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Public debt and economic growth in Latin America: A recap*

Deuda pública y crecimiento económico en América Latina: Una recapitulación

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Abstract: In this paper, we examine the effect of public debt on Gross Domestic Product (GDP) in 15 Latin American economies for fifty years. The short-run impact of debt on GDP growth is positive, but it is closer to zero beyond public debt-to-GDP ratios between 64 and 71% (i.e. up to this threshold, additional debt has a stimulating impact on growth). In the long-run, the threshold is between 95% and 97%.

Keywords: Debt, growth
JEL Codes: H63, O40

Resumen: En este trabajo examinamos el efecto de la deuda pública sobre el Producto Interno Bruto (PIB) en 15 economías latinoamericanas durante cincuenta años. El impacto a corto plazo de la deuda sobre el crecimiento del PIB es positivo, pero está más próximo a cero para ratios deuda pública/PIB situados entre 64 y 71% (es decir, hasta este umbral, la deuda adicional tiene un impacto estimulante sobre el crecimiento). A largo plazo, el umbral se ubicaría entre 95% y 97%.

Palabras clave: Deuda, crecimiento
Códigos JEL: H63, O40

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1. Introduction

The cornerstone of the relationship between public debt and Gross Domestic Product (GDP) is the conventional opinion that in the short-run GDP is determined by demand and government debt can effectively have a positive effect on it (Elmendorf and Mankiw, 1999). This short-run effect turns out to be significant when output is far from capacity. However, in the long-run public debt may displace (crowds out) investment and harm growth by raising interest rates (Baldacci and Kumar, 2010).

The empirical literature analyzing whether or not public debt is growth-enhancing have experimented a revival in the euro area (Baum et al., 2013; Dreger and Reimers, 2013; Checherita-Westpal et al., 2012). According to Gómez and Sosvilla (2015), this interest has been fueled by the substantial wakening of public finances in different economies as a result of the 2008 financial crisis. The crisis has also revitalized arguments signaling whether or not policymakers should implement expansionary fiscal policies. On the one hand, fiscal austerity may have been the main culprit for the unnecessary recessions experienced by some countries (Berg and Ostry, 2011; DeLong and Summers, 2012). On the other hand, a high level of public sector leverage has a negative effect on economic growth, and fiscal consolidation is fundamental to improve expectations about the future evolution of the economy (Cochrane, 2011; Teles and Mussolini, 2014).

As to Latin America, the issue on debt-growth nexus is particularly relevant for the region where public debt almost doubled its volume from the 1970s onwards without a clear effect on GDP. It is important to note that diverse political points of view related to the debt burden and sovereign past debt crisis have also stimulated an intense discussion on the effectiveness of fiscal policies as well as the possible adverse consequences of public debt accumulation. Despite the relevance of this debate, to our

knowledge no effort has yet been made to empirically analyze the effect of debt on economic growth in Latin America solely[3].

In this study, we focus on the relationship between gross public debt and GDP for fifty years in a group of 15 Latin American countries, namely Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. In contrast to the existing literature, we focus our attention exclusively on a less heterogeneous sample and we also extend the period of analysis to half a century. Another novelty is the introduction of an institutional variable during the whole period to test the impact of Latin American democratic governments on the relationship in the short and in the long-run.

The rest of the paper is organized as follows. In section 2 we provide an overview of the empirical literature on the effect of debt on GDP. In section 3 we estimate a direct relationship between gross public debt and growth using a simple approach. In section 4, we conclude.

2. Literature overview

The empirical literature on debt-growth link has been relatively scarce, but it has gained significance over the years. Despite the scarcity of studies, two important issues must be highlighted. The first one is that the existing literature mainly focuses on the direct effect of debt on growth, rather than on the channels of this effect. The second one is that the results are far from being convincing, as we shall briefly summarize.

In a seminal study, Reinhart and Rogoff (2010) show that public debt as a share of GDP may have a detrimental effect on the rate of growth. They find that the relationship

[3] Hardly any empirical studies have exclusively examined the topic for the region. Most of the documents on debt-to-growth nexus include some Latin American countries in a heterogeneous set of economies and they frequently do so for a short period of time. The exception to this rule is the previous work of Jacobo and Jalile (2017). However, their analysis is not extended to the long-run.

between public debt and growth can be represented by an inverted U-shaped pattern (i.e. whilst low levels of public debt positively affect economic growth, high levels have a negative impact). They use a dataset of 44 countries over 200 years and suggest a weak relationship for public debt ratios below 90% of GDP, but the growth rates decrease substantially above this threshold[4].

Since Reinhart and Rogoff's influential paper there have been several empirical studies trying to identify and to explain the negative nonlinear relationship between public debt and growth. Most of these studies tends to confirm a turning point beyond which economic growth slows down.

In fact, covering a mix of advanced and emerging market economies for almost four decades, Kumar and Woo (2010) finds a turning point at 90% of debt-to-GDP ratio. Their empirical results suggest an inverse relationship between initial debt and subsequent growth after controlling for other determinants. On average, a 10-percentage point increase in the initial debt-to-GDP ratio is associated with a slowdown in annual real per capita GDP growth of around 0.2 percentage points per year (with the impact being somewhat smaller in advanced economies).

Along this line, Cecchetti et al. (2011) estimate a threshold of 85 percent of debt-to-GDP ratio for a panel of 18 OECD countries beyond which government debt is harmful for growth, while Checherita and Rother (2012) report analogous results for a set of euro area countries over a period of 40 years. Likewise, Baum et al. (2013) focus on 12-euro area countries for the period 1990-2010 and detect a similar threshold by employing a dynamic approach (the short-run impact of debt on per capita GDP growth is positive but it decreases to zero beyond ratios of 67%, and for ratios above 95% additional debt has a negative impact).

[4] In a previous attempt, Schclarek (2005) does not find any support for an inverted-U shape relationship between debt and growth for industrial economies. As to developing countries, he finds that lower total external debt levels are associated with higher growth rates.

However, Caner et al. (2010) and Elmeskov and Sutherland (2012) show that the turning point is probably lower (77% for a set of 77 countries, and 66% for a dozen of OECD countries, respectively). Similarly, Panizza and Presbitero (2012) argue that a negative correlation between debt and growth does not imply causality, as lower growth can result in a higher public debt to GDP ratio. Nevertheless, the results are consistent with the existing literature that has found a negative correlation between debt and growth.

In an additional effort to improve previous studies, Dreger and Reimers (2013) base their analysis on the distinction between sustainable and non-sustainable debt periods. Their thresholds are theory-based and depend on the macroeconomic framework. They conduct the analysis using annual data for 12-euro area members and find that the negative impact of the debt-to-GDP ratio on growth is limited to periods of non-sustainable public debt.

In an interesting study that covers the period 1970-2010, Calderón and Fuentes (2013) test whether public debt hinders growth and explore if economic policy ameliorates this effect. Their results reveal a negative and robust effect of public debt on growth. Among other findings, an enhanced policy environment and its interaction with public debt has helped explain the improved growth performance of industrial and developing countries for the years 2001–05 compared to the years 1991–95.

These preceding studies are somewhat unified and extended by Antonakakis (2014) who explores the role of theory-driven (non-)sustainable debt-ratios in combination with debt-ratio thresholds on economic growth. Based on both dynamic and non-dynamic panel data analyses in the 12-euro area countries over the period 1970-2013, he finds that non-sustainable debt-ratios above and below the 60% threshold have a detrimental effect on short-run economic growth, while sustainable debt ratios below the 90% threshold exert a positive influence on short-run economic growth. In the long-

run, both non-sustainable and sustainable debt-ratios above the 90% threshold as well as non-sustainable debt-ratios below the 60% compromise economic growth.

However, no single threshold seems to be right for all countries or at all times. Using total public debt data from 118 developing, emerging and advanced economies over the period 1960 to 2012, Eberhardt and Presbitero (2015) argue that there is no evidence for a common debt threshold for all countries over time. They find that long-run debt coefficients differ across countries and provide evidence that countries with higher average debt-to-GDP ratios are more likely to see a negative effect on their long-run growth performance.

Moreover, Égert (2015) also presents evidence suggesting that 90% is not a magic number because the threshold may be lower and the nonlinearity may change across different samples and specifications. The author shows that finding a negative nonlinear relationship between the public debt-to-GDP ratio and economic growth is extremely difficult and sensitive to modelling choices and data coverage. In the very rare cases when nonlinearity *à la* Reinhart and Rogoff can be detected the negative correlation kicks in at very low levels of public debt (between 20% and 60% of GDP).

The latest analysis on debt-to-growth relationship for the EU is the study of Gómez and Sosvilla (2015) who examine the causal effect between debt and growth in a sample of eleven European countries using time series. The authors find that public debt has a negative effect on growth from an endogenously detected breakpoint and above a threshold varying between 56% and 103% according to the country.

3. Estimation and Results

Following Baum et al. (2012) and Checherita et al. (2012), we firstly analyze the impact of one-year lagged debt-to-GDP ratios on annual real GDP per capita growth rates and we obtain a near of the short-term debt effect. Hence, a positive impact of debt on growth could be interpreted as a stimulating effect of additional debt. Secondly,

we consider the long-term effects of debt on the GDP. Our empirical growth model is based on a conditional convergence equation that relates the GDP per capita growth rate to the initial level of income per capita, the investment/saving-to-GDP rate and the population growth rate. The model is augmented to include the level of gross government debt (as a share of GDP).

Our set of countries covers Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. This is a less heterogeneous sample in the sense that we only consider developing economies from Latin America, but we do not pretend the countries to be alike. As in most of the studies, our selection does not solve problems derived from things that can be different from each other.

We use a quadratic equation in debt since we are interested in checking whether there exists a non-linear impact of government debt on growth. Other control variables include: (i) variables measuring the economic openness; (ii) a variable signaling the existence of democratic governments; and (iii) policy environment variables.

For the economic openness variables (i) we use the real exchange rate and the sum of export and import shares in GDP to expand the model beyond a closed-economy form. As to the democratic government indicator (ii), we test the impact of the presence of democratic governments on growth[5]. We turn to the common claim that the lack of democracy becomes a particularly powerful constraint on economic growth for countries with low levels of development (Aghion et al., 2008). The last group of variables (iii) involves price stability and we measured it as inflation rate[6].

The basic equation for our estimation is as follows:

[5] We follow Loayza, Fajnzylber, and Calderón (2005).

[6] We also consider country-fixed effects to control for the country-specific characteristics. The country dummies capture economic and social features that remain unchanged over time. In addition, we also include year dummies to control for common shocks across countries.

$$g_{i,t} = \alpha + \beta_1 debt_{i,t-1} + \beta_2 debt_{i,t-1}^2 + \varphi gdppc_{i,t-1} + \gamma gfk_{i,t-1} + \delta pop_{i,t-1} + \kappa\,(other\_controls) + \mu_t + \upsilon_t + \varepsilon_{i,t}$$

where $g_{i,t}$ is the growth rate of GDP per capita; $debt_{i,t}$ is gross government debt as a share of GDP; $gdppc_{i,t}$ is the initial level of GDP per capita; $gfk_{i,t}$ is investment rate proxied as gross fixed capital formation) as a share to GDP; $pop_{i,t}$ is population growth rate; *other_controls* include real exchange rate, economic openness, democratic government indicator and inflation rate; μ_t is country fixed effects; υ_t is time fixed effects; and $\varepsilon_{i,t}$ is the error term.

The series for our estimation comes from the *World Development Indicators* and the *International Financial Statistics* databases and cover the period 1960-2015.[7] As to democratic government indicator, there is no fully satisfactory measure of the regime type (Munck and Verkuilen, 2002), and the options are considerably reduced when one requires a measure for a large sample of countries over a long period of time. A measure with broad historical coverage is the "Polity2" variable from the *Polity IV Dataset* (Marshall and Jaggers, 2000). This variable measures the extent to which democratic or authoritarian government ("authority patterns") are institutionalized in a given country. It takes into account how the executive is selected, the degree of checks on executive power, and the form of political competition.

In our baseline model, we evaluate the short-term effects of public indebtedness on economic growth, so the dependent variable is the growth rate of the GDP per capita of the same year. In our subsequent models, to analyze the impact of long-term effects of public indebtedness we have considered as dependent variable the 5-year cumulative overlapping growth rate.

[7] The availability and reliability of some variables for different countries restrict our analysis to 2015.

The basic estimation technique is panel fixed-effects corrected for heteroskedasticity and autocorrelation. The results across various models are presented in Table 1. Given the strong potential for endogeneity of the debt variable, especially reverse causation (low or negative growth rates of per-capita GDP are likely to induce higher debt burdens), we use various instrumental variable estimation techniques (the results are also presented in Table 1).[8]

Table 1

Variables	Annual growth rates				Cumulative 5-year overlapping growth rate			
	Model (1)	Model (2)	Model (3)	Model (4)	Model (6)	Model (7)	Model (8)	Model (9)
ln(gdppc)	*-5.884****	*-6.463****	*-5.148****	*-5.703****	*-42.65****	*-44.22****	*-42.68****	*-43.89****
	(1.747)	(1.819)	(1.771)	-1.838	(4.514)	(4.544)	(4.597)	(4.598)
debt	*0.115****	*0.117****	*0.116****	*0.124****	*0.187***	*0.216***	*0.190***	*0.218***
	(0.0351)	(0.0369)	(0.0348)	(0.037)	(0.0882)	(0.0921)	(0.0873)	(0.0915)
debt²	*-0.000811****	*-0.0008203****	*-0.000828****	*-0.000865****	*-0.000980***	*-0.00111***	*-0.000996***	*-0.00113***
	(0.000196)	(0.000205)	(0.000196)	-0.0002061	(0.000480)	(0.000497)	(0.000477)	(0.000497)
openness	*-0.0103*	*-0.0088*	*-0.0120*	*-0.0134*	*-0.0393*	*-0.0457*	*-0.0388*	*-0.0479*
	(0.0147)	(0.01495)	(0.0146)	(0.0149)	(0.0359)	(0.0359)	(0.0360)	(0.0360)
gfkf	*-0.262****	*-0.2408****	*-0.259****	*-0.237****	*-0.701****	*-0.696****	*-0.702****	*-0.693****
	(0.0544)	(0.0555)	(0.0541)	(0.0553)	(0.128)	(0.128)	(0.128)	(0.128)
Pop	*-0.927*	*-0.796*	*-1.175*	*-1.101*	*0.999*	*1.187*	*0.983*	*1.092*
	(0.842)	(0.8534)	(0.850)	(0.864)	(2.040)	(2.033)	(2.057)	(2.050)
inflation	*-0.0469***	*-0.0454***	*-0.0368**	*-0.0337**	*-0.231****	*-0.241****	*-0.233****	*-0.235****
	(0.0214)	(0.0222)	(0.0215)	(0.0223)	(0.0518)	(0.0523)	(0.0526)	(0.0527)
polity2			*0.102***	*0.130***			*-0.00794*	*0.0635*
			(0.0451)	(0.049)			(0.109)	(0.115)
real exchange rate		*-0.00019*		*-0.00033***		*-0.000902***		*-0.000965***
		(0.00017)		(0.00017)		(0.000424)		(0.000446)
Cons	*64.37****	*64.37****	*56.59****	*60.46****	*419.9****	*433.9****	*420.3****	*430.2****
	(15.89)	(15.89)	(16.20)	(16.77)	(40.75)	(41.03)	(41.74)	(41.73)
Observations	*463*	*463*	*448*	*448*	*425*	*425*	*425*	*425*
Debt TP	*70.900*	*71.315*	*70.048*	*71.676*	*95.408*	*97.297*	*95.382*	*96.460*
Country FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1								

As stated in Hiebert et al. (2002), in a panel context many studies on growth regressions have made use of the instrumental variable (IV) approach to deal with the

[8] Data on correlation among control variables as well as robustness check tests can be requested to the authors.

issue of simultaneity bias. The estimators used in our paper General Methods of Moment (GMM) estimators. With the GMM estimator we also correct for the possible heteroskedasticity and autocorrelation in the error structure by using the consistent estimator. The two-step GMM provides some efficiency gains over the traditional IV/2-SLS estimator derived from the use of the optimal weighting matrix, the overidentifying restrictions of the model, and the relaxation of the independent and identical distribution (i.i.d.) assumption (see Baum et al., 2007).

We have also estimated the confidence intervals for each model turning point. Since the turning point is a non-linear combination (the ratio) of two estimated coefficients (debt and debt squared) the normal distribution 95% confidence intervals (CI) estimated for each coefficient cannot be used to compute the CI for the turning point. Consequently, we use the delta method to assess the statistical uncertainty surrounding the turning point estimates. This method is commonly applied to compute the standard error of non-linear functions for which it is difficult to analytically compute the variance (Vance, 2006).

The delta method basically expands a function of random variables (e.g., the ratio) about its mean using (usually a one-step) Taylor approximation, and then computes the variance. Its accuracy depends on the degree of linearity of the derivative function at the evaluation point (Vance, 2006), i.e., it is a good Taylor approximation when the random variable has a high probability of being close enough to its mean. Therefore, the delta method assumes that the coefficients in the model are normally distributed, being influenced by the sample size (Hole, 2007).

The results across all models show a highly statistically significant non-linear relationship between the government debt ratio and the per-capita GDP growth rate for Latin American countries in the sample. The debt-to-GDP turning point of this concave relationship (inverted U-shape) is roughly between 64% and 71% for the sample across

all models in the short-run. In the case of the long-run specification we have found a higher debt threshold between 95% and 97%.

As to openness indicators, we do not find any relevant influence of the real exchange rate in the debt-to-growth relationship. This result is consistent with our expectations.

Regarding to the open economy variables, the evidence in the literature is quite favorable to the short-run contractionary devaluations hypothesis. The evidence also suggests that in the long-run real devaluations will have no effect on output (Edwards, 1985)[9]. Thus, in a region with a long history of sudden and large currency devaluations, we in fact expect a negative effect of real exchange rate in the short-run disregarding its value and a nearly null one in the long-run.

Additionally, the relationship between openness and economic growth has long been a subject of much interest and controversy in the international trade literature. Chang, Kaltani, Loayza (2005) point out that openness promotes the efficient allocation of resources and growth through comparative advantage, allows the dissemination of knowledge and technological progress and encourages competition in domestic and international markets[10]. However, some economists take the opposite position and argue that the effect of openness on growth is doubtful (Krugman, 1994; Rodrik and Rodríguez, 2001).

These controversial theoretical findings also appear in the empirical literature. For example, Yanikkaya (2003) goes as far as to show that openness may actually not be good for growth. This author shows that trade barriers are positively and significantly associated with growth, especially for developing countries. At this point, we assume that if a country depends on economic conditions existing in other countries, its economic situation will be highly exposed to external shocks both in the short and in the

[9] This is not surprisingly because there are several theoretical reasons why a devaluation can produce a decline in real activity. See also Krugman and Taylor (1978) and Diaz-Alejandro (1965).
[10] See also Winters (2004) and Easterly and Kraay (2000) among others.

long-run. This situation possibly leads to an erratic behavior of GDP in the country in question. Likewise, a high dependence on imports is likely to lead to a high degree of exposure to economic conditions in the rest of the world. Besides, protectionism has been a classical feature in Latin American countries since their independence with a doubtful effect on growth. Under these assumptions, we do not expect any sign in the coefficient.

Finally, the institutional variable is also statistically significant and it tends to highlight importance of democratic governments on economic growth rates in the short-run. However, in the long-run it is not the nature of a country's political system what determines the course of its economic growth.

4. Concluding remarks

We investigate the impact of government debt on GDP in 15 Latin American economies, namely Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela for a period of fifty years.

Our study finds a highly statistically significant non-linear relationship between the government debt ratio and the per-capita GDP growth rate for Latin American countries in our sample. The debt-to-GDP turning point of this concave relationship (inverted U-shape) is roughly between 64 and 71% on average for the sample in the short-run, across all models. This means that, on average for the Latin American countries, government debt to-GDP ratios above this threshold would have a negative effect on economic growth (i.e. up to this threshold, additional debt has a stimulating impact on growth). In the long-run, this threshold is between 95% and 97%.

As to openness indicators, we do not find any relevant influence of the real exchange rate in the debt-to-growth relationship. With regards to the institutional variable we have selected, it shows the expected sign and countries with democratic governments

tend to exhibit higher growth rates in the short-run relationship between debt and growth. However, it seems not to be the nature of a country's political system what determines the path of this relationship in the long-run.

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