-0.05	-0.19	-0.05	-0.02
	(0.55)	(0.66)	(0.49)	(0.51)
LIC	-2.23	-1.52	-2.43	-2.11
	(2.65)	(2.65)	(2.23)	(2.12)
LTDSGDP	0.34	0.25	0.58	0.71
	(0.51)	(0.54)	(0.51)	(0.48)
LINV	2.12**	2.88**	2.32**	2.09**
	(0.80)	(0.75)	(0.80)	(0.84)
OPEN			-0.96	-1.12
			(0.68)	(0.75)
PEDUC	2.97*		3.48**	4.50**
	(1.77)		(1.55)	(1.11)
SEDUC		1.51**		
		(0.70)		
TOT	0.06**	0.05**	0.05**	0.05*
	(0.02)	(0.02)	(0.02)	(0.03)
INFL	-0.0003	-0.0003	-0.0003	
	(0.0003)	(0.0002)	(0.0002)	
RER				-0.33
				(0.22)
CPIA	1.18**	1.06**	1.16**	0.95**
	(0.27)	(0.23)	(0.28)	(0.31)
CONSTANT	6.08	11.26	7.73	3.95
	(14.70)	(7.89)	(10.53)	(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: Robust standard errors are in brackets. Two and one star (*) mean, respectively, a 5% and 10% significance level. All variables are five-year average. All regressions include time dummies not shown for the sake of brevity. AR(1) and AR(2) are the Arellano and Bond autocorrelation tests of first and second order (the null is no autocorrelation), the F-test refers to the significance of the regression, and the OIR test is the Hansen test for over-identifying restrictions (the null is the validity of the instrument set). Test LIC is a t-test for joint hypothesis of the annulment of the coefficients on the LIC dummy and on the interaction term.

Table 4: *Total Investment Equation*

Dependent variable: **Total Investment**	All sample	LIC	MIC	All sample	LIC	MIC
INV (-1)	0.49**	0.50**	0.33**	0.50**	0.50**	0.37**
	(0.08)	(0.10)	(0.10)	(0.07)	(0.09)	(0.00)
NPVDGDP (-1)	0.88**	0.20	0.59			
	(0.42)	(0.54)	(0.53)			
NPVDXTS (-1)				0.39	0.19	0.44
				(0.35)	(0.52)	(0.36)
LTDSGDP	-0.21	-0.38**	0.09	-0.17	-0.36*	0.10
	(0.13)	(0.16)	(0.14)	(0.12)	(0.19)	(0.11)
REV	0.31**	0.32**	0.15*	0.37**	0.29**	0.19**
	(0.09)	(0.12)	(0.08)	(0.08)	(0.14)	(0.09)
GROWTH	0.36**	0.36**	0.20	0.33**	0.39	0.15
	(0.17)	(0.15)	(0.14)	(0.14)	(0.26)	(0.15)
CPIA	0.86*	1.95**	0.46	0.83*	2.22**	0.59
	(0.51)	(0.74)	(0.59)	(0.44)	(0.95)	(0.58)
LIC	-0.16			0.11		
	(0.81)			(0.69)		
CONSTANT	-1.66	-4.05	6.90*	-2.19	-3.59	4.77
	(2.59	(2.54)	(3.91)	(2.89)	(4.32)	(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: Robust standard errors are in brackets. Two and one star (*) mean, respectively, a 5% and 10% significance level. All variables are five-year average. All regressions include time dummies not shown for the sake of brevity. AR(1) and AR(2) are the Arellano and Bond autocorrelation tests of first and second order (the null is no autocorrelation), the F-test refers to the significance of the regression, and the OIR test is the Hansen test for over-identifying restrictions (the null is the validity of the instrument set).

Table 5: *Public Investment Equation*

Dependent variable: **Public Investment**	All sample	LIC	MIC
PUBINV (-1)	0.42**	0.36**	0.46**
	(0.09)	(0.11)	(0.11)
NPVDGDP (-1)	0.48	-0.29	0.85**
	(0.34)	(0.66)	(0.28)
TDSGDP	-0.07	-0.20	0.02
	(0.07)	(0.16)	(0.07)
PRINV	-0.07	-0.18**	-0.19**
	(0.05)	(0.09)	(0.07)
REV	0.26**	0.27**	0.13**
	(0.07)	(0.06)	(0.06)
GROWTH	0.13**	0.15**	0.13
	(0.05)	(0.07)	(0.10)
CPIA	0.79**	1.29*	0.70
	(0.32)	(0.73)	(0.42)
LIC	1.88**		
	(0.63)		
CONSTANT	-4.97**	-1.62	-2.84
	(1.49)	(2.26)	(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: Robust standard errors are in brackets. Two and one star (*) mean, respectively, a 5% and 10% significance level. All variables are five-year average. All regressions include time dummies not shown for the sake of brevity. AR(1) and AR(2) are the Arellano and Bond autocorrelation tests of first and second order (the null is no autocorrelation), the F-test refers to the significance of the regression, and the OIR test is the Hansen test for over-identifying restrictions (the null is the validity of the instrument set).

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.