Debt structure and Growth in Developing Countries

Preliminary and incomplete

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Abstract

This paper examines the complex link between external debt and economic growth. As illustrated in the recent sovereign bond crisis, a 'good' management of external public debt is pivotal for the stability of developing and industrialized countries, several economies with a strong appetite for indebtedness having come close to default. While the general public and policy-markers tend to over-stress the potential danger of debt accumulation, this instrument has long been identified in the economic literature as a powerful one to foster and stabilize growth through increased investment and consumption smoothing. The novelty of our approach consists here in focusing on the structure of external debt and examine more closely the respective growth contribution of its different components. We rely on a panel error-correction model to estimate an augmented growth equation and use the Pooled Mean Group (PMG) approach, developed by Pesaran, Shin, and Smith (1999), to deal with the estimation of dynamic heterogeneous panels. We find that while the overall impact of external debt on growth is negative, public and private borrowings have opposite long run effects. Official lending - and in particular its bilateral component - seems to explain the negative impact of public external debt. Regarding private external debt, commercial banks loans to the private sector are found to bring higher growth benefits than bond issuances.

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1 Introduction

As the global financial crisis has developed into continued economic stagnation and forced governments to adopt expansionary fiscal measures, policymakers and academics have regained considerable interest in debt issues. Fresh concerns about the adverse effects of large sovereign debts and their sustainability in developed countries have echoed to some degree the debt predicament faced by developing and emerging economies in past decades. For these countries, with limited policy tools with which to address economic shocks, debt management and its sustainability have remained a major concern. Following a period of favorable global credit conditions and hasty debt build-up, the international debt crisis of the 1980s exemplified the extensive social and economic costs brought about by a debt distress, with lasting adverse consequences on growth performance. Although the global situation of these economies has markedly improved compared to the 1990s - thanks to successive debt relief schemes or pro-active national policies to curb external debt dependency - many low income countries are still vulnerable to reversals in trade and financial flows or rapid movements in commodity prices that may put pressure on debt-burden indicators. These concerns are now especially acute given the current context of global financial and economic crisis and its spillover effects to developing countries.

The complexity of the relation between debt and growth, especially in developing countries, has prompted a large body of literature. The strong prior of standard theory is that developing countries, being short of capital and having low savings, should benefit from external financing. Foreign capital in the form of external borrowing can be used to finance domestic investment projects and lead to higher growth in those countries with larger financial needs. Relying on an augmented Solow growth model framework, Barro and Sala-i Martin (1995) show that access to foreign borrowing leads to a faster rate of convergence. Moreover, developing countries, facing generally shorter business cycles than their developed counterparts and having higher consumption volatility than output volatility (Rand and Tarp, 2002), could use access to foreign borrowing to help them mitigate the impact of shocks on business cycle and smooth their consumption.

However, excessive levels of indebtedness are perceived as a macroeconomic risk as they are associated with high expected debt-service costs and increased uncertainties about a country's repayment ability. Debt overhang theories argue that over-borrowing makes a direct contribution to slower growth (Krugman, 1988; Sachs, 1989). The mechanism is fundamentally based on the disincentives effects generated by excessively high debt repayments. Imbs and Ranciere (2006) note that when the debt burden grows so heavy that creditors do not expect to be fully repaid on contractual terms, it becomes increasingly difficult to write optimal debt contracts that would preserve debtor's incentives to improve or maintain its ability to repay. As any additional resource that is produced will be claimed by foreign creditors to service debt obligations, the debt overhang effectively generates a tax on investment and discourages domestic capital formation, depressing future production and income. Debt overhang also tends to be associated with worsening of policy choices as it reduces government's willingness to undertake adjustment efforts and costly structural reforms with high political costs. High level of uncertainties combined with a deteriorated policy environment, are likely to affect how available resources are allocated in the economy and encourage short-termism behaviors, with adverse consequences on productivity growth. In particular, a rise in investors' risk aversion could lead them to consider activities that present lower risks and quicker returns, rather than long-term irreversible investment projects with higher productivity gains.

So far, the empirical literature on debt and growth has been inconclusive. Previous studies have sought to assess the disincentive effects of external debt on capital formation in highly indebted countries. Cohen (1993) finds that the level of debt does not by itself explain the slowdown of investment; rather, it is the actual flow of debt service that generates a liquidity constraint and crowds out investment. There is also evidence that the consistently negative relationship between external debt and growth may be strongly influenced by time factors or other common determinants of investment, which are unrelated to debt (Warner, 1992; Deshpande, 1997). Recent studies have focused particularly on detecting the presence of non-linearities in the debt-growth relationship. Pattillo, Poirson, and Ricci (2002a, 2003) show the existence of a debt threshold, at about 160-170 percent of exports, beyond which the marginal impact of debt on growth becomes negative. Cordella, Ricci, and Ruiz-Arranz (2005) introduce a debt irrelevance threshold and find that the negative and non-linear impact only prevails at intermediate levels of debt, but not at low or high levels. Other recent empirical findings tend to emphasize the lack of robustness of the negative relationship between debt burden and growth, as well as the nonlinearity effects (Imbs and Ranciere, 2006; Panizza and Presbitero, 2012).

From a methodological standpoint, recent contributions on empirical testing of growth equations, such as Bergheim (2007), Loayza and Ranciere (2006) or Gemmell, Kneller, and Sanz (2011) among others, have uttered the need for a modeling that would better take into account the time series dimension of the data. Indeed, when the main focus is on characterizing a long-run relationship, relying on panel data where T, the time dimension, is approximately equal N, the number of cross-sections, standard averaging procedures appear rather inappropriate. Among various alternatives, the Auto Regressive Distributed Lag (ARDL) framework developed in panel context by Pesaran and co-authors (Pesaran and Smith, 1995; Pesaran et al., 1999) seems the most preferable to address the debt-growth issue of this paper.

In the absence of convincing evidence on a causal negative link going from debt to growth, we propose a different approach to determine the long run growth impact of external borrowing, in which we highlight the importance of debt management and the relevance of considering the structure of external debt. Some past studies have analyzed the composition of public debt, seeking to identify its determinants (Borensztein, Cowan, Eichengreen, , and Panizza, 2008), or assessing the impact of sovereign debt on corporate borrowing costs (Agca and Celasun, 2012). However, to our best knowledge, no other study has focused on identifying the type of debt that matters for economic growth. Building on Patillo et al.'s results, this study re-examines the debt-growth relationship in the case of developing countries. Our contribution to the literature is twofold. First, we rely on a panel error-correction model to estimate an augmented growth equation and use the Pooled Mean Group (PMG) methodology developed by Pesaran et al. (1999) as an alternative way of estimating long-run relationships in a dynamic heterogeneous panel context. Moreover, the ARDL specification allows to disentangle the short and long-run dynamics at work, and thus highlighting the effects of trend and cyclical changes of external debt on output growth. Second, we consider the structure of external debt and examine more closely the contrasting impacts of its various components (short-term vs. long term, public vs. private, debt instruments) and their respective impact on growth.

Our results show that while the overall impact of external debt on growth is negative, public and private borrowings have opposite long run effects. Official lending - and in particular its bilateral component - seems to explain the negative impact of public external debt. Regarding private external debt, commercial banks loans to the private sector are found to bring higher growth benefits than bond issuances.

The remainder of the paper is the following. Section 2 presents the empirical framework we propose to follow in this paper. Section 3 presents the dataset and discuss some preliminary results. Finally, Section 4 concludes.

2 Methodology

Empirical growth equations correspond to long run relationships, i.e. they are linked to the derivation of a theoretical equilibrium occurring with a certain timing, which, if not precisely defined, goes beyond the business cycle frequency. Looking at empirical techniques implemented to test such models - which rely almost exclusively on (linear) specifications estimated through standard panel procedures (Pooled, Mean Group, LSDV, IV or (system)-GMM estimations) on 3 to 10-year average data -, it appears that they are at odds with their main objective. Indeed, if averaging the data allows to "ignore" non-stationarity issues, it does not however properly address the underlying dynamics at work. In addition, the aggregation of time series information fails to allow for potentially differentiated short vs. long-run impacts of determinants. Regarding the link between external debt and growth in particular, recent contributions such as Vamvakidis (2007) or Checherita and Rother (2010) point out the need to focus not only on stocks (long-run levels) but also on flows (short-run variations), which calls for macro panel modeling where both individual and time dimensions are taken into account.

Various methodologies can be used to address these issues. The first idea that comes to any applied economist's mind when dealing with the long run lies in the application of a cointegration analysis, as popularized by Engel and Granger. In this context, one tests first the integration degree of the series under scrutiny. If they all turn out to be integrated of order one, i.e. stationary in first differences, one can test whether there exists a cointegration or long-run relationship in levels between them by testing the stationarity of the residual. In case the test rejects the null of no cointegration, there exists an error correction model, which specifies both short and long-run dynamics through the error correction mechanism, that can be estimated relying on standard techniques (OLS in time series, DOLS or FM-OLS in panel). In spite of its empirical relevance and relative simplicity, this approach appears rather restrictive since all determinants must be integrated of the same order (1) to possibly characterize a long run relationship. In contexts where there is no homogeneity in time series characteristics of potential determinants as it seems to be the case in growth model where both stationary and non-stationary processes can be considered as explanatory variables, this approach cannot be implemented. A recent alternative to this canonical framework is provided with the ARDL approach developed by Pesaran and co-authors in a series of papers in both time series (Pesaran, 1997; Pesaran, Shin, and Smith, 2001) and macro panel contexts (Pesaran and Smith, 1995; Pesaran et al., 1999), for which issues are partially similar. As recalled by Loayza and Ranciere (2006), within this framework, simple modifications to standard methods can render consistent and efficient estimates of the parameters in long-run relationship between both integrated and stationary variables, and inference on these parameters can be conducted using standard tests.

We propose now to detail the PMG estimation and testing procedures related to the ARDL representation of the error correction model we aim to estimate on our augmented growth equation.

As previously mentioned, Pesaran et al. (1999) approach has been popularized in empirical economics by increasing interest in questions related to dynamic panel data model for which the number of time series observations T and cross-sections/groups N are of the same magnitude. In this context, traditional approaches that involve either perfect heterogeneity such as the Mean Group (MG) procedure, or (almost) perfect homogeneity with pooled estimator such as the fixed or random effects estimators assuming that only the intercepts are allowed to differ across groups, all other coefficients and error variance being constrained to be the same, seem restrictive. Indeed, as Pesaran suggest, whereas long-run dynamics can be assumed to be common across groups due to equilibrium mechanisms, e.g. budget or solvency constraints, arbitrage conditions, common technological responses, etc., it seems unlikely that the same applies in the short-run, calling for an intermediate estimator, i.e. the *pooled mean group* (PMG) estimator, which would involve both pooling and averaging methods. Moreover, Pesaran and Smith (1995) have shown that usual estimations of pooled models (FE, IV, GMM) can produce inconsistent and potentially very misleading estimates of the average values of the parameters in dynamic panel data models where both N and T are large. As Loayza and Ranciere (2006) summarize, the PMG estimator thus offers "the best available compromise in the search for consistency and efficiency".

In order to derive such an estimator, it is useful to start from the ARDL (p,q) representation of the long-run relationship, we get:

$$\Delta y_{i,t} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} \boldsymbol{x}_{i,t-j} + \mu_i + \varepsilon_{i,t} \tag{1}$$

where subscripts i and t stand for country i and date t respectively, y is the per-capita GDP growth rate, x a vector of growth determinants including usual control variables (initial level of GDP, education level, population growth, terms of trade growth, investment rate, etc.) as well as debt variables[1], μ_i represent the fixed effect capturing time-invariant country-specific characteristics, and $\varepsilon_{i,t}$ is the random error.

As proposed by Pesaran et al. (1999), it is convenient to re-parametrize the model as follows:

$$\Delta y_{i,t} = \phi_i y_{i,t-1} + \beta'_i \boldsymbol{x}_{i,t} + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta^*_{ij} \Delta \boldsymbol{x}_{i,t-j} + \mu_i + \varepsilon_{i,t} \tag{2}$$

where $\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{ij}$, $\beta_i = \sum_{j=0}^{q} \delta_{ij}$, $\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}$, $\forall j = 1, \ldots, p-1$ and $\delta^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im}$, $\forall j = 0, \ldots, q-1$

Assuming that the disturbances, of mean zero and variances σ_i^2, are independently distributed both across countries i and time t, as well as independently distributed from the regressors $\boldsymbol{x}_{it}$, if an homogeneous relationship holds between the endogenous variable $y_{i,t}$

[1] All variables are defined in Section 3.1 and detailed in Appendix 1

and the set of exogenous regressors $\boldsymbol{x}_{i,t}$ such that:

$$y_{i,t} = -\beta_i'/\phi_i \boldsymbol{x}_{i,t} + \eta_{i,t},\ \eta_{i,t} \sim \mathsf{I}(0) \quad (3)$$

$$\text{with } -\beta_i'/\phi_i = \theta\ \forall i \in \{1,\ldots,N\} \quad (4)$$

The previous equation can finally be re-written as follows:

$$\Delta y_{i,t} = \underbrace{\phi_i \Big\{ y_{i,t-1} - \theta' \boldsymbol{x}_{i,t-1} \Big\}}_{\text{Long-run component}} + \underbrace{\sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^* \Delta \boldsymbol{x}_{i,t-j}}_{\text{Short-run component}} + \mu_i + \varepsilon_{i,t} \quad (5)$$

, where ϕ_i is the error correction term and assumed to be significantly negative.

Whereas the long-run component is constrained to be identical for all units, the model defined in Equation 5 allows heterogeneity in the short-run coefficients, including the error correction term. to be heterogeneous. Estimating the model through maximum likelihood - first by deriving the long-term coefficients across countries through a concentrated maximum likelihood procedure, then by deriving country specific parameters by maximum likelihood using previously obtained long-run coefficients - gives the *pooled mean group* (PMG) estimator, which denomination highlights both the pooling implied by the homogeneity restrictions on long run coefficients and averaging across countries to obtain other country specific parameters.

Among the set of assumptions imposed on disturbances in order to guarantee the consistency of PMG estimates stands out regressors' strict exogeneity. This implies that the order of the ARDL process must be augmented enough to ensure that the residuals of the error correction model is exogenous and thus, serially uncorrelated. As recalled by Pesaran et al. (1999), this requirement is of particular importance for the consistency of the short-run parameters, whereas long run parameters can easily afford possible dependence of $\boldsymbol{x}_{i,t}$ on $\varepsilon_{i,t}$ as long as $\boldsymbol{x}_{i,t}$ have finite-order AR representations.

To check *ex-post* the validity of the estimates, Pesaran et al. (1999) propose a series of validation and diagnostic tests which aim first to question the assumption of homogeneity of long run coefficient across countries, and second, to check the good properties of the residuals. Regarding the first issue, the null of homogeneity of long run parameters can be tested through a Hausman test based on the comparison of covariance matrices of estimated coefficients relate to both MG and PMG approaches. A series of diagnostic tests aim to assess usual good properties of residuals. Turning to diagnostic tests, they include standard Godfrey test on serial correlation, Ramsey RESET tests to measure heteroskedasticity as well as functional form and Jarque-Bera procedure for normality - which is a required assumption for sample with a small time span.

3 Preliminary results

3.1 Data and their properties

Estimations have been performed on a sample consisting in 71 developing countries over the 1970-2009 period, with data coming from various sources. The dependent variable, i.e. the per-capita-GDP growth rate, as well as the main standard control variables (initial income, investment rate, government size, trade openness) are taken from the Penn World Table. School enrollment rates come from Barro and Lee (2000), population growth are from Word Development Indicators (World Bank) and inflation rates from International Financial Statistics (IMF) databases. Finally, debts series are excerpt from the World Bank. For more details, see Appendix 1.

3.2 Preliminary estimations

We report in Appendix **??** the results from the estimation of various error correction models according to the PMG procedure and report both long and short run parameter estimates.

The models we consider include all the same set of usual control variables, i.e. initial level of GDP, education level proxied by the secondary school enrollment rate, population growth, openness ratio calculated as the sum of imports and exports over GDP, and terms of trade growth. They differ according to the external debt variables we introduce, which correspond to several levels of disaggregation, according to the scheme reproduced in Appendix B.

Overall, we note that traditional determinants are significant and exhibit the expected signs in all our models. The initial level of GDP present a highly significantly negative parameter, which confirms the β-convergence hypothesis. Schooling is significant and positive, confirming that accumulation of human capital foster growth. The same occurs for openness, which is consistent with previous findings on similar samples Pattillo, Poirson, and Ricci (2002b). Finally, terms-of-trade growth appears either non significant or even significantly negative, which is a bit at odds with traditional findings. This is probably due to the heterogeneity of our sample, which consists in both HIPC and non-HIPC countries, the former being not necessarily advantaged by a rise in the terms of trade due to their net importer status.

Turning now to our first specification, i.e. **Model 1**, we consider a traditional growth equation augmented with the total-external-debt-over-exports-ratio in the context of an error correction model, which implies to check first that the error correction term appears significantly negative. This is the case here, i.e. $\phi = -0.89$ and significant at a 1% level. Our ARDL approach is thus validated and allows us to disentangle short vs. long run impacts of debt on growth. Focusing first on the long run component, i.e. the set of variables taken in levels, the debt coefficient appears significantly negative, which confirms previous findings showing a strong and significant negative relationship between external debt and growth estimated on average data. Looking now at the short run component, i.e. the coefficients of the variables taken in first differences, it appears also significantly negative. This confirms the intuitions of recent litterature that both debt stocks and flows are important to explain growth dynamics.

Disaggregating total external debt into short vs. long-term external debt, we now consider our second specification, i.e. **Model 2**. The underlying idea is that maturity may be of critical importance for creditors. If we assume that debt's maturity is consistent with the underlying investment projects' timing, then it is expected that long-term projects, which convey higher risks would also be more conducive to long-term growth through an increase in productivity (TFP growth). In that respect, we would expect a positive impact of long-term debt and, conversely, a potentially negative one for short-term debt if those prevent from investing in high-potential projects. Finally, as described in Vamvakidis (2007), government focusing on long term borrowings can also have the following pervert effect: their effort to repay the debt will be delayed, and the more they rely on external indebtedness, the less they will feel internal pressure to undertake the necessary reforms, whose outcome among others, is to foster growth. As a whole, the expected signs for both components are not clear cut and must rely on empirical assessment. Here we find that the average effect captured in previous model is identically conveyed by both parameters.

Another issue in the literature lies in the opposition between public external debt, i.e. sovereign debt, and private debt, i.e. the external debt hold by firms and commercial banks. Looking at **Model 3**, we find that associated coefficients exhibit opposite signs, being negative for the public component. This result confirms first existing literature which has clearly emphasized the perverse effect associated to excessive levels of public debt. Indeed, as recalled by Pattillo, Poirson, and Ricci (2004), when external debt grows large, investors may lower their expectations of returns in anticipation of higher and more distortionary taxes needed to repay the debt, so that new domestic and foreign investment is discouraged, which in turn slows down capital accumulation and thus growth. Conversely, high levels of private external debt appear to positively impact growth. This could be viewed as an illustration of the productivity channel, described in Pattillo et al. (2004). Going one step ahead in **Model 4**, we can see that most of the positive effect is driven by commercial banks, in opposition to firms.

The last two specifications, i.e. **Model 5** and **Model 6** focus on the various creditors holding both public and private external debt components. Our results suggest that while debts that are hold by official creditors have a negative impact, those hold by private agents do not exhibit significant long run effect on growth. This latter result is a bit at odds with existing literature (Borensztein, 2001), which highlights the fact that private creditors are usually more keen to invest in risky projects, whereas public institutions should have broader set of objectives governing their investment decisions including a welfare dimension. Finally, the last specification helps to better understand this result, only bilateral creditors exhibit the negative sign, the multilateral ones - such as the International Monetary Fund, exhibit the expected sign.
At this stage, it appears that focusing on disaggregated data allows to draw a more contrasted picture on the impact of debt on growth. Those considerations call obviously for further research into that direction.

4 Conclusion

To be done.

From a methodological standpoint possible extensions to address endogeneity / double causality issues could lie in system cointegration framework (Bergheim, 2007) or IV approach in non stationary environment (Robinson and Gerolimetto, 2006). Regarding the detection of threshold effects, nonlinear modeling such as PTR/PSTR or asymmetric ARDL framework of Shin, Yu, and Greenwood-Nimmo (2011) could be implemented and tested on similar specifications.

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A Data description

Table 1: Variables descriptions and sources

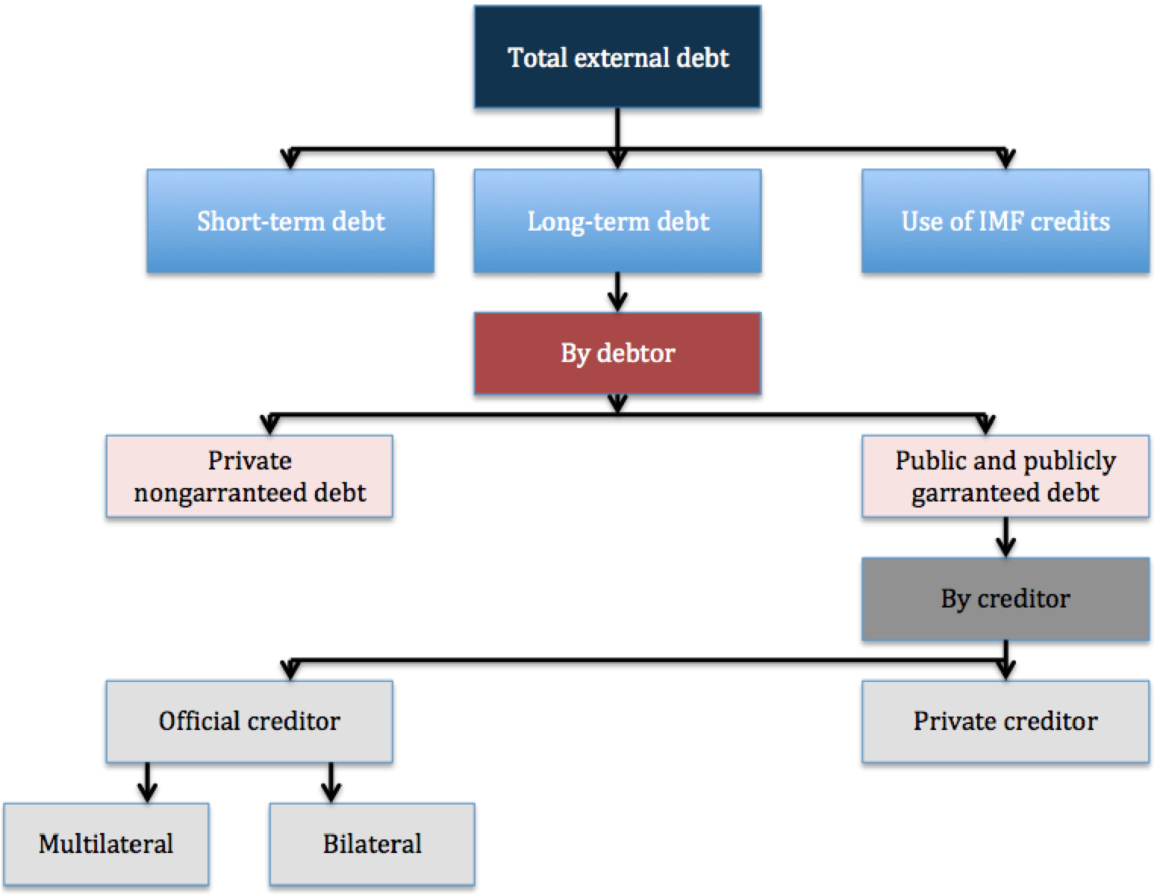
Variable	Definition	Source
Growth	Growth rate of PPP real GDP per capita (calculated in logarithmic terms)	Penn World Table (PWT)
Control variables		
Initial Income	Logarithm of real per capita GDP lagged one period	PWT
Human capital	Logarithm of average years of secondary schooling in the population over age 15, lagged one period	?
Investment rate	Investment to GDP ratio	PWT
Population growth	Annual growth rate of population calculated in logarthmic terms	World Development Indicators (WDI)
Trade openness	Sum of exports and imports to GDP	PWT
Terms of trade growth	Annual percentage change in the ratio of exports to imports prices	International Financial Statistics (IFS) & WDI
Debt variables, as a ratio of GDP or total exports		
External Debt Stocks	Total external debt sotcks	Global Development Finance (GDF)
Short term debt	External debt with an original maturity of one year or less	GDF
Long term debt	External debt with an original or extended maturity of more than one year	GDF
IMF credits	Use of IMF credit (under the Extended Credit Facility, Standby Credit Facility, Rapid Credit Facility, Stand-By Arrangements, Flexible Credit Line, and the Extended Fund Facility)	GDF
Concessional debt	External debt with an original grant element of 25 percent or more	GDF
Private sector debt	Long-term private sector (private banks and private entities) external debt	GDF

Table 1: Variables descriptions and sources (concluded)

Variable	Definition	Source
Public sector debt	Long-term public sector external debt (central government, state and local government, central bank, public and mixed enterprises, and official development banks)	GDF
Private nonguaranteed debt (PNG)	Long-term external obligations of private debtors that are not guaranteed for repayment by a public entity	GDF
PNG, commercial banks	Nonguaranteed long-term commercial bank loans from private banks and other private financial institutions	GDF
PNG, bond	Nonguaranteed long-term debt from bonds that are privately placed	GDF
Public & publicly guaranteed debt (PPG)	Long-term external obligations of public debtors and private debtors that are guaranteed for repayment by a public entity	GDF
PPG, official creditors	Loans from international organizations (multilateral loans) and loans from governments (bilateral loans)	GDF
PPG, multilateral	Loans and credits from the World Bank, regional development banks, and other multilateral and intergovernmental agencies	GDF
PPG, bilateral	Loans from governments and their agencies (including central banks), loans from autonomous bodies, and direct loans from official export credit agencies	GDF
PPG, private creditors	Public and publicly guaranteed debt from private creditors	GDF
PPG, commercial banks	PPG commercial bank loans from private banks and other private financial institutions	GDF
PPG, bonds	PPG debt from bonds that are either publicly issued or privately placed	GDF
PPG, other private creditors	Other private credits from manufacturers, exporters, and other suppliers of goods, and bank credits covered by a guarantee of an export credit agency	GDF

B External debt structure

The decomposition of external debt we assume in this paper can be represented as follows:



Source: Author's representation based on a World Bank's document

C Results

Table 2: Pooled Mean Group regressions, whole sample

Panel A: Long-run coefficients

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Variables	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Err.
Control variables												
Initial GDP per capita	-0.105	[0.010]***	-0.084	[0.009]***	-0.076	[0.007]***	-0.080	[0.007]***	-0.077	[0.007]***	-0.085	[0.008]***
Education	0.141	[0.019]***	0.086	[0.017]***	0.058	[0.016]***	0.082	[0.017]***	0.086	[0.017]***	0.074	[0.018]***
Population growth	0.034	[0.147]	-0.137	[0.147]	-0.138	[0.189]	-0.014	[0.191]	0.101	[0.184]	0.189	[0.199]
Trade openness	0.031	[0.009]	0.032	[0.008]***	0.034	[0.007]***	0.032	[0.007]***	0.027	[0.007]***	0.025	[0.008]***
Terms of trade growth	-0.030	[0.008]***	-0.026	[0.007]***	-0.045	[0.007]***	-0.040	[0.007]***	-0.045	[0.007]***	-0.041	[0.007]***
Debt components												
Total external debt	-0.017	[0.003]***										
Short-term			-0.015	[0.005]***	-0.012	[0.005]***	-0.016	[0.005]***	-0.020	[0.006]***	-0.028	[0.007]***
Long-term			-0.012	[0.003]***								
Private sector												
Public sector												
PNG					0.028	[0.009]***			0.036	[0.008]***	0.019	[0.010]*
PNG, commercial banks							0.038	[0.009]***				
PNG, bond							-0.065	[0.038]*				
PPG					-0.015	[0.003]***	-0.015	[0.003]***				
PPG, official creditors									-0.010	[0.003]***		
PPG, multilateral											0.011	[0.004]***
PPG, bilateral											-0.017	[0.004]***
PPG, private creditors									-0.004	[0.005]	0.002	[0.006]
Error Correction Coef. (ϕ)	-0.862	[0.044]***	-0.893	[0.049]***	-0.915	[0.040]***	-0.908	[0.038]***	-0.925	[0.040]***	-0.858	[0.032]***
Hausman Test (p-value)	1.750	(0.941)	1.620	(0.978)	4.680	(0.791)	7.490	(0.587)	3.740	(0.928)	15.220	(0.124)
Log Likelihood	4651.961		4744.091		4832.338		4707.724		4770.128		4861.528	
Num. Obs.	2585		2655		2655		2655		2655		2725	
Lag structure	(3,1,1,1,1,3)		(3,1,1,1,1,3,3)		(2,1,1,1,1,2,2,2)		(2,1,1,1,1,1,1,1,1)		(2,1,1,1,1,1,1,1,1)		(1,1,1,1,1,1,1,1,1,1)	

Notes: This table reports the long-run coefficient estimates for the ARDL model, obtained using the Pooled Mean Group estimator. The joint Hausman test is based on a comparison with the Mean Group estimator. Significance at 10%, 5%, and 1% are denoted by *, ** and ***, respectively.

Panel B: Short-run coefficients

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Variables	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Control variables												
Δ Growth(-1)	0.042	[0.030]	0.052	[0.033]	0.059	[0.023]***	0.059	[0.022]***	0.068	[0.022]***		
Δ Growth(-2)	-0.018	[0.021]	-0.014	[0.023]								
Δ Education	-0.121	[0.172]	-0.099	[0.187]	-0.194	[0.200]	-0.118	[0.189]	-0.153	[0.189]	-0.098	[0.190]
Δ Population growth	1.994	[2.773]	2.99	[2.763]	0.463	[2.902]	0.669	[2.821]	-0.156	[2.931]	1.600	[2.589]
Δ Trade openness	-0.146	[0.031]***	-0.154	[0.035]***	-0.147	[0.034]***	-0.145	[0.032]***	-0.149	[0.032]***	-0.158	[0.036]***
Δ Terms of trade growth	-0.005	[0.007]	-0.008	[0.007]	0.004	[0.007]	0.003	[0.006]	0.008	[0.006]	0.004	[0.006]
Intercept	0.660	[0.032]***	0.556	[0.029]***	0.521	[0.023]***	0.537	[0.023]***	0.524	[0.023]***	0.538	[0.020]***
Debt components												
Δ Total external debt	-0.086	[0.015]***										
Δ Total external debt (-1)	0.019	[0.012]										
Δ Total external debt (-2)	-0.019	[0.010]*										
Δ Short-term			-0.150	[0.165]	-0.126	[0.124]	-0.103	[0.115]	-0.128	[0.136]	-0.064	[0.077]
Δ Short-term (-1)			-0.162	[0.097]*	-0.319	[0.261]						
Δ Short-term (-2)			-0.213	[0.154]								
Δ Long-term			-0.102	[0.019]***								
Δ Long-term (-1)			0.032	[0.014]**								
Δ Long-term (-2)			-0.014	[0.012]								
Δ Private sector												
Δ Private sector (-1)												
Δ Public sector												
Δ Public sector (-1)												
Δ PNG					0.245	[0.240]			0.159	[0.251]	0.280	[0.314]
Δ PNG (-1)					-0.652	[0.681]						
Δ PNG, commercial banks							0.188	[0.202]				
Δ PNG, bond							0.952	[1.032]				
Δ PPG					-0.103	[0.018]***	-0.096	[0.018]***				
Δ PPG (-1)					0.006	[0.013]						
Δ PPG, official creditors									-0.127	[0.026]***		
Δ PPG, multilateral											-0.193	[0.045]***
Δ PPG, bilateral											-0.031	[0.044]
Δ PPG, private creditors									-0.055	[0.045]	-0.039	[0.041]

Notes: This table reports the short-run coefficient estimates for the ARDL model, obtained using the Pooled Mean Group estimator. Significance at 10%, 5%, and 1% are denoted by *, ** and ***, respectively.