The long-term consequences of external debt: Revisiting the evidence and inspecting the mechanism using panel VARs*

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Abstract

We estimate a panel vector autoregression model to examine the relationship between external debt and economic growth. We use a large dataset based on 123 countries, classified according to income levels over the period 1990 to 2015. While total external debt appears to have a negative effect on growth rate overall, it is positively associated with income growth in the lower- and upper-middle income countries. Further disaggregating external debt into its components reveals that public external debt negatively affects economic growth across all income categories of countries, whereas the impact of private external debt is not statistically significant. We do not detect a *common* threshold level in the relationship between public debt and economic growth across countries. Savings and investment are the primary channels through which external debt impacts economic growth. These results are robust to various model specifications, additional controls, and identifying restrictions.

JEL classification: H3, H6, O4, O57

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1. Introduction

The rise in external debt in many countries has invigorated a debate about the costs of escalating public and private debt. High and unsustainable levels of external debt can be especially risky for developing countries, exposing them to exchange rate fluctuations, sudden-stops in capital flows and sharp capital outflows, which may precipitate into a banking or currency crisis (Hemming et al. 2003).[1] Therefore, governments and policymakers around the world have become increasingly apprehensive about the short and long run effects external debt may have on growth, raising a set of testable policy questions: what are the macroeconomic effects on longer-term growth of high external debt? Are these effects conditional on the *components* (or types) of external debt and growth, as well as on the income level of countries? Finally, what are the channels through which external debt works to affect growth?

Our study examines the relationship between the types of external debt (total, public, and private external debt) and income growth by estimating a panel vector autoregression (PVAR) model using data for 123 countries from 1990 to 2015. In addition to the difference in estimation strategy used in the previous literature, we examine the macroeconomic impact of types of external debt, which may have divergent implications for growth. Furthermore, it is natural to expect that the impact of external debt varies across countries due to the difference in their income levels, institutions, fiscal framework and degree of openness. These extensions enable us to present novel empirical findings that are more granular than those offered by the previous literature.

Our empirical results reveal several key insights. Total external debt appears to have a negative effect on GDP growth in the aggregate data. This result especially holds for the sample of low-income countries. On the other hand, external debt is positively associated with income growth in the middle-income groups. While public external debt lowers output growth for most countries, there is no obvious effect of private external debt on income. These results are derived after controlling for a set of relevant endogenous variables in our estimation, and are robust to various model specifications. We also find that the effect of a higher GDP growth on total and public external debt is visibly negative for most countries. Our analysis across multiple debt windows confirms the existence of a non-linear effect on growth. Interestingly, we detect no evidence for a *common* threshold level in the relationship between public external debt and economic growth once we account for the impact of global factors and their spillover effects. Finally, we pinpoint savings and investment as the primary channels through which external debt is likely to have an impact on economic growth.

[1] Rising external debt creates anticipations about more distortionary taxes needed to repay debt, which lowers the expectations of investors and discourages investment (Patillo, Poirson and Ricci 2004). In addition, heavily indebted countries are often faced with uncertainties and instabilities related to the debt overhang which are likely to depress both domestic and foreign capital formation within the economy. The uncertainty hinders incentives to improve technology and often leads to misallocation of resources. Patillo, Poirson and Ricci (2004) underline that high debt levels may limit growth by creating a poorer policy environment, thereby resulting in lower total factor productivity growth by adversely affecting the efficiency of investment.

The impact of public debt on growth has been the topic of various studies (see, for instance, Reinhart and Rogoff (2010), and Eberhardt and Presbitero (2015)). Westphal and Rother (2012) detect a non-linear relationship between income growth and public debt in the Euro area. Egert (2015) employ a bivariate regression model to determine the threshold level for central government debt. Although the results are dependent on the country groups and time period under consideration, the analysis concludes that the detrimental effect of debt arises at debt levels as low as 20 percent for some country groups, while at 60 percent debt-to-GDP ratio for others. Panizza and Presbitero (2014), Cecchetti et al. (2011) and Casares (2015) all highlight the relationship between public debt and growth.

Among the very few studies underlining the negative impact of external debt on income growth, Patillo et al. (2002, 2004) are perhaps the most prominent, although their findings are based exclusively on developing countries. Schclarek (2004) suggests that the negative relationship between total external debt levels and growth rates is primarily driven by public external debt. By implementing a system of generalized method of moments (GMM) dynamic panel econometric technique, they examine the channels through which this link may manifest itself. Along with extending and updating the data used in these studies, we pay close attention to improving the estimation techniques employed in the existing analyses of external debt and income growth nexus through estimation of a panel vector autoregression model. Using frontier econometric techniques, we methodically investigate the transmission of idiosyncratic shocks to external debt across countries and over time by generating impulse response functions (IRFs).

The inclusion of several controls in our baseline estimation as well as under robustness checks helps shed more light on the specific channels through which external debt affects growth. Our primary result, which highlights savings and investment as the primary channels through which external debt is likely to have an impact on economic growth, connects with a broad empirical literature. Schclarek (2004), Kumar and Woo (2010), and Westphal and Rother (2012) analyze empirically the channels through which external debt can potentially affect economic growth. The former study finds that the main channel is private capital accumulation. However, this relationship holds only for emerging economies, while there is some supporting evidence for the channel of private savings for advanced economies. Kumar and Woo (2010) find evidence in favor of the investment channel for advanced economies. Our results are especially remarkable from a methodological perspective as well, since the previous literature does not fully account for endogenous interactions amongst factors influencing the growth of external debt.

PVAR models have been used to inspect multivariate time-series for panel data and in the context of a variety of macroeconomic inquiries.[2] PVARs are often used to construct coincident or leading indicators of economic activity (Canova and Ciccarelli 2009), or to evaluate the macroeconomic effects of unconventional monetary policies (Gambacorta et al. 2014). Based on a large annual dataset on 22 OECD countries over the period 1987-2009, Boubtane et al. (2012) empirically

[2] Canova and Ciccarelli (2013) provide a comprehensive overview of PVAR models used in macroeconomics and finance literature.

examine the interaction between immigration and host country economic conditions to test how immigration shocks are transmitted in a variety of countries. Another example is the study by Love and Zicchino (2006) which attempts to measure the effect of shocks to financial factors on a cross-section of U.S. firms. In a recent study, Liaqat (2019) employs a dynamic PVAR approach to assess the adverse effect of public debt on the growth of capital formation in a large group of countries. Lof and Malinen (2014) estimate a PVAR to analyze the relationship between debt and growth and observe that while a rise in income growth has had a negative effect on debt, there is an insignificant long-run reverse impact of debt on growth.

Our interest in the use of PVARs is particularly motivated by our emphasis on uncovering the extent of the dynamic heterogeneity in the effect of external debt, and thus, to endogenously group economies in order to characterize their differences. Since PVARs allow for interdependencies in testing whether feedbacks are generalized or involve only certain groups of countries, it is an exceptionally useful empirical technique for the analysis at hand. PVARs have been commonly used to construct average effects across heterogeneous groups of units (Canova and Ciccarelli 2013). As discussed later in the paper, we use this approach to distinguish between the average effects of private and public external debt across countries belonging to different income categories.

The rest of the paper is organized as follows. The empirical methodology as well as a description of the data used is provided in Section 2. Section 3 discusses the baseline estimation results. A discussion of various extensions to the baseline model, and robustness checks are presented in Sections 4 and 5. Finally, Section 6 concludes.

2. Data and Panel VAR Methodology

2.1 Data

Since the upshot of a mounting debt is highly likely to be associated with the state of global markets and occurrences of financial crises, it is crucial to analyze a comprehensive dataset for a large sample of countries, and over a sufficiently long horizon. Our dataset comprises of an unbalanced panel data for 123 countries, and spans a relatively long period, from 1990 to 2015.[3] Furthermore, we focus on the consequences of different components of debt, i.e. total external debt, private external debt, and public external debt, on growth. This distinction may be particularly relevant as it reflects the rise in various types of external debt in a majority of low-income and lower-middle-income countries that has resulted from an enormous inflow of money from advanced economies during a period of relatively low returns, and due to broader financial integration. The motivation to study these set of countries is further corroborated by Park, Shin and Tian (2018), who suggest that foreign debt can be especially risky for developing countries since it is rarely denominated in

[3] The availability of external debt data guided the determination of the number of countries and time period used in our study.

their domestic currencies. Consequently, developing countries are more exposed to exchange rate fluctuations, sudden-stops in capital flows, and sharp capital outflows, which may precipitate into a full-blown financial and macroeconomic crisis. As highlighted earlier, the consequences of debt are expected to differ across countries. Thus, throughout our empirical analyses, our focus remains on the implications of external debt for low- and middle-income countries only.

We use the World Bank's World Development Indicators (WDI) database and the IMF's World Economic Outlook as our primary sources. The total external debt as well as both private and public external debt (denominated in US dollars) is taken from the WDI dataset. The other macroeconomic indicators that are treated as controls in the PVAR were obtained from the WDI data, including inflation, capital formation, trade openness and population. Data on savings and investment is also procured from the same data source. Lastly, all countries have been classified based on the World Bank's definitions of income categories using GNI per capita thresholds. The categories are as follows: low, lower-middle, upper-middle, and high-income countries.[4]

2.2. The Panel VAR framework

We use a panel vector autoregression (PVAR) model in a GMM framework similar to that used by Lof and Malinen (2014). The use of a PVAR model improves on the estimation techniques employed in the existing analyses of external debt and income growth. The most important advantage of using PVARs in our study is that this methodology treats multiple variables as endogenous simultaneously (Holtz-Eakin et al. 1988). This is especially notable because the existing literature examining the effects of external debt does not fully account for the endogenous interactions amongst factors influencing the growth of debt. Our approach also enables us to investigate the transmission of idiosyncratic shocks to external debt across countries and over time by generating impulse response functions.

We define a *k*-variate homogenous panel VAR of order *p* with panel specific fixed effects as follows:

$$Y_{it} = Y_{it-1}A_1 + Y_{it-2}A_2 + \cdots + Y_{it-p+}\ A_{p-1} + Y_{it-p}A_p + u_i + e_{it}$$
$$i \in \{1,2 \ldots, N\} \quad t \in \{1,2, \ldots, T_i\} \qquad (1)$$

where Y_{it} is a $(1xk)$ vector of dependent variables, and u_i and e_{it} are $(1xk)$ vectors of dependent variable-specific panel fixed effects and idiosyncratic errors, respectively. The subscripts *i* and *t* represent country and year, respectively. The $(k \times k)$ matrices $A_1,\ A_2, \ldots, A_{p-1}, A_p$ are parameters to be estimated. We assume that the innovations have the following characteristics: E(e_{it}) = 0, E($e'_{it}e_{it}$) = Σ, and E($e'_{it}e_{is}$) = 0 for all $t > s$. We use growth rates (log-differences) of real GDP

[4] The complete list of countries used in our analysis is provided in the Appendix in Table A.1. Nonetheless, as explained earlier, our emphasis is on the low- and middle-income countries. Table A.1 also reports the income group each country belongs to over the course of the time period under consideration. Since our results are based on a rather long horizon, we observe most countries to switch between these groups overtime. As a result, using income classification definition for a particular year to group countries into income categories is likely to produce inaccurate estimates.

per capita, and growth rates (log-differences) of total, public, and private external debt in our estimation. The following equation summarizes the estimated PVAR model:

$$y_{it} = Ay_{it-1} + u_i + e_{it}$$
$$i \in \{1,2 \dots, N\} \quad t \in \{1,2, \dots, T_i\} \tag{2}$$

After estimating the PVAR model, we generate impulse response functions to identify how external debt growth affects income, and vice versa. The IRFs can be used to isolate the effects of shocks in one variable on another variable while keeping all else constant. The coefficient matrix A and the covariance matrix of the residuals are assumed to be homogenous across all countries. The IRFs are considered stable if all moduli of the companion matrix $\bar{A}$ are strictly less than one, where:

$$\bar{A} = \begin{bmatrix} A_1 & A_2 \cdots & A_p & A_{p-1} \\ I_k & O_k \cdots & O_k & O_k \\ O_k & I_k \dots & O_k & O_k \\ \vdots & \ddots & \vdots & \vdots \\ O_k & O_k \cdots & I_k & O_k \end{bmatrix}$$

Stability implies that the panel VAR is invertible and has an infinite-order vector moving-average representation, providing known interpretation to the estimated impulse-responses (Abrigo and Love 2016). The confidence intervals for IRFs are estimated using 200 Monte Carlo simulations by drawing random samples from the distribution implied by the estimated coefficients, a standard sampling procedure used in the literature.[5]

Since the innovations (e_{it}) are contemporaneously correlated, and a shock in one variable is likely to be accompanied by shocks in other variables (Abrigo and Love 2016), we apply a Cholesky decomposition to the IRFs, thereby imposing a recursive structure. This recursive structure represents a causal ordering which can be used to isolate the effects of a shock to one variable on another variable, for example, the effect of a shock to debt on GDP, keeping all else constant. We use the identifying assumptions imposed in the earlier literature, wherein debt affects GDP instantaneously while the effect of GDP on debt occurs after a lag (see, for instance, Caldara and Kamps (2008), and Liaqat (2019)). This is because delays between fiscal policy and political decision making can result in the fiscal policy to have an immediate effect on GDP, while the reverse can only occur after a lag (Caldara and Kamps 2008). Therefore, we place external debt before GDP growth in our PVAR specifications.

[5] We use the *pvar* package of programs in Stata developed by Abrigo and Love (2016), which applies parametric Monte Carlo simulations to estimate confidence intervals using Gaussian approximation. This approach is used to theoretically explore some general characteristic of an estimator, with predefined parameters, which may be difficult to derive analytically. The parametric simulation process draws random samples from the distribution entailed by our PVAR coefficients. Alternatively, bootstrap methods could be used to derive confidence intervals, whereby no assumptions regarding the underlying distribution are made. Nonetheless, because bootstrapping does assume that future paths will have the same fundamental realizations that have been experienced in the past, and does not produce consistent estimates when the distribution does not have finite moments, or when the sample sizes are small (Chernick 2007), we instead rely on parametric Monte Carlo simulations to estimate our confidence intervals.

In addition to external debt and output growth, the vector of dependent variables, Y_{it}, comprises of the growth rate (log-differences) of the following endogenous variables: population growth, growth of gross capital formation, and rate of inflation. The purpose of controlling for additional endogenous variables in our baseline specification is twofold. Firstly, if external debt growth has been shown to be correlated with the growth of, say, capital formation, the exclusion of a potentially significant variable from our specification is likely to render biased estimates. In fact, our choice of dependent variables in the estimation of our baseline PVAR model is motivated by the relevance of these variables in affecting the volume of external debt well-known in the existing literature (see, for example, Clements, Bhattacharya and Nguyen (2003), and Patillo, Poirson and Ricci (2004)).[6] Secondly, the inclusion of multiple controls in our estimation helps shed light on the specific channels through which external debt affects output growth. As explained earlier, exploring the transmission of idiosyncratic shocks to external debt serves as a key benefit of using PVARs in our analysis.

We also estimate extended models with additional endogenous variables in Y_{it}, such as, trade openness and savings rate, as well as a simplified specification with no additional controls as robustness checks.[7] The effect of international trade on central government debt as well as external debt has also been recognized in the literature. Likewise, controlling for the growth of savings permits us to gauge the role of another crucial channel which has largely remained unexplored in the existing literature. Our results are reinforced even after imposing alternative Cholesky ordering in the estimation of equation (2). This final step is driven by the expectation that external debt may be closely tied to at least some of the other endogenous variables included in our PVAR estimation. We show that the baseline IRFs are robust to alternate causal specifications, and hence, may well have a structural interpretation.

3. Baseline Results

We apply the PVAR methodology to study the impact of three components of external debt - total, public and private - on GDP growth. We further disaggregate the effects of these three types of debt across three sets of country classification, based on GNI levels (low, lower-middle, and upper-middle income groups). Our disaggregated analysis reveals that the relationship between debt and growth is heterogenous across the types of external debt, and is conditional on the country classification.

For the combined sample, our main finding suggests that total external debt exerts a negative effect on GDP growth, as presented in Figure 1. A novel empirical pattern that emerges from our analysis is that the effect of a shock to external debt is persistent, as it remains statistically significant even

[6] Our approach is similar to that used by Patillo, Poirson & Ricci (2004). Their empirical methodology consists of augmenting a standard growth specification based on conditional convergence by adding debt indicators. We control for each country's size (i.e. population) and physical-capital accumulation in our baseline specification in a similar spirit of growth accounting framework exercised in their study.

[7] Table A.2 in the Appendix reports descriptive statistics for all the variables used in our regressions by income categories.

three years after the shock. Thus, total external debt seems to not only have a contemporaneous effect on GDP growth but continues to generate low growth for a significant period of time. One possible explanation of this result may be obtained by utilizing the endogenous growth model by Romer (1987, 1990). As the proportion of external public debt-to-GDP rises, the country's risk premium also increases, and the interest payments on total external debt soar. This may have a negative impact on household disposable income and savings, which reduces the resources for capital accumulation, causing the growth rate of the economy to shrink.

Digging deeper reveals that the negative relationship between total external debt and growth is primarily affected by public external debt, which has a negative effect on GDP growth that lasts for approximately five years, while the effect of private external debt on income growth is negative, but not distinguishable from zero. The evidence is consistent with that in Casares (2015), who utilizes an endogenous growth model to generate an inverted U-shaped relationship between external debt and GDP growth. However, the identification of the source that generates the negative relationship between external debt and growth is a novel finding in the empirical literature, extending not only the results found in Patillo, Poirson and Ricci (2002) and Schclarek (2004), but also the border literature on the debt-growth nexus (Reinhart and Rogoff 2010; Eberhardt and Presbitero 2015; Egert 2015).

<Figure 1>

These results are found to vary significantly across income groups. The low-income group has the highest percentage of mean total and public external debt, while the high-income countries have the largest average private external debt-to-GNI ratio.[8] We re-estimate our model for the three types of external debt across income groups. Figure 1A presents the first set of results, describing the relationship between total external debt and income growth for the three income categories. For the low-income countries, total external debt exerts a negative impact on GDP growth, and the effect is highly persistent, as it remains statistically significant roughly six years after the shock. On the other hand, the relationship between total external debt and growth is reversed for the middle income countries, as total external debt exerts a positive impact on growth rate.

A comparison of the estimation results over various country groups (disaggregated based on GNI per capita) discloses a substantial amount of heterogeneity in the influence of both private and public external debt on output growth. Figure 1B presents the second set of results, describing the relationship between private external debt and growth. As before, the effect of private external debt on income growth is not distinguishable from zero for both the low-income and middle-income groups. The relationship between public external debt and growth is depicted in Figure 1C. Interestingly, the results are reversed when looking at the low and lower-middle income group, as public external debt generates a negative effect on this set of countries. The effect is lasting, with GDP growth returning to equilibrium approximately seven years after the shock for the low-income group. On the other hand, the effect is insignificant for the upper middle-income group.

[8] Refer to Table A.2 in the Appendix.

<Table 1>

The results summarized in Table 1 extend a broad set of literature. For example, the first row confirms that these empirical patterns are consistent with those found in Schlarek (2005), detecting a negative relationship between external debt and growth rate. However, these results are solely driven by public external debt of developing countries. Our disaggregated analysis reveals that the relationship between debt and growth is heterogenous across different types of external debt and is conditional on the country classification. In addition, these findings offer useful extensions to some of the earlier studies. For example, Reinhart and Rogoff (2010) focus on both central government and external debt, but do not analyze the heterogeneity across income groups, nor disaggregate over types of debt. Similarly, Egert (2015) focuses on detecting threshold levels for public debt in advanced economies, and Eberhardt and Presbitero (2015) study public debt in the developing and developed economies.

While our focus in this paper is to identify the empirical patterns in the data, these results can also be contextualized to offer policy prescriptions. From the perspective of a small open economy (many of which are categorized as either a low-income or lower-middle income country), both total and public external debt negatively influence GDP growth. One concern might be to reduce the reliance on foreign borrowing by advancing and deepening domestic capital markets and by strengthening the banking sector. A fiscal rule that incorporates external debt and places a limit on this type of borrowing may be another way to restrict this channel. An important implication of these findings is that the consequences of high external debt needs to be understood better, perhaps through incorporating it in a model with an active fiscal authority (Leeper 1991).

To summarize our results, the most important contribution of this study is that it focuses on the consequences of external debt on growth and emphasizes the dissimilarity in the effects of private and public external debt using data for a large sample of countries. By repeating the analysis for individual country groups, we depict how the significance of this relationship varies enormously over income categories of countries. Furthermore, our methodology precisely accounts for the endogeneity of debt to income growth, a feature not addressed by the previous analyses on the subject. This is a key contribution since most of the existing empirical analyses on the relationship between debt and economic performance predominantly centers on government debt; the link between external debt and economic growth has not yet been thoroughly investigated.

4. Extensions and Robustness Analysis of the Baseline Results

This section examines the robustness of our results to additional controls and to alternative PVAR specifications. In order to verify the robustness of our baseline results across various specifications and identifying restrictions, as well as to shed light on the possibly reverse relationship, i.e. the effect of income growth on external debt, we estimate several extensions of our baseline estimation.

4.1 Additional controls

We begin with the estimation of an extended model with the inclusion of an additional endogenous variable, namely, trade openness, which has been shown to be an important determinant of debt in several existing studies (Clements, Bhattacharya and Nguyen 2003; Patillo, Poirson and Ricci 2004).[9] It is widely accepted that economies that are open to trade are more likely to enjoy higher long-term rates of growth of per capita income. Patillo, Poirson and Ricci (2004) show that trade openness is found to affect growth through capital accumulation, one of the endogenous variables used in our baseline PVAR, in contrast to theoretical and empirical predictions of some earlier studies. Greater openness is predicted to increase capital formation also because more open economies are likely to compete for foreign investment, thereby investing more in infrastructure, as compared to closed economies. Therefore, we include an indicator for openness as our first extension of the baseline PVAR. The IRFs generated are presented in Figure 2.

It is obvious that both, the total and public external debt have a significantly negative impact on growth rate for the complete sample of countries and the low-income group. This result is consistent with our baseline findings. Resembling our baseline results, we detect a positive effect of the overall level of external debt on growth rates in the lower- and upper-middle income groups. The rest of the impulse-responses are largely comparable to those depicted in Figure 1, except for the effect of public debt on growth in the upper-middle income countries, which also now becomes negative.

<Figures 2 & 3>

As a further robustness exercise, we test the sensitivity of our results to the inclusion of another relevant variable along with trade openness, namely, the growth of government spending. Since fiscal spending and budget deficits are expected to affect output growth through the growth of capital formation, central government spending is included to control for the impact of fiscal balances on output growth. In addition, higher foreign aid often allows governments to increase spending on public investment. The IRFs generated are reported in Figure 3 and are mostly similar to our benchmark results as well as to those shown in Figure 2.

4.2 Alternative PVAR structure

Since the endogenous variables in Y_{it}, such as real income, may have a contemporaneous effect on external debt, the results may be sensitive to the order of causation used in our identification scheme. To address this issue, we impose alternative Cholesky ordering in the estimation of Eq. (1). The results are shown in Figure 4. We find no major changes in either the direction or the magnitude of the response of income growth to a rise in either public, private, or total external debt growth. The only exception is the now negative impact of total external debt for the lower-middle income group. This outcome is driven by a relatively strong negative effect of public debt on

[9] Trade openness is defined as the sum of exports and imports expressed as a share of GDP.

income growth in these countries. The effect of private external debt, once again, turns out to be ambiguous for all country groups, with some evidence of a negative effect in the case of upper-middle income countries. Since the IRFs are robust to alternate causal specifications, the reduced-form errors are unlikely to be correlated and may well have a structural interpretation (Liaqat 2019). Thus, we have conducted a rigorous robustness analysis by using alternative variables in addition to testing the extended models described above. Our benchmark estimates are robust to these specifications and several identifying restrictions.[10]

<Figure 4>

4.3 Threshold levels and effects

The theoretical literature often evaluates the relationship between debt and growth using a threshold analysis, which suggests that debt has a positive impact on investment and growth up to a certain threshold level; beyond this level, however, its impact is adverse. Using a large panel data of 93 developing countries over the period 1969-1998, Pattillo et al. (2002) find that the average impact of external debt on per capita GDP growth is negative for net present value of debt levels above 35-40 percent of GDP. Several other studies have looked at the impact of external debt on economic growth in developing economies. Most of these studies are motivated by the "debt overhang" hypothesis—a situation where a country's debt service burden is so heavy that a large fraction of output accrues to foreign lenders and consequently creates disincentives to invest (Krugman 1988; Sachs 1989). Bussière et al. (2013) and Pattillo, Poirson, and Ricci (2002, 2004) find a nonlinear effect of external debt on growth, i.e., a negative and significant impact on growth at high debt levels (typically, over 60 percent of GDP), but an insignificant impact at lower debt levels. In contrast, Cordella, Ricci, and Arranz (2005) find evidence of a debt overhang for intermediate debt levels, but an insignificant debt-growth relationship at very low and very high levels of debt.

As indicated in Cohen (1993), the relationship between the face value of debt and investment can be represented as a type of a 'Laffer curve': as outstanding debt increases beyond a threshold level, the expected repayment begins to fall because of the adverse effects mentioned above. The implication is that an increase in the face value of debt leads to an increase in repayment up to the 'threshold' level; along the 'wrong' side of the debt Laffer curve, on the other hand, increases in the face value of debt reduce expected payments. Given the positive effects of capital accumulation on economic activity, a similar type of Laffer curve between external debt and growth could be expected.

We use existing threshold levels characterized in the literature to identify differences in the response of output growth to the types of external debt. To extract these effects, we re-run our

[10]As an additional robustness exercise, we estimated a simplified model, with the exclusion of all endogenous variables other than external debt and growth variables. The estimates generated are yet again generally in line with our benchmark results. The results based on the simplified model are presented in the Appendix in Figure A.1.

baseline model to study the effect of the type of external debt on growth when the debt threshold is between 0-30, 30-60, 60-90 and above 90 percent, respectively. Table 2 summarizes the baseline results, as well as the effects under the four different debt thresholds for the overall and the disaggregated set of countries.[11]

<Table 2 here>

Our results detect some patterns of non-linearity between external debt and growth, though it does not display consistent evidence in support of a universally applicable threshold level in the relationship between debt and growth. For the baseline case, total external debt has a positive effect on GDP even within the 60-90 percent threshold, and which turns negative beyond the 90 percent threshold. Public external debt, on the other hand, displays a negative effect for lower levels (below 30 percent), but positive for a window between 30-60 percent, and negative again for beyond 60 percent. Private external debt displays a positive effect in between the 30-60 percent threshold, with the number of observations limiting our analysis for beyond this threshold value.

Across countries too, there is significant variation in the response of GDP to debt. For low-income countries, total external debt seems to generate a negative response across all thresholds, which is clearly driven by the public debt component of external debt. For lower-middle income countries, this effect is reversed; while total external debt brings about a positive GDP response, public debt produces an insignificant one. Finally, for the upper-middle income group, total external debt has a negative impact at higher thresholds (between the 60-90 percent window). However, this impact is much lower for private external debt, which displays a negative effect even between the 0-30 percent threshold.

In short, as far as the total external debt is concerned, debt ratios above 90 percent of GDP are associated with a negative impact on growth rate. The evidence for the windows below this debt level is mixed and is contingent on the country income classification as well as on the type of debt. Our results complement the findings of Egert (2015), Chudik et al. (2015), and Eberhardt and Presbitero (2015). The latter, while focusing on determining the threshold level for central government debt, conclude that the results are dependent on the country groups and time period under consideration and that the detrimental effect of debt arises at debt levels as low as 20 percent for some country groups, and at 60 percent debt-to-GDP ratio for others. These studies find no evidence for a consistent threshold level in the relationship between public debt and economic growth.

4.4 A word on causality

One of our main empirical results suggests that the growth of external debt has a statistically significant impact on income growth. We further detect a stark contrast in its impact across countries. One possible reason for this result may be that the drivers of accumulating debt are

[11] The corresponding IRFs are reported in Figure A.2 in the Appendix.

different across countries.[12] For example, the negative relationship between public external debt and growth for low and lower middle-income groups may be consistent with the view that public external debt in developing countries tends to crowd out economic activity by discouraging capital formation and lowers future public infrastructure spending (Aizenman et al. 2007). Given that high debt is likely to constrain the scope for countercyclical fiscal policies, this may also result in higher volatility and further lower growth (Aghion and Kharroubi 2007; Woo 2009). On the other hand, the positive impact of growth of external debt on income growth in lower- and upper-middle income categories seems to reflect the fact that accumulation of debt in this set of countries mainly arises due to liquidity requirements for productive investment spending. The underlying data also suggests a lower average external debt for these countries, suggesting better fiscal management and debt practices may more prevalent as compared to those in lower-income countries.

<Figure 5>

Do the statistically significant long-run effects of external debt on economic growth simply imply a long-run correlation between debt and GDP growth? In order to differentiate between the causal effects of external debt on growth, and vice versa, we also estimate the response of external debt to a rise in growth rates. The above-mentioned results are robust to alternative VAR specifications, but in order to ensure that the long-run association between the two variables of interest is mainly driven by the effect of debt on economic growth, we plot the IRFs measuring the response of debt to growth in Figure 5. We notice that income growth consistently negatively affects external debt growth, both private and public, for the low-income group of countries. For all the other sub-samples, the effect of income growth is either negative or statistically insignificant. Amongst the types of debt, the most well-defined results are with respect to public external debt, which tends to fall with higher growth rates for all country groups other than the lower-middle countries. In contrast to the previously insignificant effect of private external debt on growth, we find that economic growth significantly lowers the growth of private external debt in low and lower-middle income countries. These results are summarized in Table 3.

<Table 3>

5. Disentangling the impact of external debt on growth

To disentangle the channels through which external debt is likely to have an impact on economic growth, we investigate the impact of external debt on: (i) total savings (gross national savings expressed as a percentage of GDP); and on (ii) total investment (gross fixed capital formation). Although these relationships are estimated individually, the impact of debt on growth may work through several channels simultaneously. For example, the reduction in investment and slower

[12] Other channels that can also explain these empirical patterns may be through higher long-term interest rates and sovereign risk spill-overs to corporate borrowing costs in lower income countries (Gale and Orszag (2003); Corsetti et al. (2013)), higher future distortionary taxation (Barro (1979); Dotsey (1994)), as well as greater uncertainty about prospects and policies.

growth of capital stock may affect GDP directly through a standard production function approach, or through a slowdown in labor productivity growth. The channels proposed here have also been tested by Schclarek (2004), Kumar and Woo (2010), and Westphal and Rother (2012). However, these authors do not fully account for the endogenous interactions among factors and focus primarily on public debt.

We apply again the methodology described in section 2, which relies on a PVAR model in a generalized method of moments framework and generate the impulse response functions of the two variables of interest (i.e. either savings or investment) to a shock in the growth rate of external debt. The vector of dependent variables, Y_{it}, now comprises of log-differences of the following endogenous variables: population growth, growth of gross capital formation, output growth, rate of inflation, along with the growth rates of external debt and saving rates. The IRFs of the estimated model are presented in Figures 6 and 7, and the key results are summarized in Table 4, indicating the impact of different types of external debt on GDP (which is included for comparison), savings, and investment.

<Table 4>

The impact of all types of external debt on savings across all sets of countries is mostly negative, which may be viewed as counterevidence to the Ricardian equivalence hypothesis. These results imply that several channels are at work: it could reflect that private agents may anticipate inflationary pressures, troubles in the financial markets, and/or transfer capital abroad, or excess capital could lower the long-run interest rates, subsiding the incentives to save. The results confirm those found in Westphal and Rother (2012), who detect a negative effect of public debt on savings.

It is also interesting to check whether the impact of external debt on savings and output growth co-move. For public external debt, there exists a positive relationship between the effects on savings and growth, whereby both move in the same direction. This relationship also holds for the complete sample and for total external debt. Income based disaggregation reveals that despite total external debt exerting a negative effect on savings in the lower-middle and upper-middle set of countries, the overall effect of external debt on GDP is positive.

The effect of external debt on investment varies considerably across country income groups and across debt types. For the complete set of countries, total external debt has a negative effect on GDP growth but a positive impact on investment. This effect is better understood when examining disaggregated external debt. Public external debt exerts a negative effect on investment. On the other hand, private external debt exerts a positive effect on investment. The combined effect may, therefore, explain the overall positive impact of external debt on investment.

Over income classifications, the type of external debt plays an important role in determining the impact on investment. Public external debt is found to reduce investment. This effect can be explained by the fact that, in their consolidation efforts, governments may tend to cut expenditure allotted for public investment, including maintenance of public infrastructure. Accordingly, this channel may be problematic from a fiscal sustainability perspective. Such a pattern is also

documented in Chalk and Tanzi (2004). On the other hand, private external debt has a positive effect on investment, which may work through financial channels, such as, through an increase in lending or credit borrowing. These findings complement those found in Westphal and Rother (2012), and Kumar and Woo (2010), which provide evidence for the impact of public debt on investment in advanced economies.

<Figures 6 & 7>

6. Conclusion

We estimate a panel vector autoregression model using data for a large number of countries over 1990-2015 in order to identify the relationship between external debt and income growth. We investigate whether the results obtained differ across various groups of countries, and more importantly, for different components of external debt. Through the estimation of a PVAR model, we systematically investigate the transmission of idiosyncratic shocks to external debt across countries and over time. We show that our results are robust to various model specifications, controls and identifying restrictions.

We detect a considerable degree of heterogeneity in the influence of both private and public external debt on output growth. Our empirical findings indicate that total external debt growth appears to have an adverse impact on GDP growth in the complete sample of countries as well as for the low-income group. Conversely, external debt is positively associated with income growth in lower- and upper-middle income groups. Although public external debt decreases output growth for most countries, there is no noticeable effect of private external debt on growth rates. Likewise, the effect of a higher GDP growth on total and public external debt is markedly negative for most countries. Income growth is also expected to depress the growth of private external debt for at least the low- and lower-middle income groups. Analysis based on the components of debt and across income classifications allows us to inspect the non-linearities in this relationship at a more granular level. Finally, we highlight savings and investment as the primary channels through which external debt is likely to have an impact on economic growth rate.

The empirical findings borne out of this paper suggests important policy implications. Countries – especially low- and middle-income countries – should continue efforts to develop technical capacity on public management frameworks that enable them to closely monitor debt buildups and adopt better fiscal management practices. Developed financial markets that leverage savings in low-income countries can play a substantial role in their economic growth and development. These are some of the potential topics for future research.

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Tables and Figures

Table 1: The effect of external debt on growth – Summary of baseline results

	Total External Debt		Public External Debt		Private External Debt	
	Effect	Shock Persistence	Effect	Shock Persistence	Effect	Shock Persistence
Complete sample	Negative	3 years	Negative	5 years	Insignificant	-
Low-income	Negative	6 years	Negative	7 years	Insignificant	-
Lower-middle income	Positive	2 years	Negative	3 years	Insignificant	-
Upper-middle income	Positive	-	Insignificant	-	Insignificant	-

Notes: Based on the estimation of PVAR (Eq. (1)) and the corresponding impulse response functions of income growth to a shock in external debt using income and debt classifications from the World Bank.

Table 2: The effect of external debt on growth – Threshold levels and effects

	Baseline	0-30%	30- 60%	60-90%	>90%
Panel A: Total External Debt					
Complete Sample	Negative	Insignificant	Insignificant	Positive	Negative
Low-Income	Negative	Negative	Insignificant	Negative	Negative
Lower-middle income	Positive	Insignificant	Insignificant	Positive	NA
Upper-middle income	Positive	Insignificant	Insignificant	Negative	NA
Panel B: Public External Debt					
Complete Sample	Negative	Negative	Positive	Negative	Negative
Low-Income	Negative	Negative	Positive	Negative	Negative
Lower-middle income	Negative	Insignificant	Insignificant	NA	NA
Upper-middle income	Insignificant	Insignificant	NA	NA	NA
Panel C: Private External Debt					
Complete Sample	Insignificant	Insignificant	Positive	NA	NA
Low-Income	Insignificant	Insignificant	NA	NA	NA
Lower-middle income	Insignificant	Insignificant	NA	NA	NA
Upper-middle income	Insignificant	Negative	NA	NA	NA

Notes: Based on the estimation of PVAR (Eq. (1)) and the corresponding impulse response functions of income growth to a shock in external debt using income and debt classifications from the World Bank. "NA" indicates that the number of observations were not sufficient to obtain PVAR estimates.

Table 3: The effect of growth on external debt

	Total External Debt	Public External Debt	Private External Debt
Complete sample	Negative	Negative	Insignificant
Low-income	Negative	Negative	Negative
Lower-middle income	Insignificant	Insignificant	Negative
Upper-middle income	Insignificant	Negative	Insignificant

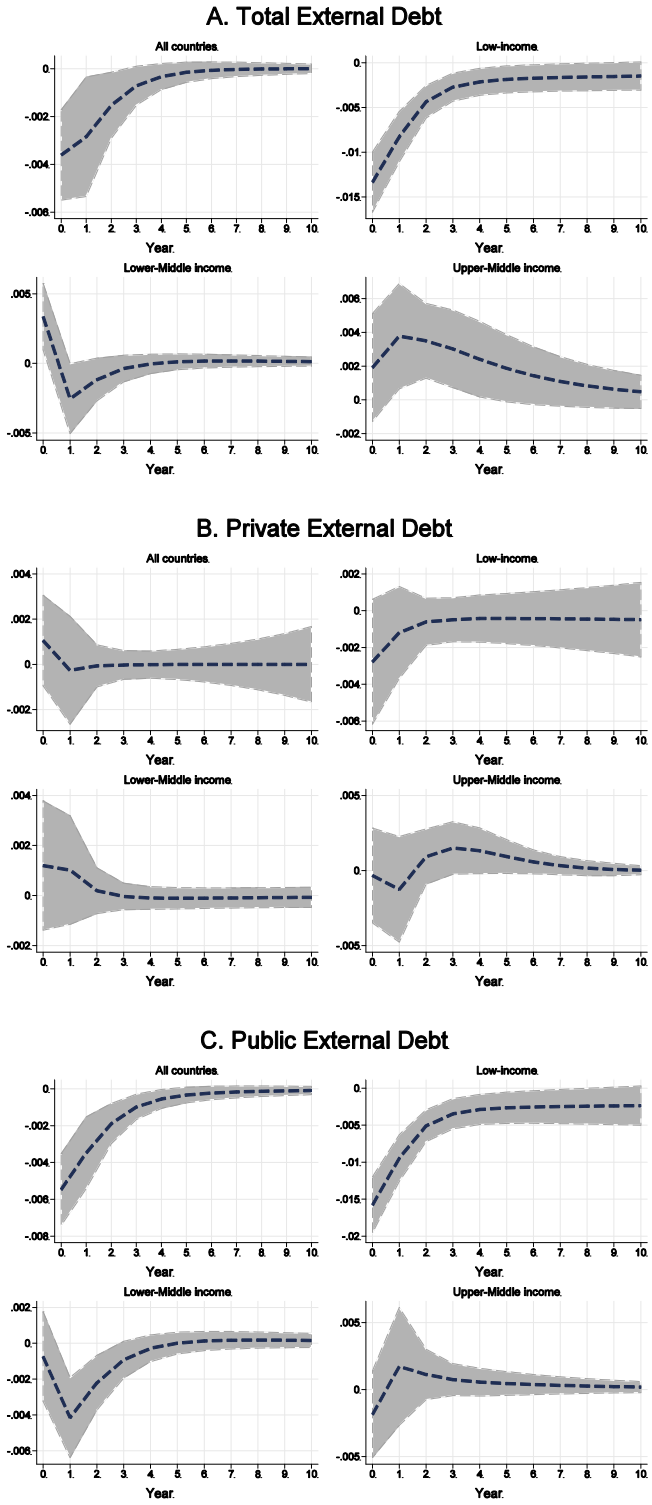
Notes: Based on the estimation of PVAR (Eq. (1)) and the corresponding impulse response functions of external debt to a shock in income growth using income and debt classifications from the World Bank.

Table 4: The effect of external debt on savings and investment

	Total External Debt			Public External Debt			Private External Debt		
	GDP	Savings	Investment	GDP	Savings	Investment	GDP	Savings	Investment
Complete Sample	Negative	Negative	Positive	Negative	Negative	Negative	Insignificant	Insignificant	Positive
Low-Income	Negative	Insignificant	Positive	Negative	Insignificant	Positive	Insignificant	Insignificant	Insignificant
Lower-middle income	Positive	Negative	Insignificant	Negative	Negative	Negative	Insignificant	Negative	Positive
Upper-middle income	Positive	Negative	Positive	Insignificant	Insignificant	Insignificant	Insignificant	Negative	Positive

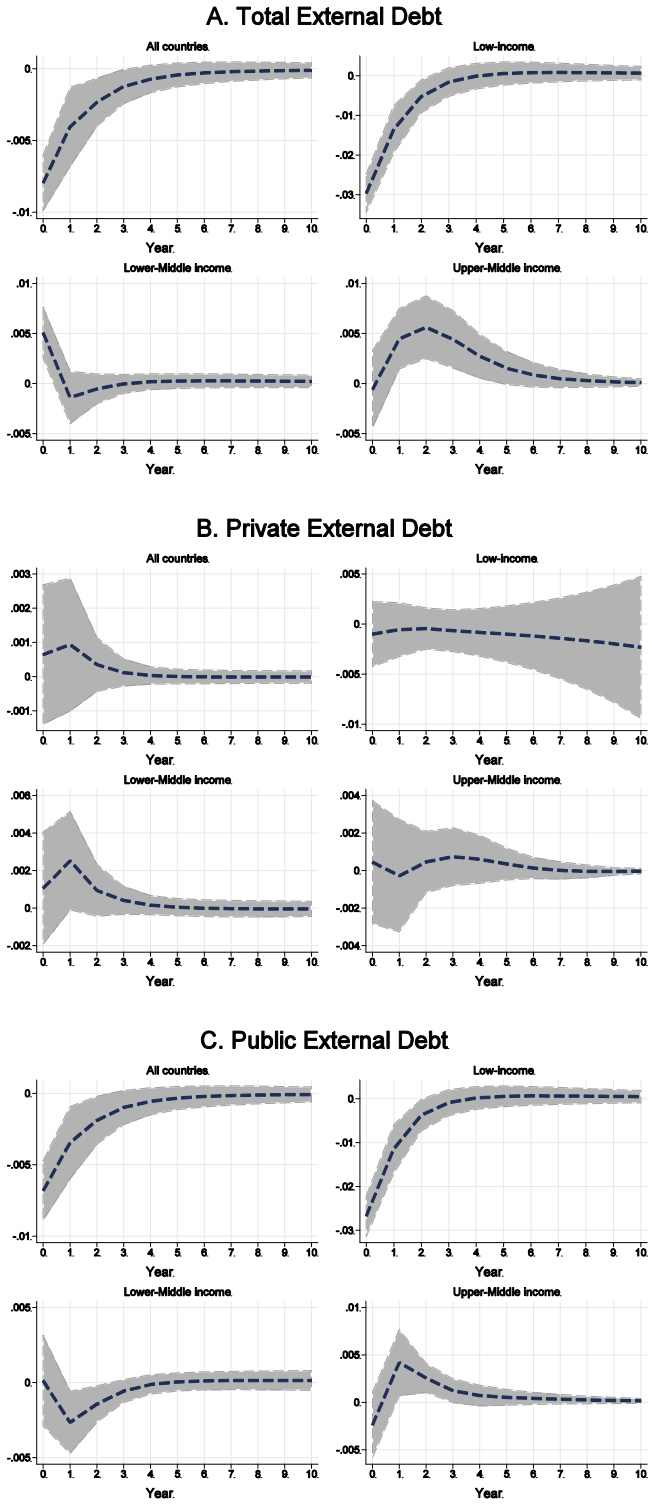
Notes: Based on the estimation of PVAR (Eq. (1)) and the corresponding impulse response functions of investment and savings growth to a shock in external debt using income and debt classifications from the World Bank.

Figure 1: Impulse response functions for baseline estimation



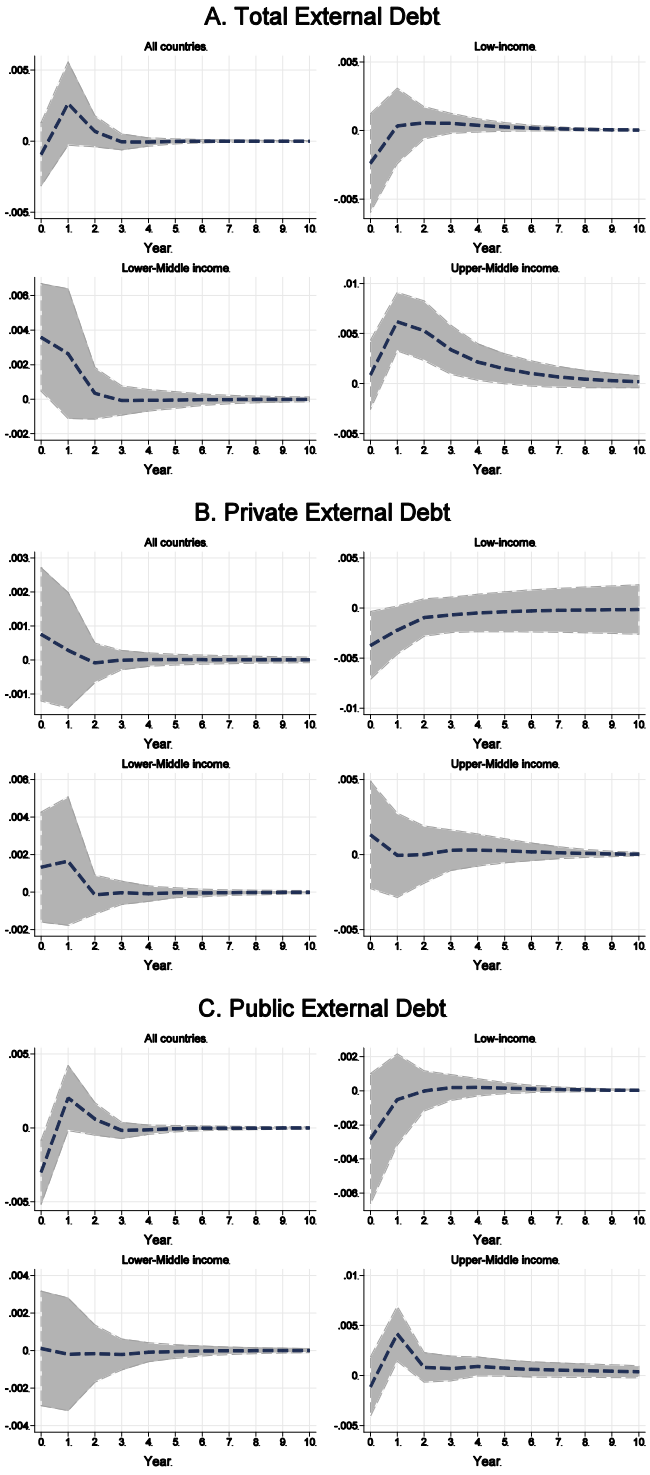
Notes: Orthogonalized impulse response functions of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 2: Extended model including trade openness



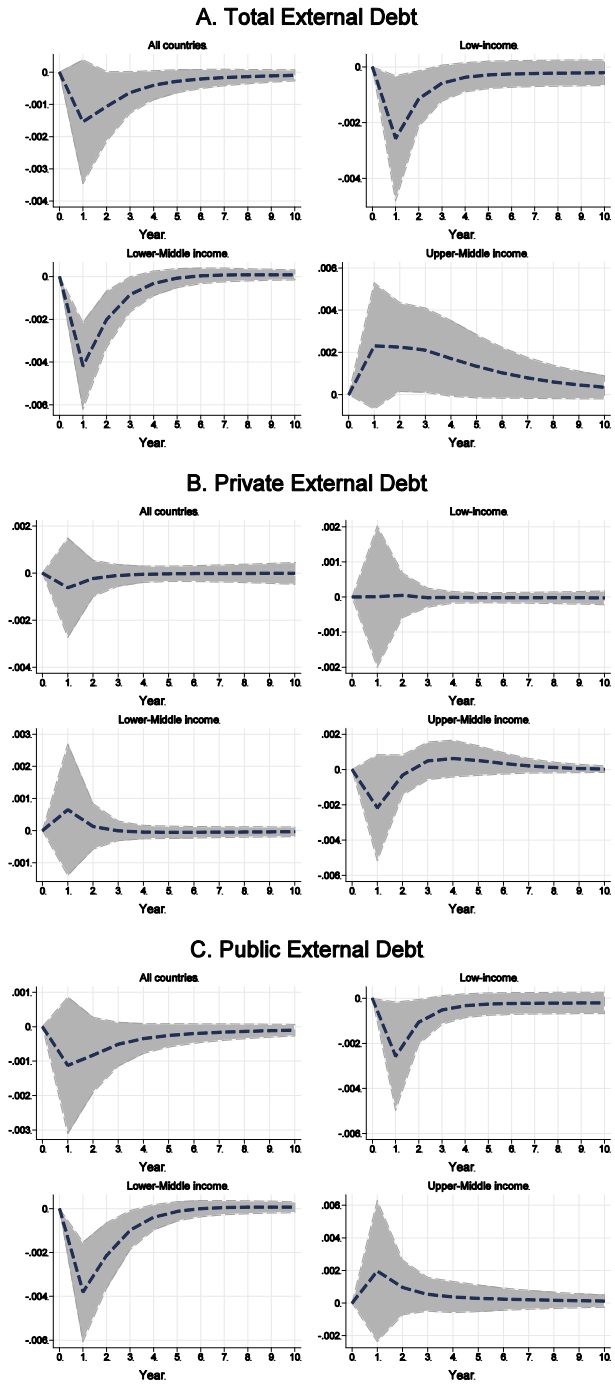
Notes: IRFs of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries based on an extended model. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 3: Extended model including trade openness & government spending



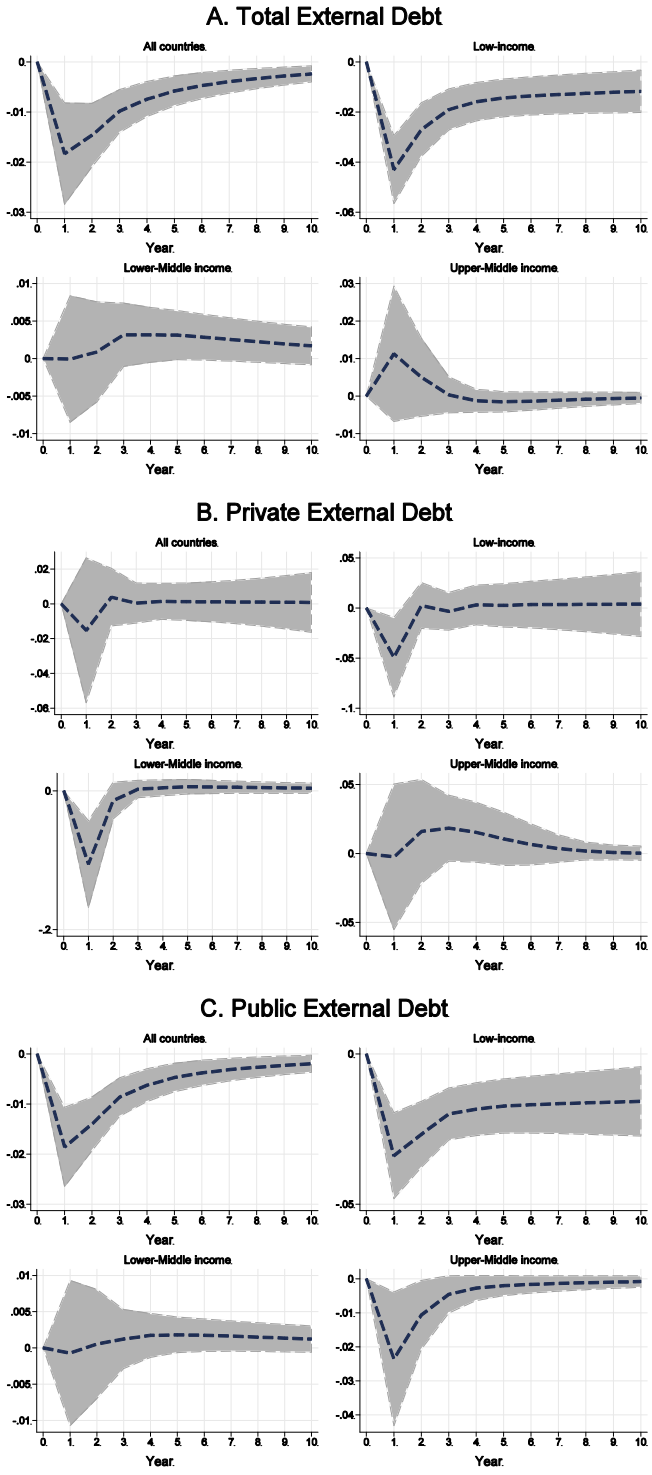
Notes: IRFs of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries based on an extended model. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 4: Robustness - Recursive order



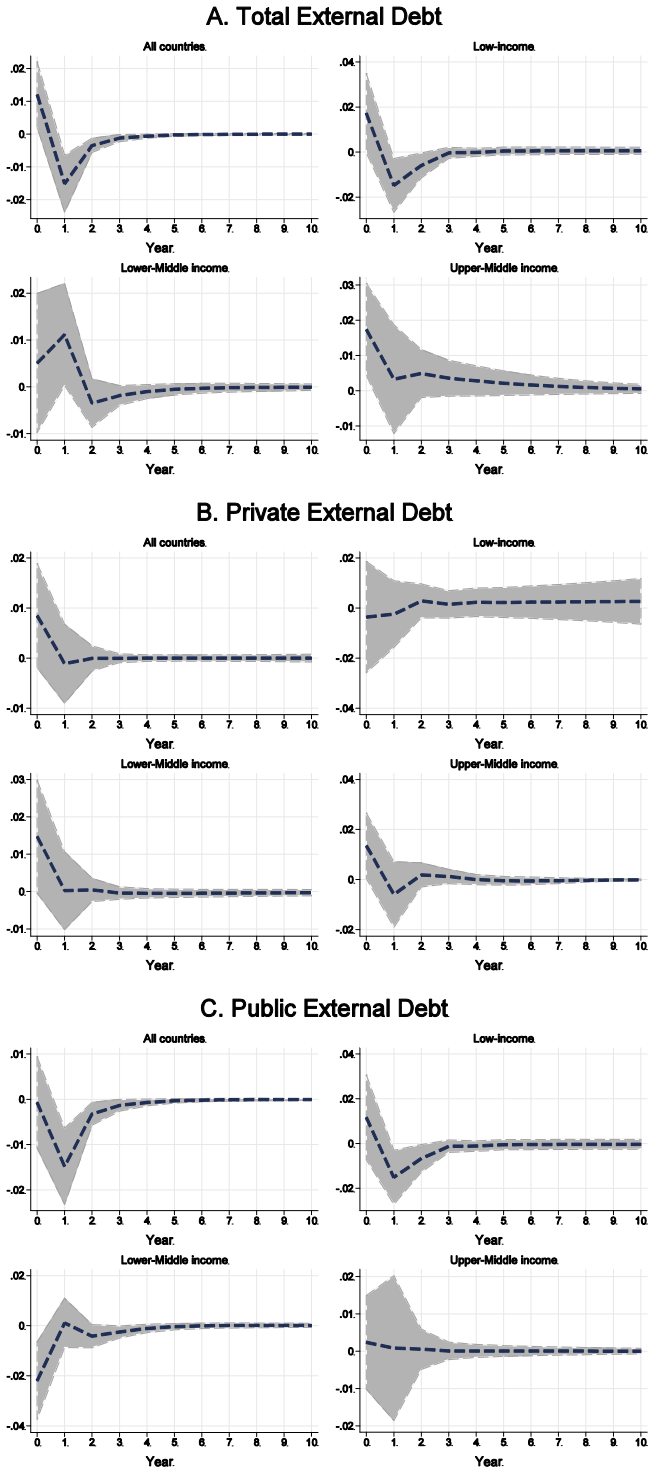
Notes: IRFs of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries based on a recursive order. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 5: Estimating the effect of growth on debt



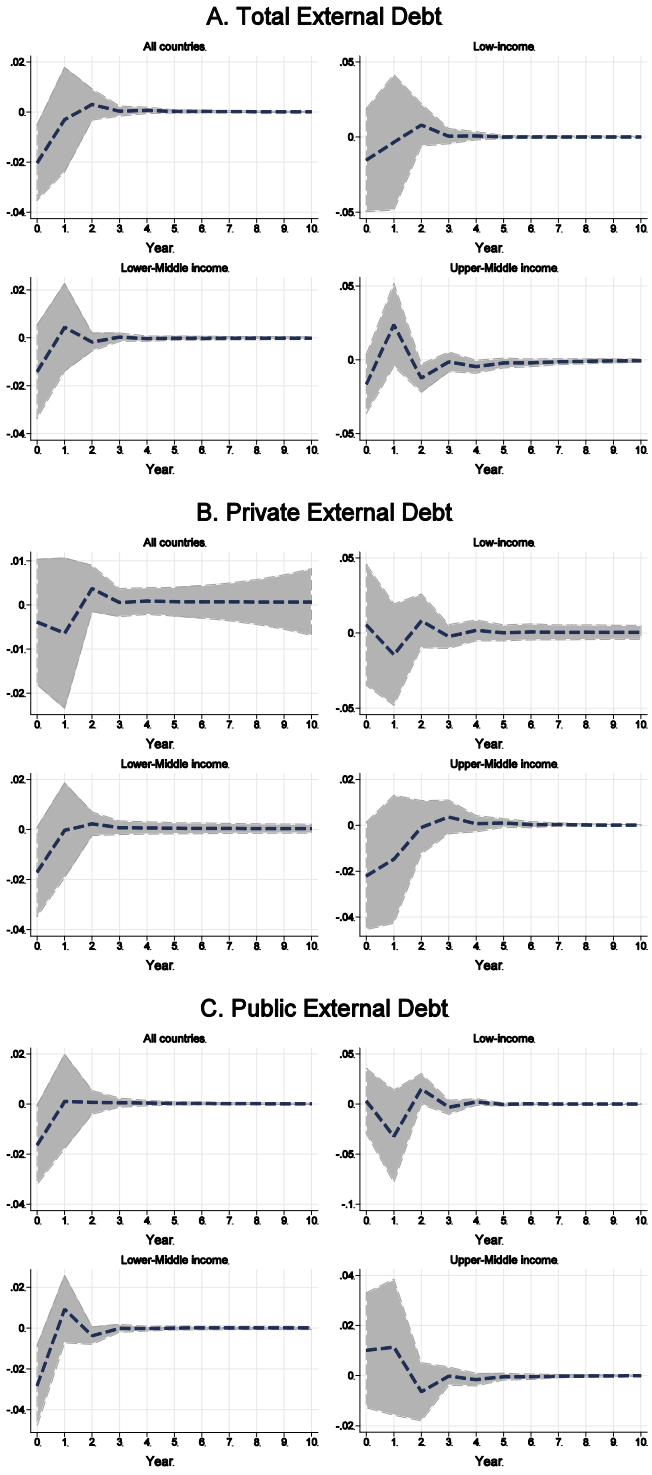
Notes: Orthogonalized impulse response functions of external debt to a shock in income growth computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 6: The effect of external debt on investment



Notes: Orthogonalized impulse response functions of investment growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 7: The effect of external debt on savings



Notes: Orthogonalized impulse response functions of savings to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Appendices

Table A.1: List of countries

	High-Income	Upper Middle-Income	Lower Middle-Income	Low-Income
Afghanistan				2007-2015
Albania		2008-2014	1996, 1999-2007, 2015	1992-1998
Algeria		2010-2015	1990-2009	
Angola	1991-1993	2011-2014	2004-2010, 2015	1994-2003
Argentina	2011-2015	1990-2010	2002-2003	
Armenia		2008, 2014	2004-2015	1994-2003
Azerbaijan		2008-2015	2004-2007	1994-2003
Bangladesh			2013-2015	1990-2013
Belarus		2007-2015	1994-2006	
Belize		2006-2015	1990-2005	
Benin				1990-2015
Bhutan			2004-2015	1990-2003
Bolivia			1997-2000, 2005-15	1990-2004
Bosnia and Herzegovina		2007-2015	2000-2006	
Botswana		2003-2015	1990-2002	
Brazil	2011-12	1995-98, 2005-10, 2013-15	1990-2004	
Bulgaria		2006-15	1990-2005	
Burkina Faso				1990-2015
Burundi				1990-2015
Cabo Verde			1993-2015	1990-92
Cambodia	1990-92		2013-15	1993-2012
Cameroon			1991, 1993, 2004-15	1990-2003
Central African Republic				1990-2015
Chad			2014	1990-2015
China		2010-15	2001-09	1990-2000
Colombia		2007-15	1990-2006	
Comoros				1990-2015
Congo, Dem. Rep.	1991-93			1994-2015
Congo, Rep.			1990-92, 2004-15	1993-2003
Costa Rica		2001-15	1990-2000	
Cote d'Ivoire			2007-15	1990-2006
Djibouti			2007-15	1990-2006
Dominica		2000-15	1990-99	
Dominican Republic		2006-2015	1991-2005	
Ecuador		2008-15	1990-2007	
Egypt, Arab Rep.			1996-2015	1990-95
El Salvador			1992-2015	1990-91
Eritrea	2012-15			1995-2011
Ethiopia				1990-2015

Fiji		2007-15	1990-2006, 2009-10	
Gabon		1990-2015	1998-99	
Gambia				1990-2015
Georgia			2004-15	1993-2003
Ghana			2007-15	1990-2006
Grenada		1998-2015	1990-97	
Guatemala			1992-2015	1990-91
Guinea				1990-2015
Guinea-Bissau				1990-2015
Guyana		2014-15	2004-13	1990-2003
Haiti	1990			1991-2015
Honduras			2000-15	1990-99
India			2007, 2009-15	1990-2008
Indonesia			1995-97, 2003-15	1990-2002
Iran, Islamic Rep.	1991-92	2007-15	1993-2006	
Jamaica		2005-15	1990-2004	
Jordan		2013-15	1990-2012	
Kazakhstan	2012-14	2006-11, 2015	1993-2005	
Kenya			2012-15	1990-2011
Kosovo		2014	2000-13, 2015	
Kyrgyz Republic			2011-15	1993-2010
Lao PDR			2010-15	1990-2009
Lebanon		1996-2015	1990-95	
Lesotho			2010-15	1990-2009
Liberia				1990-2015
Macedonia, FYR		2007-15	1994-2006	
Madagascar				1990-2015
Malawi				1990-2015
Malaysia		1995-2015	1990-94, 1998-99, 2001	
Maldives		2006-15	1991-2005	1990
Mali				1990-2015
Mauritania			2007-15	1990-2006
Mauritius		2002-15	1990-2001	
Mexico		1992-2015	1990-91, 1995	
Moldova	1993-94		2007-15	1995-2006
Mongolia		2012-14	2006-11, 2015	1993-2005
Montenegro		2007-15		
Morocco			1990-2015	
Mozambique				1990-2015
Myanmar	1990-99		2011-15	2000-10

Nepal				1990-2015
Nicaragua			2000-15	1990-99
Niger				1990-2015
Nigeria			2006-15	1990-2005
Pakistan			2008-2015	1990-2007
Panama	2014-15	1998-2013	1990-97	
Papua New Guinea			1993-94, 1996, 2006-15	1990-2005
Paraguay		2013-15, 2011	1990-2012	
Peru		2008-15	1990-2007	
Philippines			1995-97, 1999-2000, 2003-15	1990-2002
Romania		2005-15	1990-2004	
Russian Federation	2011-14	2004-10, 2015	1993-2003	
Rwanda				1990-2015
Samoa		2012-15	1994-2011	1990-93
SaoTome and Principe	1990-2000		2008-15	2001-07
Senegal			2008-2014	1990-2007, 2010, 2015
Serbia	1990-94	2006-15	1995-2005	2000
Sierra Leone				1990-2015
Solomon Islands			1992-2000, 2007-15	1990-91, 2001-06
Somalia	1990-2012			2013-15
South Africa		2004-15	1995-2003	
Sri Lanka			2004-15	1990-2003
St. Lucia		1992-2015	1990-91	
St. Vincent and the Grenadines		2001-15	1990-2000	
Sudan			2007-15	1990-2006
Swaziland			1990-2015	
Syrian Arab Republic	2009-15		2000-01	1996-99
Tajikistan			2013-14	1993-2012, 2015
Tanzania				1990-2015
Thailand		2007-15	1990-2006	
Togo				1990-2015
Tonga		2011-15	1990-2010	
Tunisia		2008-14	1990-2007, 2015	
Turkey	2013	1998-2015	1990-97, 2001-02	
Turkmenistan		2009-15	2003-08	1994-2002
Uganda				1990-2015
Ukraine		2013	1993-94, 2003-15	1995-2002
Uzbekistan			2008-15	1993-2007
Vanuatu			1990-2015	

Venezuela, RB	2010-15	1999-2009, 2011	1990-98, 2002-03	
Vietnam			2008-15	1990-2007
Yemen, Rep.			2008-15	1990-2007
Zambia			2006-15	1990-2005
Zimbabwe			2013-15	1990-2012

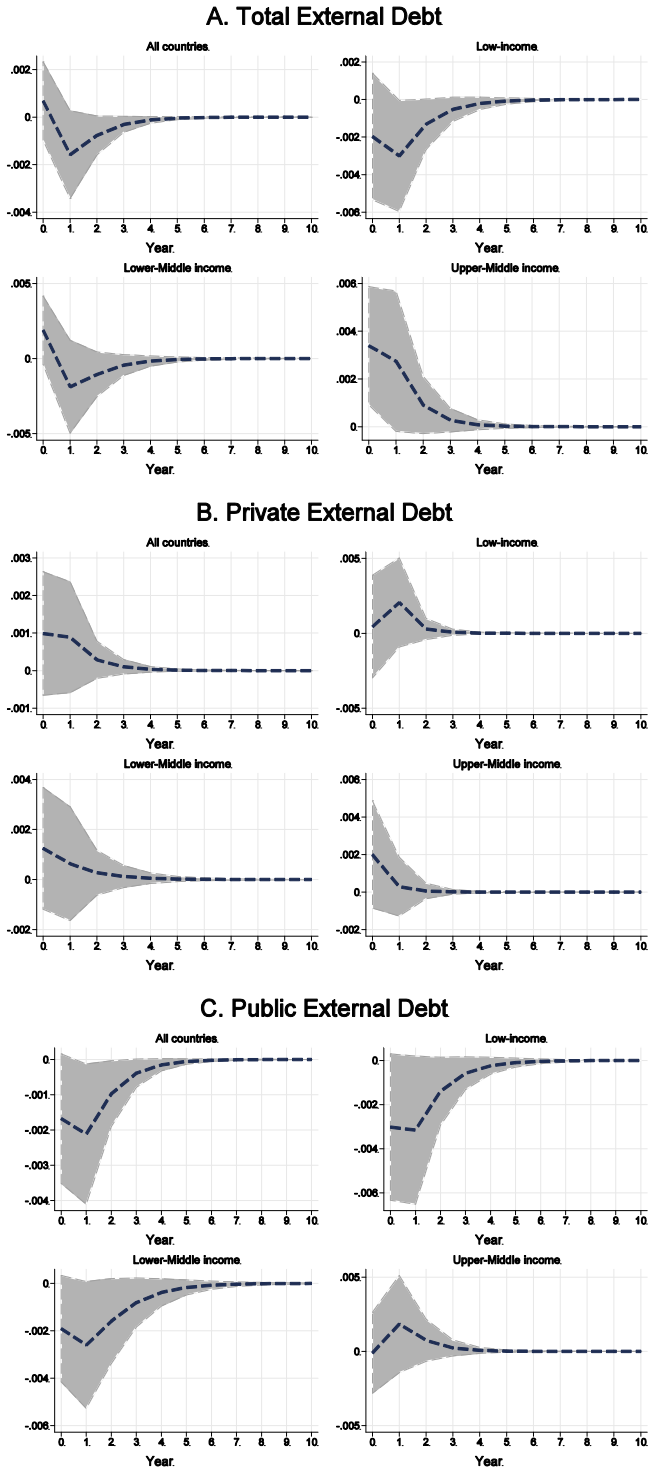
Source: World Bank: World Development Indicators (WDI)

Table A.2: Descriptive Statistics

	High-Income		Upper Middle-Income		Lower Middle-Income		Low-Income	
	Obs.	*Mean*	*Obs.*	*Mean*	*Obs.*	*Mean*	*Obs.*	*Mean*
Total external debt (%)	21	49.10	534	48.39	1108	46.39	1294	93.87
Private external debt (%)	21	23.25	445	14.30	820	8.91	626	5.24
Public external debt (%)	21	11.97	534	26.30	1105	31.35	1294	73.32
Real GDP per capita	1264	37233.57	940	9189.54	1361	3399.59	1352	858.15
Population (thousands)	1899	15400	951	25300	1390	36500	1387	43100
Capital formation (%)	1104	23.51	772	25.13	1178	24.34	1268	21.51
Inflation	1339	14.06	935	9.19	1358	36.54	1348	86.05
Trade openness (%)	1032	1.09	661	0.84	1000	0.78	975	0.64
Government spending (%)	1073	37.85	877	33.10	1156	30.50	1123	25.62
Savings (%)	896	25.59	709	21.13	1029	20.68	955	14.83

Notes: Annual data is obtained from World Bank's WDI and IMF's WEO databases.

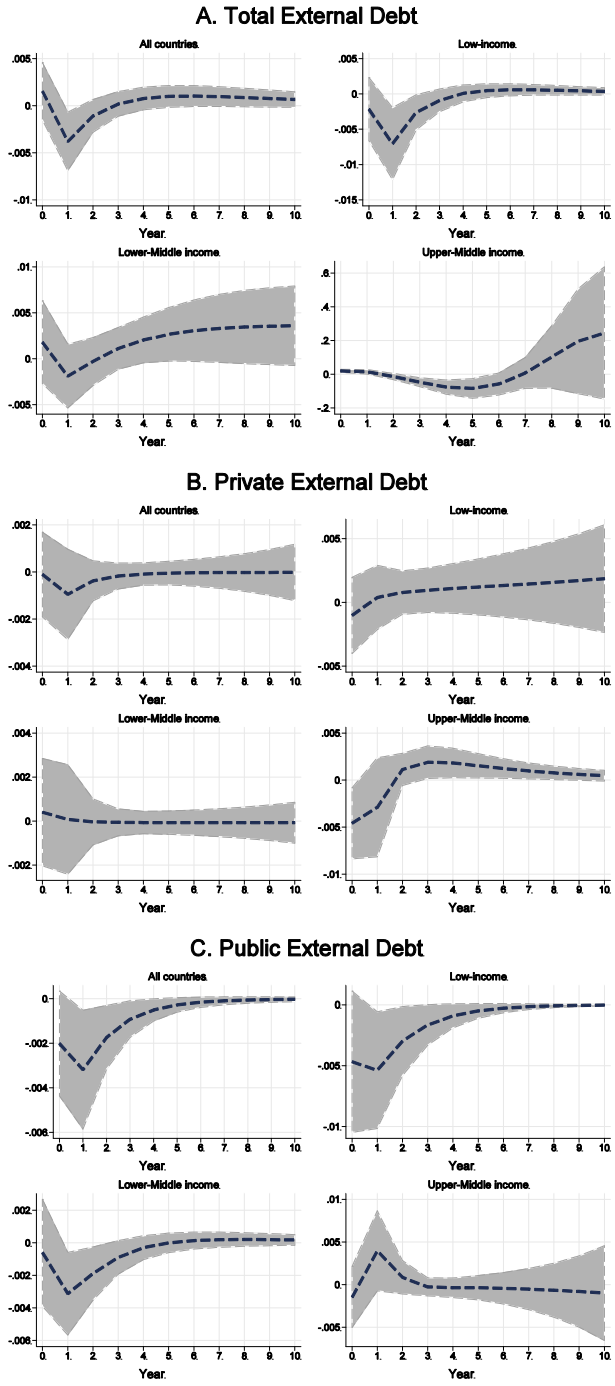
Figure A.1: Robustness - Reduced model



Notes: Orthogonalized impulse response functions of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

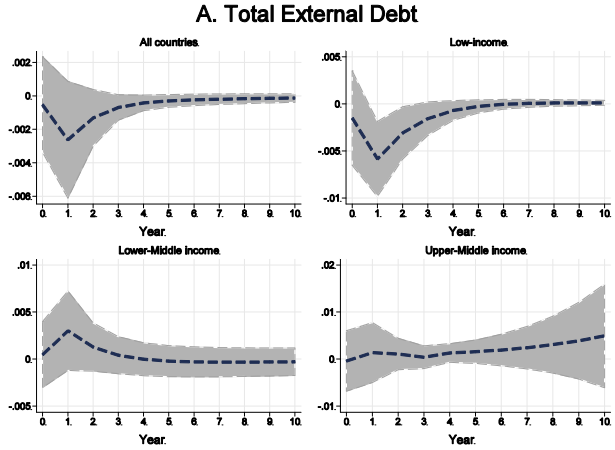
Figure A.2: The effect of external debt on growth – Threshold levels and effects

I. 0<Debt<30

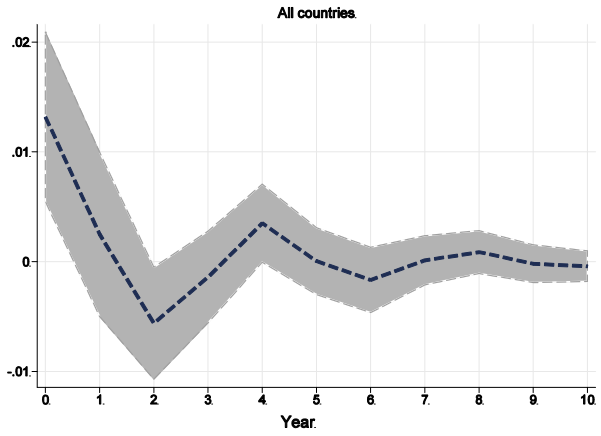


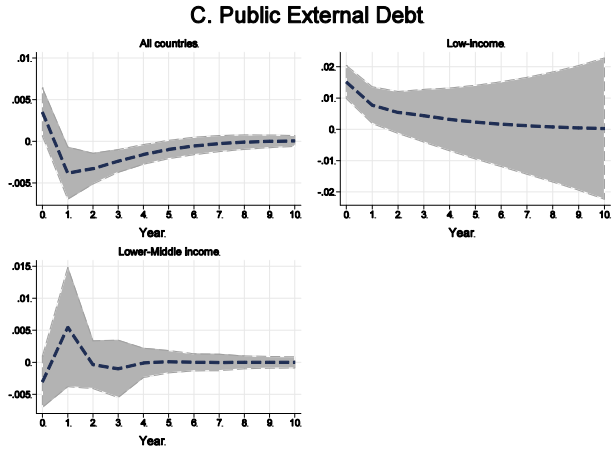
Notes: Orthogonalized impulse response functions of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

II. 30<Debt<60



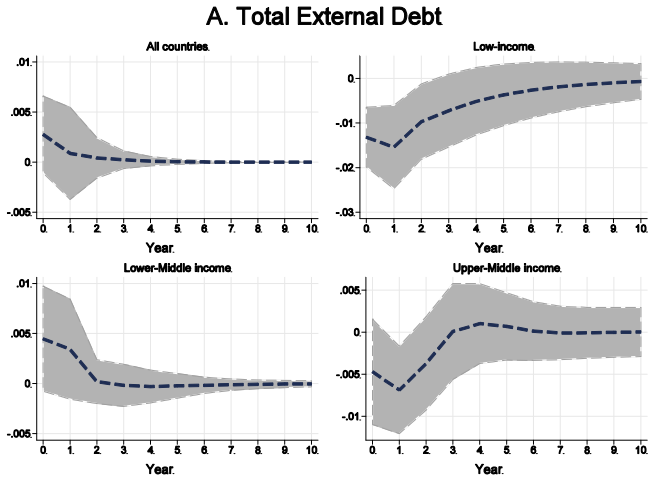
B. Private External Debt



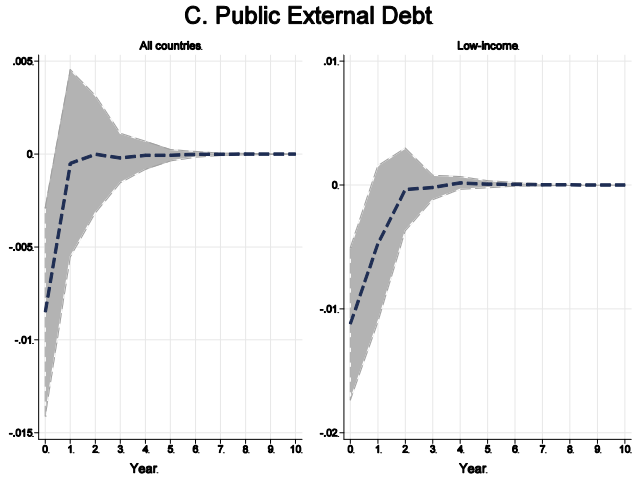


Notes: Orthogonalized impulse response functions of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

III. 60<Debt<90

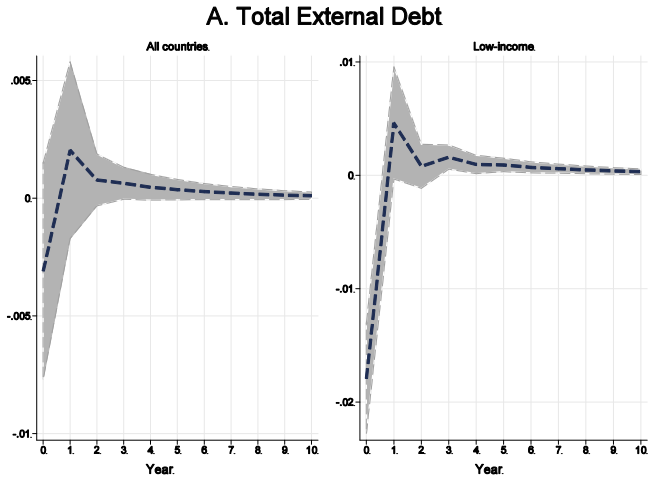


B. Private External Debt (Not enough observations)

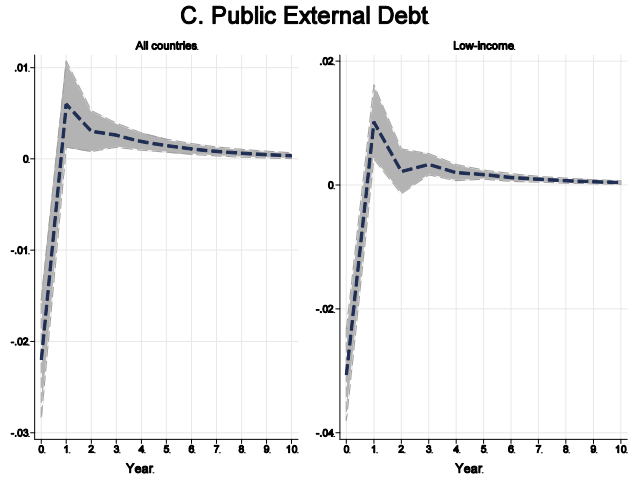


Notes: Orthogonalized impulse response functions of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

IV. Debt>90



B. Private External Debt (Not enough observations)



Notes: Orthogonalized impulse response functions of income growth to a shock in external debt computed from estimated PVAR (Eq. (1)) for the complete sample and over income categories of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.