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Abstract^{*}

The growth prospects of a nation are stymied by the burden of government debt. This study has two goals: first, it tests whether public debt hinders growth; and, second, it explores whether economic policy ameliorates this effect. A large panel data of countries for 1970–2010 reveal a negative and robust effect of public debt on growth. Strong institutions, high quality domestic policies, and outward-oriented policies partly mitigate this adverse effect. 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. Viewing the actual performance of the Latin America and the Caribbean region, South America encompasses the group of countries more benefited by improvement of economic policies, while Central America and the Caribbean lag considerably. A simultaneous sharp reduction in public debt and an improvement in the policy environment induce an increase in the growth rate per capita of 1.7 percentage points for the Caribbean and 2 percentage points for South America. A more conservative scenario that considers an upgrade in quality of policies and a reduction of public debt leads to lower but still significant growth benefits for the Caribbean and South America, by 0.85 and 1.5 percentage points, respectively.

JEL Codes: O11, O47

Keywords: Public debt, policy environment, growth

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1. Introduction

The recent global financial crisis triggered a series of orthodox, unconventional monetary and fiscal policies that led to a sharp increase in the sovereign debt of advanced countries. The massive debt build-up reignited the debate about fiscal sustainability and the impact of the accumulation of government liabilities on financial markets and on real economic performance. Poor economic performance, referring to low growth and low productivity, reduces a country's capacity to pay and aggravates the fiscal sustainability problem, raising the expectation of a severe fiscal adjustment.

It has been argued that public debt can stimulate aggregate demand and have a positive growth effect in the short run. Public debt, however, crowds out private investment and deteriorates economic performance in the long run (Elmendorf and Mankiw, 1999). By raising long-term interest rates, higher public debt can crowd out investment (Modigliani, 1961, Gale and Orszag, 2003; Baldacci and Kumar, 2010). This is not the only channel through which a fiscal debt burden may affect long-run growth. Deterioration of the fiscal balance in the presence of high public debt stocks is detrimental for growth, even though a deficit helps to finance public capital (Adam and Bevan, 2005, Saint-Paul, 1992 and Aizenman, Kletzer, and Pinto, 2007). Generally, it is argued that a higher stock of public debt will induce future distortionary taxation, or higher inflation, to pay the debt, which reduces future potential growth. Thus, high public debt reduces the ability to implement countercyclical fiscal policies, resulting in higher volatility and lower growth (Aghion and Kharroubi, 2007; Woo, 2009). A sovereign debt crisis can affect growth to the extent that it triggers banking or currency crises (Burnside, Eichenbaum, and Rebelo, 2001; Hemming, Kell, and Schimmelpfennig, 2003).

This paper's goal is to empirically investigate the relationship between public debt and growth, and to explore alternative channels to those proposed in the existing literature. First, the paper examines the direct effect of public debt on growth through its impact on the steady state of output per capita. Next, the study considers a more promising channel: the ability of good policy environments to cushion the adverse growth effects of public debt accumulation.

The underlying theoretical framework employed here is the neoclassical model, where policy variables have level effects in the long run and growth effects during the transition. The impact of debt burden on the steady state equilibrium of the economy is called the direct effect. In this model, structural reforms aimed at deepening the domestic financial market increase the growth rate of the economy during the transition. Levine (2005) argued that more developed financial markets boost economic growth by improving the savings–investment allocation. Another potential role for financial markets is to mitigate the adverse effect of public debt on growth. The government would need to finance the debt and this could be done through higher taxes or issuing new debt. Thus, deeper financial markets existing at the beginning of the period in question could smooth the fiscal adjustment due to refinancing public debt.

Financial openness is another policy determinant of growth (Alfaro et al., 2004; Bonfiglioli, 2008; Kose, Prasad and Terrones, 2009; Calderon and Fuentes, 2012). Rising international financial integration provides additional funding for investment at a lower interest rate and attracts foreign direct investment, which seems beneficial for growth (Borensztein, De Gregorio, and Lee, 1998). As with deeper domestic financial markets, enhanced access to world capital markets, signaled by greater financial openness, helps governments to adjust when refinancing debt.

This paper uses a comprehensive long-time series dataset on public debt, or, gross government debt to GDP ratio, compiled by Abbas et al. (2010). These data are merged with a panel dataset of 136 countries organized in five-year non-overlapping observations during 1970–2010—with each country having at most eight time series observations. This analysis of the effects of fiscal debt on growth and volatility focuses on Latin America. The study uses a worldwide sample of 136 countries for more accurate estimates of the parameters associated with growth determinants, and for understanding the extent of the interaction between different economic policies and structural factors. Table A1 summarizes descriptive statistics by regions in the sample.

The sample of Latin American countries studied comprises 22 nations. Of those 22, seven are located in Central America—Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama—five are in the Caribbean—The Bahamas, Dominican Republic, Haiti, Jamaica, and Trinidad and Tobago, and ten are in South America—

Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela.

Once the growth regression analysis is completed, the study focuses on the growth performance of Latin American economies. One advantage of accounting for policy complementarities in the regression framework is that sensitivity of growth to economic policies or specific reform depends on a specific set of structural characteristics, or other policies, of the country. Assessing the impact of fiscal debt on growth in any country depends on the level of other policies or structural factors in that country. Overall, this exercise generates growth responses to changes in policy and structural variables that vary for different countries, and it allows for identification of the constraints upon growth in a specific country.

The study revealed a negative and robust relationship between economic growth and the ratio of public debt to GDP; however, this relationship is non-monotonic. The adverse impact of public debt on growth is ameliorated by the quality of institutions, domestic policies, and outward-oriented policies.

Assessment of factors of growth performance in 2001–05 compared to 1991–95 shows that the increase in the growth rate of real GDP per capita for industrial and developing countries was mainly driven by improvement in the policy environment and by public debt reduction. Within the Latin America and the Caribbean (LAC) region, performance of the seven largest economies, or LAC-7—Argentina, Brazil, Chile, Colombia, Peru, Venezuela, and Mexico—was most benefited by improvements in policy environment and debt profile. The opposite was true for Central America and the Caribbean.

Finally, the study contains forecasting exercises for 2011–20 that project evolution of the policy environment and public debt according to their historical trends. It turned out that there are large potential gains from sound policy management and enhanced debt profile for South America and Central America, with the growth rate being approximately 1.5 percentage points higher than in the previous decade, 2001–10. The effect is modest for the Caribbean economies because there is modest improvement in these factors, assuming they follow their historical trends.

The paper continues as follows. In Section 2 there is a summary of the empirical literature on the relationship between growth and public debt, and a description of the data and estimation methodology. Section 3 presents a first glance at the data, looking at growth rate, level of GDP, and aggregate volatility across the distribution of the debt to GDP ratio. Section 4 contains an empirical analysis of the relationship between public debt and growth, controlling for macroeconomic policies, structural factors, and volatility. Three indices of quality of policy are used: overall quality of policy environment, domestic policy environment, and outward-oriented policy environment. Use of these indices allows a determination of whether policy may cushion the effect of public debt on growth. In Section 5, the empirical model is employed. The effect of each economic factor is evaluated in explaining the change in the growth rate between 2001–05 and 1991–95. Section 5 also contains a forecasting exercise, which involves prediction of the growth rate for the next 10 years, assuming the quality of policy is improved and public debt is reduced. Section 6 concludes.

2. The Empirical Approach

This section reviews the empirical literature on the relationship between public debt and growth. Later, it describes the data to be used in the empirical assessment of that relationship.

2.1 Taking Stock of the Empirical Literature

The goal of this paper is to revisit the relationship between government debt and growth using panel data of countries. Most of the literature focuses on the direct effect of debt on growth, and fails to account for some of the channels explored here. Schclarek (2004) failed to find robust evidence of a relationship between public debt and growth in a sample of 24 industrial countries with averaged data over seven five-year periods between 1970 and 2002. Kumar and Woo (2010) estimated the impact of high initial debt on subsequent growth for a panel of advanced and emerging market economies in 1970–2007. Their findings suggested the existence of an inverse relationship between initial debt and subsequent growth, which is larger for emerging economies.

Reinhart and Rogoff (2010) examined growth and inflation at different levels of government debt in advanced and emerging markets. Their correlation analysis revealed that the median GDP growth among industrial countries with low debt, or <30 percent of GDP, is 2.6 percentage points higher than that of industrial countries with high debt, or >90 percent of GDP. The differential in median growth between emerging markets with low and high debt is smaller, as it is 2.1 percentage points. The authors suggested that there is a non-linear relationship between public debt and growth.

The existence of a non-linear relationship between public debt and growth was also found by Checherita and Rother (2010) for a sample of 12 Euro area countries in 1970-2009. There is an inverted U-shape relationship between them, with a turning point at around 90-100 percent of GDP. Hence, higher public debt-to-GDP ratio is related to lower economic growth at debt levels above the range of 90–100 percent of GDP. The statistical confidence, however, may go as low as 70 percent of GDP. Hence, for many countries, current debt levels may already have a detrimental impact on GDP growth. The channels of transmission through which public debt is likely to have an adverse impact on growth appear to be private saving, public investment, total factor productivity, and sovereign long-term nominal and real interest rates.

Further, evidence that long-term growth is severely affected when the debt ratio exceeds certain thresholds was provided by Cecchetti, Mohanty, and Zampolli (2011). The authors examined the impact of debt on growth using a new dataset on debt levels in 18 OECD countries from 1980 to 2010, based primarily on flow of funds data. The data allowed analysis of the impact of household, non-financial corporate, and government debt, separately. Their findings showed that, beyond a certain level, debt is bad for growth. For government debt, the number is about 85 percent of GDP. For corporate debt, the threshold is closer to 90 percent. For household debt, there is a threshold of around 85 percent of GDP, although the impact has been imprecisely estimated. For government debt, their findings have the immediate implication that highly indebted governments should aim toward stabilizing their debt and at reducing it to levels that are sufficiently low not to retard growth. Prudence dictates that governments should also aim to keep their debt well below the estimated thresholds so that even extraordinary events will be unlikely to push their debt to levels that become damaging to growth.

2.2 Data Description

The current study is related to the empirical literature reviewed here, but it differs in the way nonlinearities are viewed. It is expected that nonlinearities will be associated with the interaction between public debt and economic policies or reforms. The study starts with a canonical growth regression that considers the following determinants (see Loayza, Fajnzylber, and Calderon, 2005):

- Transitional convergence (initial GDP)
- Structural factors (human capital, financial development, governance)
- Policy environment (government burden, public debt, price instability, trade, and financial openness)

The first set of regressions analyzes nonlinearities in the growth–public debt relationship, controlling for the level of development. The next part of the analysis examines whether the quality of policy could ameliorate the effect of public debt on growth. A model is estimated in which the independent variables are the same as above, but the policy environment includes interactions between the levels of government debt and the measures of volatility, financial openness, and the private credit market.

In this estimation, real GDP per capita, in logs, was controlled for at the beginning of the period. This is the transitional convergence control that, according to the neoclassical model, should take place across countries. Hence, a negative and significant coefficient for the initial output per capita provides evidence of traditional convergence.

Following Loayza, Fajnzylber, and Calderon (2005), a set of structural factors such as human capital, financial development, and governance that enhance long-run growth was considered. Human capital enters as a reproducible factor in the production function that augments growth. It also enhances the ability of nations to create or adapt to new technologies (Acemoglu and Zilibotti, 2001). This variable is approximated by the initial gross rate of secondary schooling, in logs, and the data was obtained from Barro and Lee (2001).

Financial development encourages growth by improving investment savings allocation and promoting innovation activities (Levine, 2005; Bittencourt, 2010). The initial private credit-to-GDP ratio of each period is the measure of financial development used.

The data was gathered from Beck, Demirguc-Kunt and Levine (2000) and updated using data from the IMF's International Financial Statistics (IFS) and the World Bank's World Development Indicators (WDI).

Governance includes several institutional aspects that may hurt growth, affecting the efficiency of investment (North, 1990). These elements include rule of law, absence of corruption, and democratic accountability, among others, and they create an environment favoring investment, entrepreneurship, and growth. The proxy of governance is the index of political risk published in the International Risk Country Guide (ICRG) by the Political Risk Services (PRS) Group.

Policy environment involves domestic policies and outward-oriented policies. The former group involves price stability, measured as inflation rate over one plus the inflation rate, and distortionary taxation and fiscal discipline, that is here approximated by overall government balance-to-GDP ratio. There is no large dataset, such as cross-country and time series, on the level of distortionary taxation; this is why overall fiscal budget has been used to capture that effect.

The outward-oriented policy environment index comprises trade and financial openness. The former is measured as total exports plus total imports over GDP. The latter is proxy by equity liability over GDP from Lane and Milesi-Ferretti (2001, 2007).

Defining volatility is no trivial task. Empirically, aggregate volatility is measured by the standard deviation of growth in real GDP per capita. It is also important, however, to measure policy volatility and external volatility. The former is measured by the volatility of discretionary fiscal policy, following the methodology outlined in Fatás and Mihov (2006). For the latter, the following items are considered: (a) terms of trade volatility, measured as the standard deviation of annual terms of trade changes, (b) external demand volatility as the standard deviation of the GDP growth rate of main trading partners weighted by their bilateral trade with the domestic country, and (c) world real interest rate volatility captured by the standard deviation of the real interest rate of the base country, following the classification in Di Giovanni and Shambaugh (2007).

The database collects a panel dataset of 136 countries organized in five-year non-overlapping observations between 1970 and 2010. Appendix I presents all data sources.

The estimation technique is the GMM-system estimator that combines the regression in differences and in levels (Arellano and Bover, 1995; Blundell and Bond, 1998).

3. A First Glimpse of the Data

Before undertaking the econometric analysis of the effects of public debt on growth around the world, the coherence between these two variables is reviewed. Table 1 shows the growth rates across the distribution of the public debt-to-GDP ratio. The first quartile is the 25th percentile of the distribution of public debt as percentage of GDP across countries, from low to high indebtedness. The average and the median growth rate in each quartile decrease as the government accumulates debt obligations. For instance, the average growth rate is 1 percentage point higher for countries in the first quartile, or 2.34 percent, compared to the countries in the fourth quartile, 1.31 percent. This is true for developing economies and industrial countries.

When the same exercise is conducted using the level of real GDP per capita, there are differences in the average and the median of GDP per capita, but the last quartile makes the difference; there is no monotonic relationship. But looking at the group of industrial countries, the wealthier countries exhibited larger public debt-to-GDP ratio, while in developing countries the relationship is the other way around; that is, the poorest country's government holds a larger level of debt as a percentage of its GDP. This effect is stronger than the previous one for industrial countries. It explains why there is no monotonic relationship between income per capita and the public debt-to-GDP ratio.

Table 1. Basic Statistics across Different Levels of Public Debt*Sample: 136 countries, 1970-2010 (5-year period observations)*

	Moments across quartiles of the distribution of public debt (from low to high indebtedness)							
	Averages across quartiles				Median across quartiles			
	I	II	III	IV	I	II	III	IV
<i>Growth in GDP per capita</i>								
All countries	2.34	1.86	1.82	1.31	2.30	2.06	1.79	1.56
Industrial countries	3.27	2.16	1.89	1.99	3.18	2.17	1.72	1.85
Developing countries	2.09	1.77	1.72	1.18	2.03	2.03	1.81	1.47
<i>Real GDP per capita (in logs)</i>								
All countries	7.79	7.84	7.91	7.08	7.84	7.81	8.03	6.61
Industrial countries	9.36	9.65	9.71	9.82	9.47	9.71	9.69	9.88
Developing countries	7.40	7.38	7.02	6.60	7.47	7.42	6.95	6.30
<i>Aggregate volatility (in logs)</i>								
All countries	1.02	0.96	0.74	0.81	0.93	0.96	0.76	0.86
Industrial countries	0.63	0.59	0.43	0.32	0.67	0.55	0.46	0.39
Developing countries	1.12	1.07	0.88	0.88	1.04	1.12	0.97	0.91
<i>Private credit (% GDP)</i>								
All countries	38.28	43.44	52.70	35.22	28.70	30.23	33.62	23.03
Industrial countries	68.68	79.61	92.37	89.75	65.08	75.78	84.18	86.11
Developing countries	30.58	35.17	34.43	24.69	22.94	25.81	24.00	18.51
<i>Public debt (% GDP)</i>								
All countries	14.16	33.11	55.10	108.23	15.07	33.28	54.85	96.35
Industrial countries	15.43	36.27	53.93	86.56	16.49	37.20	55.15	76.10
Developing countries	13.89	32.36	55.92	113.96	14.62	32.80	54.89	100.02

Note: Sample quartiles are ordered from low to high debt. For instance, the first quartile (I) comprises all the country-periods with the lowest amount of debt as percentage of GDP whereas the fourth quartile (IV) has the largest amount.

Source: Authors' elaboration.

The relationship between public debt and aggregate volatility—measured as the standard of the growth rate of GDP—is not strong. Countries in the fourth quartile are less volatile on average. The measure of financial market development, or private credit as a percentage of GDP, is an inverted U across the distribution of public debt-to-GDP ratio. This is true for industrial and developing countries, though at different levels. Industrial countries have more developed financial markets than developing countries. Countries in the third quartile have on average the deepest financial market, while those in the first quartile have the lowest level of private credit-to-GDP ratio.

The last part of Table 1 shows the average and the median of the debt ratio in each quartile. There is a large difference between the first quartile, which is 14.2 percent, and the fourth quartile, which is 108.2 percent. The level of indebtedness is similar across quartiles between industrial and developing countries, except for the fourth quartile, where the average for developing countries is 114 percent, while for industrial countries it is 86.6

percent. Taken as a whole, this evidence suggests the possibility of nonlinearities in how debt interacts with other factors in affecting growth.

4. Empirical Analysis

This section presents the empirical assessment of the relationship between fiscal policy and growth. First, the study considers a baseline case where a regression using the control variables explained in Section 2 is estimated. The second step analyzes whether specific policies may amplify or mitigate the negative effect of debt on growth. The third step, following the idea of Burnside and Dollar (2000), constructs indices that measure the quality of domestic and outward policies. Following Calderon and Fuentes (2012), an investigation has been conducted into whether the quality of economic policies helps cushion adverse growth effects from higher public debt.

4.1 Baseline Regressions

This section presents the econometric results that serve as the starting point of the assessment of the relationship between public debt and growth. Table 2 exhibits different specifications for the growth equation, as in Calderon and Fuentes (2012). The first column shows that growth is positively associated with fiscal balance and adversely related to public debt. This result is in line with the literature that emphasizes the growth-enhancing effects of fiscal discipline and low levels of public debt (Kneller, Bleaney, and Gemmell, 1999; Gupta et al., 2005; Cecchetti, Mohanty, and Zampolli, 2011; Checherita and Rother, 2010; Reinhart and Rogoff, 2010). All of the typical growth determinants have the expected sign: there is evidence of convergence, that is, negative coefficient, for initial GDP per capita, which means that all of the structural and policy variables will affect growth in the transition to a different steady state. The growth determinants denoted as structural factors include: human capital and the quality of institutions. Private credit has a positive coefficient, but it is not statistically significant.

Low inflation and fiscal discipline have a positive effect on growth; however, the former is not statistically robust. The effect of macroeconomic stability on growth has been widely documented (Fisher, 1993; Easterly and Rebelo, 1993a, b; Calderon and Fuentes, 2012), but with many caveats regarding estimation methods and sample (Easterly, 2005).

Outward-oriented policies increase growth, and this result has been supported by empirical and theoretical literature (Edwards, 1992 and 1998; Dollar, 1992; Chang, Kaltani, and Loayza, 2009; Bonfiglioli, 2008; Kose, Prasad, and Terrones, 2009). Column 2 adds to this specification the aggregate volatility of the economy as measured by the standard deviation of the growth rate in real GDP per capita. The findings remain qualitatively invariant and, as expected, the measure of aggregate volatility has a negative association with economic growth. This latter finding is consistent with Ramey and Ramey (1995) and Hnatkovska and Loayza (2005), among others.

Columns 3 through 5 show different estimations of nonlinearities in the relationship between public debt and growth. Column 3 includes a quadratic term for the debt, showing that the negative effect on growth is increasing with the level of the debt. Columns 4 and 5 examine whether the growth response to higher public debt differs with the level of development. In Column 4, different coefficients of public debt for industrial and developing countries are estimated. Both coefficients are statistically significant at the 10 percent level, with that of developing countries being higher in absolute value. In sum, the adverse impact of public debt on growth is larger for developing than for industrial economies. The difference across groups in the sensitivity of growth to public debt is not, however, statistically significant. Column 5 reports the same conclusion, based on the positive sign of the coefficient of the interaction between public debt and initial GDP per capita. Using this coefficient allows a finding of a threshold for which the effect of debt on growth is negative. This threshold is a GDP per capita equal to 6,907. In the sample, 94 out of 136 countries had a GDP per capita smaller than that threshold in 2005; for the LAC region, 18 out of 22 economies were below that threshold.

Finally, Column 6 adds to regressions in Column 1 an additive dummy for countries in the LAC region, and it multiplies this dummy to our variable of interest, or public debt. The main goal of these regressions is to test whether LAC countries display different behavior from countries in the rest of the world, that is, whether there are systematic differences in terms of autonomous growth and the sensitivity of growth to changes in public debt. Our estimates show that the coefficients for the LAC region are not statistically

different from zero, and the behavior of the region fails to be different from that of the sample.¹

Table 2. Growth and Public Debt: Regression Analysis

Dependent variable: growth in real GDP per capita (annual average over 5-year period)

Sample: 136 countries, 1970–2010 (5-year period observations)

	[1]	[2]	[3]	[4]	[5]	[6]
<i>Transitional convergence</i>						
Initial real GDP per capita (in logs)	-2.2774 ** (0.685)	-1.6901 ** (0.639)	-1.9054 ** (0.613)	-2.3537 ** (0.765)	-5.0178 ** (1.255)	-2.4170 ** (0.679)
<i>Structural factors</i>						
Human capital (in logs)	1.7560 ** (0.763)	1.4326 * (0.744)	1.9887 ** (0.732)	1.7579 ** (0.766)	2.0164 ** (0.806)	1.8852 ** (0.798)
Private credit (% of GDP, logs)	0.6604 (0.648)	0.1848 (0.622)	-0.0553 (0.754)	0.6420 (0.649)	0.3027 (0.704)	0.7641 (0.602)
Institutions (in logs)	4.8034 ** (1.990)	3.3107 * (2.076)	6.1856 ** (2.025)	4.9299 ** (2.080)	5.9977 ** (2.625)	4.7773 * (2.475)
<i>Domestic policy environment</i>						
CPI inflation (in logs)	-1.1299 (0.826)	-1.1194 (0.896)	-0.2638 (0.789)	-1.2152 (0.845)	-1.0581 (1.050)	-1.2048 (0.951)
Fiscal balance (% of GDP)	0.2489 ** (0.064)	0.2019 ** (0.065)	0.1988 ** (0.054)	0.2536 ** (0.067)	0.2414 ** (0.061)	0.2405 ** (0.068)
<i>Outward policy environment</i>						
Trade openness (Trade as % of GDP, logs)	3.1238 ** (1.152)	3.1357 ** (1.252)	3.3743 ** (1.406)	3.2553 ** (1.142)	2.8408 ** (1.275)	3.3544 ** (1.220)
Financial openness (Equity liabilities as % GDP, logs)	0.9869 ** (0.471)	0.8284 * (0.442)	0.8611 * (0.469)	0.9396 * (0.484)	0.9234 * (0.481)	0.9390 * (0.508)
<i>Growth volatility</i>						
Std. dev. growth in real GDP per capita (in logs)	..	-1.1937 ** (0.522)	..	..	..	..
Government burden						
Public debt (% of GDP, logs)	-1.0557 ** (0.539)	-0.7661 (0.523)	5.5400 ** (2.341)	..	-6.1812 ** (2.207)	-0.6900 (0.520)
Public debt, squared (% of GDP, logs)	..	..	-0.7256 ** (0.283)	..	..	..
Public debt x initial real GDP per capita	..	..	..	..	0.6992 ** (0.275)	..
Public debt x dummy industrial Countries	..	..	..	-0.8828 * (0.556)	..	..
Public debt x dummy developing Countries	..	..	..	-0.9602 * (0.552)	..	..
Public debt x dummy LAC Countries	..	..	..	..	..	-1.8241 (2.080)
<i>Regional dummy</i>						
Latin America and the Caribbean (LAC)	..	..	..	..	..	6.7452 (7.857)
No. countries	739	737	739	739	739	737
No. observations	116	116	116	116	116	116
No. instruments	91	91	91	91	91	91
<i>Serial correlation tests (p-value)</i>						
AR(1)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	(0.270)	(0.516)	(0.681)	(0.232)	(0.238)	(0.267)
<i>Overidentifying restrictions (p-value)</i>						
Sargan Test	(0.424)	(0.499)	(0.563)	(0.487)	(0.360)	(0.313)
Hansen Test	(0.341)	(0.506)	(0.506)	(0.336)	(0.323)	(0.229)

Note: * (**) implies statistical significance at the 10 (5) percent level. All estimations include time dummies.

Source: Authors' elaboration.

¹ We were unable to conduct the dynamic panel data estimation for a sample of LAC countries due to insufficient degrees of freedom.

In summary, there is a negative association between public debt and economic growth, which was previously found in the literature (Cecchetti, Mohanty, and Zampolli, 2011; Checherita and Rother, 2010; Reinhart and Rogoff, 2010). The new result is that the negative effect is increasing with the level of debt and decreasing with the level of the country's development.

4.2 Do Structural Factors and Policies Help Cushion the Adverse Growth Effects of Public Debt Accumulation?

Table 3 contains an augmented growth regression analysis that includes the interaction between public debt and structural factors. Given that the structural factors and policy variables enter in the regression with coefficients of the same sign and magnitude as before, and that our interest is in the debt and growth relationship, the analysis concentrates on the latter issue.

The negative impact of public debt diminishes with the level of real GDP per capita (Column 1). The next three columns show that the adverse growth impact of public debt is mitigated in countries with deeper domestic credit markets, higher-quality institutions, and higher financial openness. One result of these regressions is that the threshold for having a negative effect of debt on growth is such that, in the case of financial openness, only one LAC economy is below the threshold, while for institutional quality, all LAC countries are below the threshold. This evidence suggests that quality of institutions is the critical variable for ameliorating the negative effect of public debt on growth.

Table 3. Growth, Public Debt, and Structural Factors

Dependent variable: growth in real GDP per capita (annual average over 5-year period)
Sample: 136 countries, 1970–2010 (5-year period observations)

	[1]	[2]	[3]	[4]	[5]
<i>Transitional convergence</i>					
Initial real GDP per capita (in logs)	-5.0178 ** (1.255)	-1.6744 ** (0.535)	-1.5360 ** (0.546)	-1.6274 ** (0.600)	-3.4491 (2.645)
<i>Structural factors</i>					
Human capital (in logs)	2.0164 ** (0.806)	1.7976 ** (0.785)	1.5629 ** (0.745)	2.1649 ** (0.891)	1.4341 (1.206)
Private credit (% of GDP, logs)	0.3027 (0.704)	-2.0442 * (1.144)	0.4254 (0.618)	0.0984 (0.550)	5.8884 (4.185)
Institutions (in logs)	5.9977 ** (2.625)	4.9567 ** (1.923)	1.9708 (2.266)	2.6752 (1.869)	-2.3803 (2.832)
<i>Domestic policy environment</i>					
CPI inflation (in logs)	-1.0581 (1.050)	-1.4847 * (0.838)	-1.9967 ** (0.944)	-2.6567 ** (1.354)	-3.1915 * (1.666)
Fiscal balance (% of GDP)	0.2414 ** (0.061)	0.1445 ** (0.053)	0.1528 ** (0.056)	0.2047 ** (0.078)	0.0964 (0.082)
<i>Outward policy environment</i>					
Trade openness (Trade as % of GDP, logs)	2.8408 ** (1.275)	2.2612 ** (1.141)	2.7387 ** (1.226)	2.8024 ** (0.920)	3.0559 ** (1.044)
Financial openness (Equity liabilities as % GDP, logs)	0.9234 * (0.481)	0.6999 * (0.389)	0.6628 * (0.424)	-2.4866 ** (1.100)	-1.3658 (1.562)
<i>Growth volatility</i>					
Std. dev. growth in real GDP per capita (in logs)	..	..	..	..	-1.4788 ** (0.316)
Government burden					
Public debt (% of GDP, logs)	-6.1812 ** (2.207)	-2.8753 ** (0.817)	-3.3208 ** (0.904)	-1.6888 ** (0.702)	-3.6506 (2.472)
Public debt x initial real GDP per capita	0.6992 ** (0.275)	..	..	..	0.777 (0.734)
Public debt x private credit	..	0.6276 ** (0.265)	..	..	-1.6179 (1.164)
Public debt x institutions	..	..	0.6283 ** (0.234)	..	0.5283 ** (0.180)
Public debt x financial openness	..	..	..	0.6478 -0.22558	0.270 (0.362)
<i>Period dummies</i>					
Period: 1966–70	6.3063 **	6.8527 **	7.0804 **	4.5882 **	4.5434 **
Period: 1971–75	5.8442 **	5.2671 **	5.4675 **	3.7088 **	2.8253 *
Period: 1976–80	5.1269 **	5.0160 **	5.3470 **	3.7240 **	2.8143 **
Period: 1981–85	3.1988 **	3.1382 **	3.4536 **	1.8779 **	1.0193
Period: 1986–90	3.1531 **	2.0660 **	1.9808 **	1.2640 **	0.0024
Period: 1991–95	2.3371 **	2.1330 **	2.2612 **	1.0219 *	0.4412
Period: 1996–2000	0.8495 *	1.0265 **	1.1141 **	0.4026	0.0203
Period: 2001–05	0.3228	0.7097 **	0.8140 **	0.2880	-0.3758
Constant	-0.2934	-8.4061	-4.3568	1.7946	21.0406 *
No. countries	739	739	739	739	737
No. observations	116	116	116	116	116
No. instruments	91	91	91	91	92
<i>Serial correlation tests (p-value)</i>					
AR(1)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	(0.238)	(0.650)	(0.583)	(0.162)	(0.184)
<i>Overidentifying restrictions (p-value)</i>					
Sargan test	(0.360)	(0.655)	(0.747)	(0.355)	(0.331)
Hansen test	(0.323)	(0.416)	(0.491)	(0.412)	(0.659)

Note: * (**) implies statistical significance at the 10 (5) percent level.

Source: Authors' elaboration.

When all the interactions are included (Column 5), the cushioning effect of financial openness and private credit disappears, while the level of development and the quality of institutions remains significant and still helps to mitigate the growth effect of rising debt. When a control for growth volatility is added, quality of institutions is the only variable that helps ameliorate the negative effect of debt on growth. The adverse effects of higher initial public debt on subsequent growth will be smaller in countries with high-quality institutions.

Does sound economic policy mitigate the negative effect of public debt on growth? To answer this question, the model includes as many policy variables as are available. To simplify this, in a more parsimonious model, the coefficients of one of the baseline regressions have been used, and an index of the quality of policies has been constructed, in the spirit of Burnside and Dollar (2000), to check whether the quality of policy could ameliorate the adverse effect of public debt on growth. A model has been estimated in which the independent variables are the same as above, but the policy environment has been replaced by these policy indices. The advantage of these indices is that they help to estimate a more parsimonious model, and they overcome problems of degrees of freedom or excess of moment conditions. These indices are constructed based on their contribution to growth, but their disadvantage is that they may change as the control variables change.

The overall policy environment (PE) index is a weighted average of the four policy indicators in regression [1] of Table 2: CPI inflation rate, fiscal overall balance as a percentage of GDP, exports and imports as a percentage of GDP, and the amount of equity liabilities as a percentage of GDP. The first two capture domestic policy indicators, while the latter two proxy outward policies. Weights are provided by the coefficient estimates of the corresponding variables reported in regression [1] of Table 2. Hence, the overall policy index is computed as:

$$PE = -1.1299 * Inflation + 0.2489 * Fiscal\ Balance + 3.1238 * Trade\ Openness + 0.9869 * Financial\ Openness.$$

with the index of domestic policy environment (DPE) being calculated as

$$DPE = -1.1299 * Inflation + 0.2489 * Fiscal\ Balance$$

and the outward policy environment index (OPE) is computed as:

$$OPE = 3.1238 * Trade\ Openness + 0.9869 * Financial\ Openness.$$

Table 4 shows the distribution of the rate of growth, aggregate volatility, and the public debt-to-GDP ratio across the quartiles of the distribution of domestic policy and outward policy environment. Countries in the first quartile of domestic and outward policy that have the lowest value of the policy index have an average growth rate equal to 0.39 percent. As the quality of policy improves, the average growth rate increases, reaching 3.6 percent in the fourth quartile of both policy indices.

Table 4. Growth, Volatility, and Public Debt across Different Domestic and External Policy Environments

Sample: 136 countries, 1970–2010 (5-year period observations)

A. Economic growth

		Outward policy environment			
		I	II	III	IV
Domestic policy environment	I	0.39	-0.14	0.69	0.80
	II	1.37	1.87	1.87	2.22
	III	2.45	2.41	2.23	2.17
	IV	1.71	1.73	2.61	3.64

B. Growth volatility

		Outward policy environment			
		I	II	III	IV
Domestic policy environment	I	1.15	1.17	1.13	1.19
	II	1.10	0.83	0.66	0.87
	III	0.80	0.59	0.65	0.73
	IV	0.80	0.97	0.71	0.80

C. Public debt

		Outward policy environment			
		I	II	III	IV
Domestic policy environment	I	3.72	3.96	4.01	3.87
	II	3.77	3.62	3.93	3.89
	III	3.23	3.57	3.81	3.90
	IV	3.03	3.62	3.70	3.61

*Note: 1/ The domestic and outward policy environments are weighted average of different policy indicators that are included in regression [1] of Table 5: CPI inflation rate, fiscal overall balance (as % of GDP), exports and imports as percentage of GDP and the amount of equity liabilities as a percentage of GDP. Weights are provided by the coefficient estimates of the corresponding variables reported in regression [1] of Table 5. The domestic policy index is calculated as $DPE = -1.1299 * Inflation + 0.2489 * Fiscal\ Balance$ while the outward policy index is computed as $OPE = 3.1238 * Trade\ Openness + 0.9869 * Financial\ Openness$. The quartiles of the distribution of DPE and OPE are ordered such that higher quartiles implied an improved policy environment.*

Source: Authors' elaboration.

Growth volatility decreases with the improvement of domestic policy. But if the level of domestic policy is fixed, and moved across the distribution of outward policy index, volatility does not change much. For instance, looking at the row of the first quartile of domestic policy, the growth volatility begins at 1.15 percent and ends at 1.19 percent. This is true for all rows. It suggests that sound domestic policy is important for volatility but not for outward policy. The reason for this could be that a more open economy is more prone to external shocks, and is therefore more volatile. Sound domestic policy, defined as low inflation and high fiscal balance, provides more room for the government to face a recessive shock.

Public debt is uniformly distributed across the quartile for both policy indexes. There is no difference when comparing the upper-left corner of the table with the lower-right corner; debt varies from 3.72 percent to 3.61 percent, between countries in the first and fourth quartiles.

Table 5 presents the regressions using the overall PE in the analysis. As expected, the coefficient of the PE is positive and statistically significant (Column 1), implying that growth is enhanced by higher quality policies. Columns 2 and 3 include the interaction between the overall PE and public debt. While Column 3 controls for aggregate volatility, Column 2 does not. The coefficient of PE alone is positive, but it fails to be statistically different from zero, while that of public debt is negative and significant. In addition, the coefficient of the interaction between PE and public debt is positive and statistically significant. This finding implies that the higher the quality of economic policy, the smaller the adverse effect on growth. The quality of the PE helps smooth out the adverse growth effects from rising public debt. In sum, the findings from Columns 2 and 3 show that an improved PE helps cushion the adverse impact of public debt on growth.

Columns 2 and 3 reveal that the impact of public debt on growth may depend on the quality of the PE. Columns 4 and 5 test whether the sensitivity of growth to public debt depends not only on the PE, but also on the initial level of government debt. Hence, an interaction between the PE index and the ratio of public debt squared has been included. The estimates show that public debt still has a negative and significant coefficient, while the interaction with the level of PE is positive and statistically significant in Column 4. The

interaction with public debt squared is negative and statistically negligible. This means that scale effects interacted with the PE have no impact on growth.

Table 5. Growth and Public Debt: Interaction with the Overall Policy Environment

Dependent variable: growth in real GDP per capita (annual average over 5 year period)
Sample: 136 countries, 1970–2010 (5-year period observations)

	[1]	[2]	[3]	[4]	[5]
<i>Transitional convergence</i>					
Initial real GDP per capita (in logs)	-2.3022 ** (0.627)	-1.6157 ** (0.456)	-1.2434 ** (0.477)	-1.5231 ** (0.434)	-1.1941 ** (0.460)
<i>Structural factors</i>					
Human capital (in logs)	1.7743 ** (0.751)	1.4722 * (0.788)	1.0387 (0.714)	1.4181 * (0.761)	0.9521 (0.726)
Private credit (% of GDP, logs)	0.6192 (0.609)	0.8805 * (0.576)	0.5516 (0.534)	0.6205 (0.590)	0.4431 (0.545)
Institutions (in logs)	5.1955 ** (2.033)	3.7786 * (2.011)	3.9464 ** (1.887)	4.1746 ** (2.006)	4.1543 ** (1.871)
<i>Policy environment indices 1/</i>					
Overall policy environment	0.9880 ** (0.162)	0.0835 (0.317)	0.0473 (0.272)	-0.1030 (0.330)	-0.0860 (0.322)
<i>Growth volatility</i>					
Std. dev. growth in real GDP per capita (in logs)	..	..	-0.8780 ** (0.308)	..	-0.8850 ** (0.303)
Government burden					
Public debt (% of GDP, logs)	-1.0539 ** (0.532)	-2.6604 ** (0.744)	-2.2390 ** (0.681)	-2.5283 ** (0.822)	-2.2223 ** (0.718)
Policy environment x public debt	..	0.1655 ** (0.077)	0.1414 ** (0.067)	0.2932 ** (0.143)	0.2147 (0.180)
Policy environment x (public debt squared)	..	..	..	-0.0195 (0.022)	-0.0097 (0.024)
No. countries	739	739	737	739	737
No. observations	116	116	116	116	116
No. instruments	91	91	92	91	92
<i>Serial correlation tests (p-value)</i>					
AR(1)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	(0.367)	(0.638)	(0.814)	(0.765)	(0.865)
<i>Overidentifying restrictions (p-value)</i>					
Sargan test	(0.355)	(0.542)	(0.423)	(0.341)	(0.552)
Hansen test	(0.446)	(0.387)	(0.557)	(0.666)	(0.426)

*Note: 1/ The overall policy environment index is a weighted average of the four policy indicators in regression [1]: CPI inflation rate, fiscal overall balance (as % of GDP), exports and imports as percentage of GDP and the amount of equity liabilities as a percentage of GDP. The first two capture domestic policy indicators while the latter two proxy outward policies. Weights are provided by the coefficient estimates of the corresponding variables reported in regression [1] of Table 4. Hence, the overall policy index is computed as: $PE = -1.1299 * Inflation + 0.2489 * Fiscal\ Balance + 3.1238 * Trade\ Openness + 0.9869 * Financial\ Openness$. In addition, the domestic policy index is calculated as $DPE = -1.1299 * Inflation + 0.2489 * Fiscal\ Balance$ while the outward policy index is computed as $OPE = 3.1238 * Trade\ Openness + 0.9869 * Financial\ Openness$. * (**) implies statistical significance at the 10 (5) percent level.*

Source: Authors' elaboration.

Next, the overall PE is deconstructed into its domestic and outward policy environment indices (DPE and OPE, respectively). Table 6 shows the regression analysis. The results in Table 6 are analogous to those in Table 5. The baseline regression in Column 1 shows that the coefficients of DPE and OPE are both positive and statistically significant, whereas public debt has an expected negative sign. Columns 2 and 3 add to the regression analysis the interaction between public debt and the two sub-indices of PE, DPE and OPE. When these interactions are included, the coefficients of DPE and OPE themselves are not statistically significant. The coefficient of public debt is negative but not different from zero. The interaction between DPE and public debt and that between OPE and public debt has a positive and statistically significant coefficient. Therefore, an improved domestic and outward-oriented policy environment helps mitigate the adverse effects of public debt on growth.

Finally, the presence of scale effects in public debt interacted with both DPE and OPE when evaluating the sensitivity of growth on public debt were also tested—see Columns 4 and 5 in Table 6. The result was that the interaction between the public debt squared and the indices of domestic and outward PE are not significant. Hence, the growth elasticity of public debt does not depend on the scale of the debt interacted with the PE.

Table 6. Growth and Public Debt: Interaction with the Domestic and Outward Policy Environment

Dependent variable: growth in real GDP per capita (annual average over 5-year period)
Sample: 136 countries, 1970–2010 (5-year period observations)

	[1]	[2]	[3]	[4]	[5]
<i>Transitional convergence</i>					
Initial real GDP per capita (in logs)	-2.3092 ** (0.634)	-1.7021 ** (0.468)	-1.3722 ** (0.506)	-1.4644 ** (0.499)	-1.32065 -0.55497
<i>Structural factors</i>					
Human capital (in logs)	1.7738 ** (0.759)	1.6120 ** (0.737)	1.1822 * (0.726)	1.4615 ** (0.741)	1.014831 -0.69589
Private credit (% of GDP, logs)	0.5860 (0.614)	0.7505 (0.584)	0.4711 (0.525)	0.5164 (0.541)	0.479792 -0.58302
Institutions (in logs)	5.2153 ** (2.022)	3.5479 * (1.943)	3.7259 ** (1.730)	4.1608 ** (2.026)	3.998434 -1.78754
<i>policy environment indices 1/</i>					
Domestic policy environment	0.9547 ** (0.235)	-0.6621 (0.714)	-0.5027 (0.579)	-0.8801 (0.953)	-0.49482 -0.6242
Outward policy environment	1.0179 ** (0.227)	0.4043 (0.319)	0.3421 (0.261)	0.2619 (0.507)	0.293458 -0.41795
<i>Growth volatility</i>					
Std. dev. growth in real GDP per capita (in logs)	..	..	-0.8531 ** (0.299)	..	-0.9057 ** (0.266)
Government burden					
Public debt (% of GDP, logs)	-1.0615 ** (0.542)	-0.8225 (1.247)	-0.9074 (1.303)	0.2397 (1.881)	-0.8745 (1.963)
Domestic policy environment x public debt	..	0.3543 * (0.183)	0.2715 * (0.163)	0.5620 * (0.333)	0.2882 (0.308)
Outward policy environment x public debt	..	0.1174 ** (0.054)	0.1046 ** (0.051)	0.2785 * (0.173)	0.1407 (0.187)
Domestic policy environment x (public debt squared)	..	..	..	-0.0392 (0.052)	-0.0022 (0.049)
Outward policy environment x (public debt squared)	..	..	..	-0.0355 (0.035)	-0.0052 (0.037)
No. countries	739	739	737	739	737
No. observations	116	116	116	116	116
No. instruments	91	91	92	91	92
<i>Serial correclation tests (p-value)</i>					
AR(1)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	(0.475)	(0.647)	(0.804)	(0.839)	(0.875)
<i>Overidentifying restrictions (p-value)</i>					
Sargan test	(0.371)	(0.483)	(0.643)	(0.513)	(0.739)
Hansen test	(0.337)	(0.746)	(0.573)	(0.808)	(0.640)

Note: 1/ The overall policy environment index is a weighted average of the four policy indicators in regression [1]: CPI inflation rate, fiscal overall balance (as % of GDP), exports and imports as percentage of GDP and the amount of equity liabilities as a percentage of GDP. The first two capture domestic policy indicators while the latter two proxy outward policies. Weights are provided by the coefficient estimates of the corresponding variables reported in regression [1] of Table 4. Hence, the overall policy index is computed as: $PE = -1.1299 * Inflation + 0.2489 * Fiscal\ Balance + 3.1238 * Trade\ Openness + 0.9869 * Financial\ Openness$. In addition, the domestic policy index is calculated as $DPE = -1.1299 * Inflation + 0.2489 * Fiscal\ Balance$ while the outward policy index is computed as $OPE = 3.1238 * Trade\ Openness + 0.9869 * Financial\ Openness$. * (**) implies statistical significance at the 10 (5) percent level. All estimations include time dummies.

Source: Authors' elaboration.

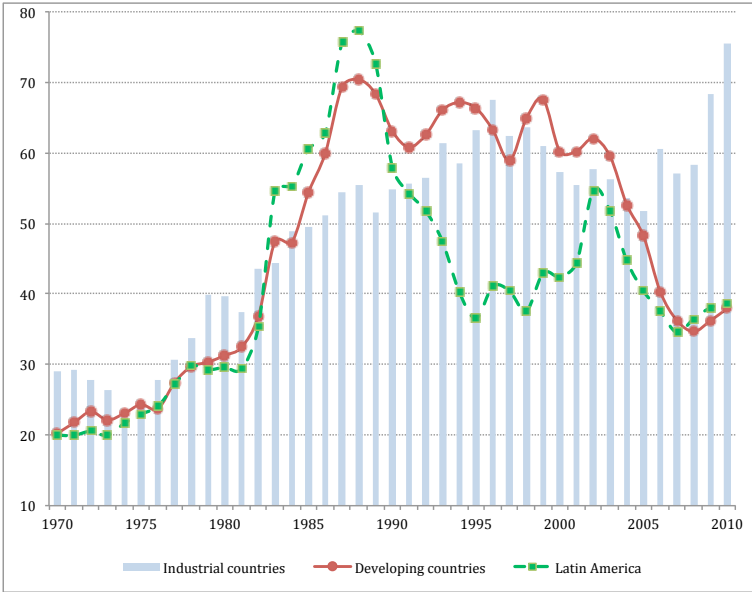
5. The Empirical Model at Work

This section uses the regression analysis undertaken in the previous sections to: (a) assess the contribution of all growth determinants, and, the PE and the ratio of public debt to GDP, in explaining the changes in economic growth over time, and (b) examine the impact on subsequent growth of different scenarios of changes in public debt and PE. The exercises will be conducted for different groups of countries and for individual LAC economies included in the sample.²

Before getting into the comparative static exercises, this section evaluates the debt situation of LAC compared to the rest of the world in the sample over 40 years. Figure 1 presents the medians of the public debt-to-GDP ratio for three groups of countries: industrial countries, developing economies, and LAC countries. Starting from a low level of public debt in the 1970s, around 25 percent, all groups rapidly increased this ratio during the 1980s; this was especially true for developing countries and the LAC region, which coincided with the external debt problem experienced by LAC. In the 1990s, industrial countries increased and developing countries maintained their public debt as a percentage of GDP at 60 percent of GDP, while LAC countries reduced their public debt to 40 percent of GDP. During the first decade of the 2000s, the debt of developing countries converged with the LAC region, while industrial countries reduced their debt in the first half of the decade, and increased it again in the second half, triggering a new debt problem for industrial countries.

² Appendix II presents descriptive statistics of the public debt and policy index variables by group of countries.

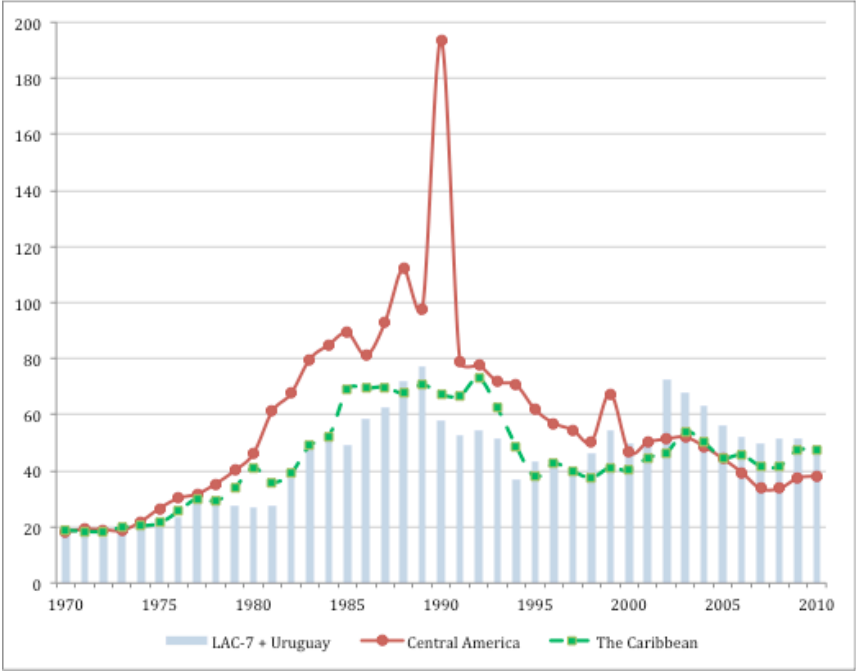
Figure 1. Public Debt across the World, 1970–2010 (percentage of GDP, medians)



Source: Abbas et al. (2010).

Within the LAC region, the behavior of public debt has been uneven. Figure 2 exhibits the evolution of public debt as percentage of GDP for three sub-regions of LAC-7 plus Uruguay, Central America, and the Caribbean. While LAC-7 plus Uruguay and the Caribbean present a similar evolution of public debt as percentage of GDP until 2000, after 2000 the Caribbean region exhibits a higher public debt, closer to the levels seen in the 1980s. Central America experienced a big increase in public debt starting in the 1970s, reaching a peak of almost 200 percent of GDP in 1990. After 1990, the region slowly converged to the public debt of industrial countries.

Figure 2. Public Debt in Latin America, 1970–2010 (percentage of GDP, weighted average)



Source: Abbas et al. (2010).

5.1 Explaining Changes in Economic Growth over Time

The first exercise with the regression results estimates the contribution of the growth determinants, especially public debt and PE, to changes in the rate of economic growth. In the exercise, the extent to which all growth determinants explain the changes in the growth rate of real GDP per capita in 2001–05 compared to 1991–95 was calculated. The comparisons were not performed for the last five-year period in our data (2006–10), or for the last decade in our sample (2001–10), to avoid making comparisons with a period that was affected by the recent global financial crisis.

These contributions were computed for two different regression models: (a) the baseline specification without interactions of Column 1 in Table 2, and (b) the specification that tests the complementarity of public debt with the indices of DPE and OPE, respectively (Column 2 of Table 6). These calculations are reported in Tables 7 and 8.

Table 7. Explaining Changes in Economic Growth over Time: 2001–05 vs. 1991–95
(baseline model)

Variable of interest: change in the growth rate of GDP per capita
Baseline model, no interaction, regression [1] of Table 2, simple averages

Region and country	Actual change	Projected change	Transitional convergence	Structural factors	Policy environment	Public debt
I. Simple averages						
World	0.95	0.89	-0.58	0.23	1.35	-0.12
Industrial	0.52	1.34	-0.71	0.22	1.93	-0.10
Developing	1.06	0.76	-0.54	0.23	1.20	-0.12
Non-LAC developing	1.48	0.88	-0.52	0.22	1.31	-0.13
LAC	-0.12	0.43	-0.61	0.26	0.88	-0.11
LAC-7	-1.14	0.87	-0.67	-0.30	2.06	-0.21
South America	-0.99	0.45	-0.58	-0.22	1.54	-0.30
Central America	-0.12	0.57	-0.71	0.86	0.35	0.07
The Caribbean	2.04	0.14	-0.50	0.41	0.17	0.06
Central America and the Caribbean	0.67	0.41	-0.63	0.69	0.28	0.07
II. Medians						
World	0.47	0.39	-0.62	0.23	0.90	-0.11
Industrial	0.16	0.99	-0.66	0.09	1.71	-0.14
Developing	0.85	0.16	-0.56	0.23	0.61	-0.11
Non-LAC developing	1.54	0.15	-0.55	0.19	0.62	-0.11
LAC	-0.62	0.30	-0.62	0.37	0.66	-0.11
LAC-7	-0.45	0.44	-0.62	-0.32	1.70	-0.32
South America	-0.61	-0.27	-0.51	-0.41	0.92	-0.26
Central America	-0.83	0.44	-0.63	0.88	0.29	-0.11
The Caribbean	1.58	-0.07	-0.63	0.42	0.14	0.00
Central America and the Caribbean	-0.83	0.47	-0.63	0.80	0.35	-0.05

Note: World and regional figures are computed using simple averages of 103 countries with full information for both subperiods, 1991–95 and 2001–05.

Source: Authors' elaboration.

Table 8. Explaining Changes in Economic Growth over Time: 2001–05 vs. 1991–95
(augmented model)

Variable of interest: change in the growth rate of GDP per capita
Augmented model, includes interactions, regression [2] of Table 6, simple averages

Region and country	Actual change	Projected change	Transitional convergence	Structural factors	Policy environment	Public debt
I. Simple averages						
World	0.66	0.87	-0.45	0.27	0.42	0.62
Industrial	0.52	1.81	-0.52	0.32	0.90	1.12
Developing	0.70	0.56	-0.42	0.26	0.26	0.46
Non-LAC developing	1.09	0.87	-0.41	0.22	0.38	0.67
LAC	-0.12	-0.11	-0.45	0.32	0.01	0.01
LAC-7	-1.14	0.14	-0.50	-0.16	0.39	0.42
South America	-0.99	-0.17	-0.43	-0.06	0.19	0.14
Central America	-0.28	0.10	-0.53	1.03	-0.14	-0.26
The Caribbean	2.04	-0.07	-0.37	0.41	-0.28	0.16
Central America and the Caribbean	0.67	-0.05	-0.47	0.67	-0.16	-0.10
II. Medians						
World	0.37	0.77	-0.46	0.30	0.40	0.53
Industrial	0.16	2.00	-0.49	0.19	1.11	1.19
Developing	0.86	0.50	-0.42	0.28	0.26	0.38
Non-LAC developing	1.60	1.02	-0.39	0.26	0.53	0.63
LAC	-0.62	0.04	-0.46	0.41	-0.01	0.09
LAC-7	-0.45	0.23	-0.46	-0.19	0.50	0.39
South America	-0.61	-0.34	-0.38	-0.22	0.13	0.13
Central America	-0.87	0.61	-0.54	1.00	0.13	0.02
The Caribbean	1.58	-0.68	-0.46	0.44	-0.55	-0.11
Central America and the Caribbean	-0.83	0.12	-0.46	0.79	-0.16	-0.05

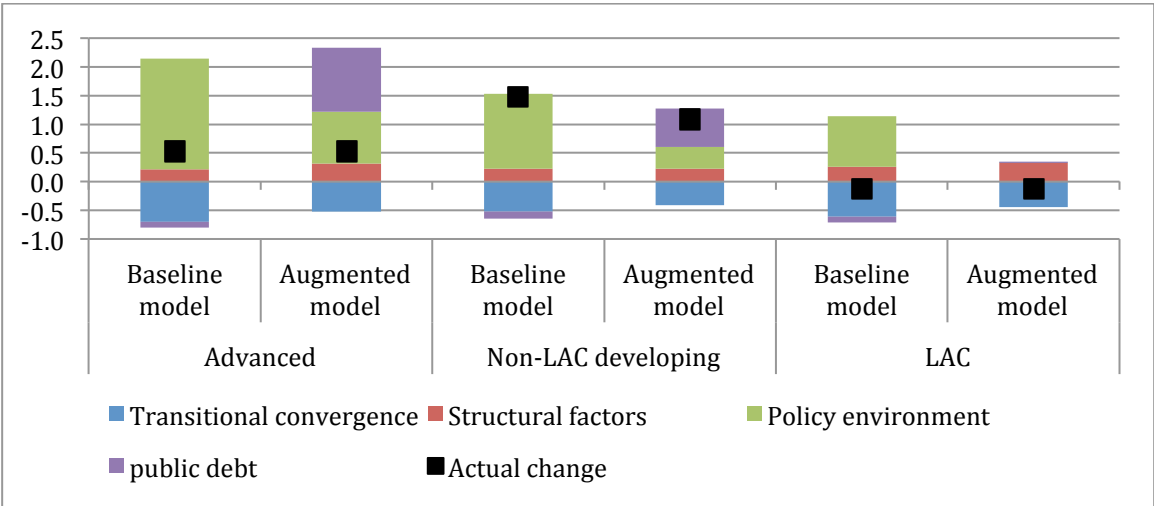
Note: World and regional figures are computed using simple averages of 88 countries with full information for both subperiods, 1991–95 and 2001–05.

Source: Authors' elaboration.

A review of the different exercises in Tables 7 and 8 reveals that the specification that better explains the average change in growth for developing economies in 2001–05 with respect to 1991–95 is the regression model that interacts public debt with DPE and OPE (see Table 8), while the baseline model better predicts the changes in growth rates for developed economies. The data actually register an average increase in the growth rate of real GDP per capita by 70 basis points for the developing group, and the regression model explains a rise in economic growth by 56 basis points (see Table 8). In this case, the average increase in the level of income per capita explains a reduction in the rate of economic growth by 42 basis points due to transitional convergence arguments. Improvements in structural factors such as human capital, financial depth, and institutions during this period help explain a growth increase of approximately 26 basis points. Finally, public debt and PE contribute to a rise in growth for the developing group by 46 and 26 basis points, respectively.

Figures 3 and 4 present the results for three groups of countries: developed, non-LAC developing, and LAC economies. The non-LAC developing economies performed better than the LAC group, mainly due to the positive effect of the PE and reduction in public debt (Figure 1), while the advanced economies group was the PE that explained the large increase in the growth rate for 2001–05 compared with 1991-95.

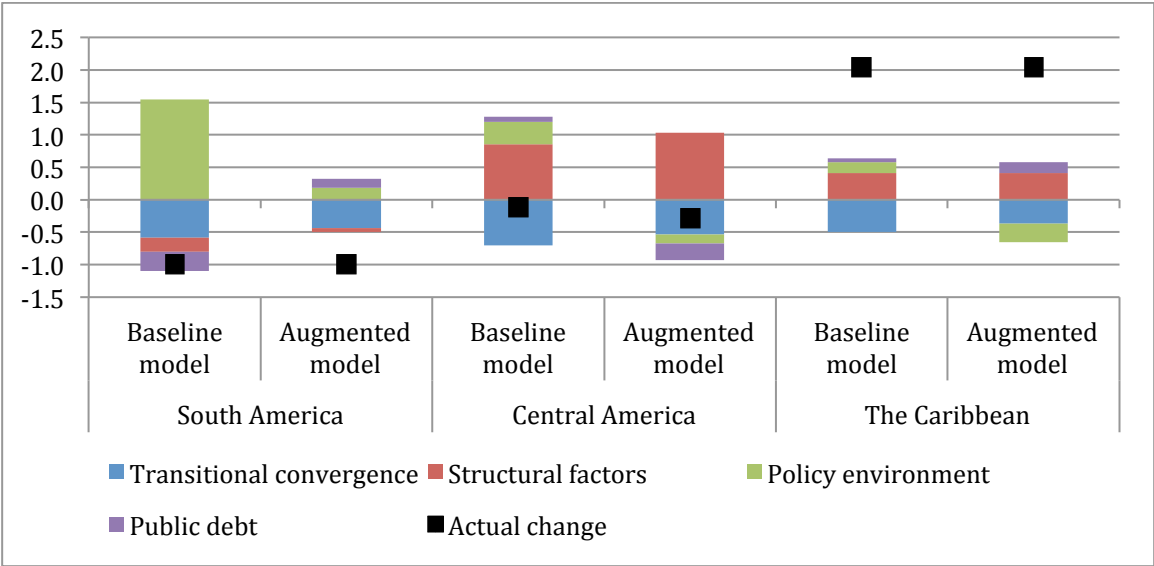
Figure 3. Explaining Changes in the Growth Rate of Real GDP Per Capita, 2001–05 vs. 1991–95 (the World and Latin America and the Caribbean, regional simple average)



Source: Authors’ elaboration.

Examining the LAC group, Figure 4 presents the same exercise for the three LAC subregions. The model does a good job of predicting Central America, but not of predicting the Caribbean region. For the latter group, the model under-predicts the growth rate. Tables 9 and 10 explain the reason: Trinidad and Tobago experienced an actual increase in growth per capita compared to the one predicted by the model. Omitted growth determinants such as the change in oil prices may be driving this result. Reviewing Figure 4, according to the augmented model, structural factors are behind Central America’s performance, while policy and public debt are growth-reducing factors. For South America, those factors enhance growth, but structural factors did not help improve growth performance.

Figure 4. Explaining Changes in the Growth Rate of Real GDP Per Capita, 2001–05 vs. 1991–95 (LAC subregions, regional simple average)



Source: Authors’ elaboration.

Comparing the changes in public debt in 2001–05 with 1991–95, it is in Chile where reduction of public debt makes the largest contribution to growth among LAC countries. Looking at debt reduction in Chile and its interaction with the PE, this strategy explains the increase in the rate of growth by 91 basis points (Table 10).³ Nevertheless, given the good

³ We should note that: (a) the growth gains are approximately 95 basis points if we do not account for the interaction), (b) the calculation takes also the changes in the policy environment (which is negative over the period) although the level for the policy environment is high in Chile, and (c) the interaction effect takes into account changes in public debt multiplied by levels of policy environment and vice versa.

PE and public debt reduction, the model predicts a small increase in the already large growth rate of the 1990s for Chile, although actual growth was slowed. The high contribution of public debt to growth in Haiti may be associated with debt forgiveness initiatives by the creditor countries. Finally, large increases in public debt alone explain the decline in economic growth for Argentina by 144 basis points, in Paraguay by 86 basis points, and in Uruguay by 106 basis points. When interaction with the PE is accounted for, the deterioration in growth rate attributed to public debt is larger for Uruguay and Paraguay.

Table 9. Explaining Changes in Economic Growth over Time: 2001–05 vs. 1991–95
(*baseline model*)

Variable of interest: change in the growth rate of GDP per capita
Baseline model, no interaction, regression [1] of Table 2, simple averages

Region and country	Actual change	Projected change	Transitional convergence	Structural factors	Policy environment	Public debt
LAC countries						
Argentina	-3.99	0.31	-0.97	-0.96	3.68	-1.44
Bolivia	-0.60	0.48	-0.57	0.18	0.80	0.07
Brazil	0.01	3.92	-0.46	0.08	4.71	-0.42
Chile	-3.55	1.76	-1.29	0.36	1.49	1.21
Colombia	-0.21	-2.03	-0.42	-0.82	-0.16	-0.62
Costa Rica	-0.83	0.44	-0.84	0.71	0.84	-0.28
Dominican Republic	-1.24	-1.05	-1.17	0.82	-0.75	0.05
Ecuador	3.25	-0.57	-0.22	-0.77	0.34	0.08
Guatemala	-1.37	1.93	-0.63	1.68	0.41	0.47
Honduras	1.68	1.62	-0.42	0.35	1.37	0.33
Haiti	4.39	4.12	0.43	1.64	1.38	0.66
Jamaica	-1.67	-1.62	-0.45	-0.39	-0.36	-0.42
Mexico	0.85	-0.62	-0.62	-0.53	0.85	-0.32
Nicaragua	2.36	2.31	-0.52	0.61	1.70	0.52
Panama	-0.90	-2.82	-0.90	1.36	-3.18	-0.11
Peru	-0.62	2.59	-0.72	1.51	1.91	-0.11
Paraguay	-0.72	-1.22	-0.11	-0.42	0.18	-0.86
El Salvador	-2.59	1.11	-1.01	1.81	0.43	-0.11
Trinidad and Tobago	6.69	-0.88	-0.80	-0.43	0.41	-0.05
Uruguay	-2.99	-0.97	-0.86	0.44	0.52	-1.06
Venezuela, R.B.	-0.45	0.18	-0.23	-1.76	1.96	0.20

Source: Authors' elaboration.

Table 10. Explaining Changes in Economic Growth over Time: 2001–05 vs. 1991–95
(*augmented model*)

Variable of interest: change in the growth rate of GDP per capita
Augmented model, includes interactions, regression [2] of Table 6, simple averages

Region and country	Actual change	Projected change	Transitional convergence	Structural factors	Policy environment	Public debt
LAC countries						
Argentina	-3.99	-1.75	-0.72	-0.70	0.65	-0.98
Bolivia	-0.60	0.46	-0.42	0.24	0.60	0.04
Brazil	0.01	3.24	-0.34	0.09	1.49	2.00
Chile	-3.55	0.29	-0.96	0.45	-0.11	0.91
Colombia	-0.21	-2.04	-0.31	-0.55	-0.44	-0.74
Costa Rica	-0.83	-0.25	-0.62	0.89	-0.29	-0.23
Dominican Republic	-1.24	-2.02	-0.87	0.87	-0.98	-1.04
Ecuador	3.25	0.07	-0.16	-0.51	0.06	0.67
Guatemala	-1.37	1.59	-0.46	1.54	0.26	0.25
Honduras	1.68	1.63	-0.31	0.38	0.57	0.99
Haiti	4.39	3.68	0.33	1.44	0.39	1.52
Jamaica	-1.67	-1.45	-0.33	-0.28	-0.57	-0.27
Mexico	0.85	-0.87	-0.46	-0.44	0.25	-0.22
Nicaragua	2.36	0.13	-0.38	0.56	-0.09	0.04
Panama	-0.90	-3.07	-0.67	1.14	-1.54	-2.00
Peru	-0.62	2.04	-0.53	1.34	0.65	0.57
Paraguay	-0.72	-1.63	-0.08	-0.11	-0.46	-0.98
El Salvador	-2.59	0.55	-0.75	1.68	0.23	-0.61
Trinidad and Tobago	6.69	-0.49	-0.60	-0.38	0.04	0.45
Uruguay	-2.99	-2.41	-0.64	0.51	-0.79	-1.49
Venezuela, R.B.	-0.45	0.08	-0.17	-1.34	0.21	1.38

Source: Authors' elaboration.

5.1. Assessing Potential Growth Benefits of Changes in Public Debt and the Policy Environment

The second exercise consists of forecasting the potential growth benefits of reducing public debt in LAC countries. The forecasts for public debt and the PE for all LAC countries are calculated in the sample using a scenario of continuous trends and another of sharp improvement in public debt and the PE. This exercise follows the strategy employed by Loayza, Fajnzylber, and Calderon (2005) to forecast growth in LAC.

The scenario of continuous trends assumes that the ratio of public debt and the PE follow historical trends. Using annual information on the ratio of public debt to GDP as well as the components for the DPE (CPI inflation and the overall budget surplus to GDP) and the OPE (trade to GDP and the ratio of equity liabilities to GDP), simple time series regression models were run to forecast the evolution of these variables over the period

2011-20. In this paper, a regression was run for each of these variables and for each country on the linear and quadratic time trend, as well as the lagged dependent variable.⁴ Then, the available information was used to project to the next decade.

The scenario of sharp reform uses the annual information for the panel of 21 LAC countries, with complete information for the public debt ratio, and for all indicators of the DPE and OPE indices. The sharp progress means that all forecast variables, including public debt, DPE and OPE indices, follow the trend of the top decile, or 90th percentile, of the distribution of the corresponding variables. Hence, quantile panel regressions were run for the 90th percentile.

Table 11 reports the potential variation in the rate of per capita growth attributed to the changes in public debt and PE under the scenario of continuous trends and the sharp progress to the 90th percentile of the distribution. Table 11 uses the coefficients from regression [2] of Table 6, which includes the DPE and OPE indices. There are four economies that will reduce the growth rate in the 2011-20 decade, as compared to the previous one, if the independent variables follow the historical trend. This means that the trajectories of these policy variables are conflicting with economic growth. Chile, Costa Rica, and Panama will not increase their growth rates much, even if they reach the 90th percentile. This shows that those economies already have good PE.

⁴ The results of these regressions are not reported but are available from the authors upon request.

Table 11. Variation in Growth Per Capita under Different Scenarios of Changes in Public Debt and Policy Environment

Projected change in growth rate in 2011–20
Regression model: regression [2] of Table 6

Country and region	Scenario A			Scenario B		
	Continuing trends			Sharp progress, 90th percentile		
	Overall projected change	Change attributed to:		Overall projected change	Change attributed to:	
	Policy environment	Public debt		Policy environment	Public debt	
Argentina		1.14	0.85	2.51	0.68	1.83
Bolivia	3.75	0.93	2.82	2.48	0.52	1.97
Brazil	2.32	1.13	1.19	3.09	1.17	1.91
Chile	0.18	0.06	0.12	0.46	0.13	0.33
Colombia	0.08	0.12	-0.04	1.97	0.70	1.27
Costa Rica	0.31	0.46	-0.16	0.46	-0.08	0.55
Dominican Republic	-0.36	-0.30	-0.06	1.21	0.22	0.98
Ecuador	1.86	0.28	1.58	2.05	0.38	1.68
Guatemala	0.50	0.47	0.02	1.35	0.51	0.85
Honduras	1.46	0.17	1.29	1.24	0.07	1.17
Haiti	3.57	1.00	2.57	4.20	1.45	2.75
Jamaica	-1.48	-0.58	-0.90	0.69	-0.50	1.18
Mexico	0.78	0.60	0.19	1.55	0.56	0.99
Nicaragua	6.59	2.32	4.27	3.12	0.97	2.15
Panama	-0.88	-0.63	-0.26	0.43	-0.39	0.83
Peru	3.32	1.20	2.12	2.60	0.90	1.70
Paraguay	1.36	-0.07	1.43	1.78	0.14	1.64
El Salvador	1.58	1.23	0.35	2.08	0.77	1.31
Trinidad and Tobago	1.70	1.15	0.55	0.96	0.19	0.77
Uruguay	1.49	0.64	0.85	2.76	0.87	1.89
Venezuela, R.B.	-1.00	-0.55	-0.45	1.08	0.28	0.80
Regional averages						
LAC	1.39	0.51	0.87	1.81	0.45	1.36
LAC-7	1.09	0.53	0.57	1.89	0.63	1.26
South America	1.53	0.49	1.05	2.08	0.58	1.50
Central America	1.48	0.66	0.82	1.46	0.34	1.12
The Caribbean	0.86	0.32	0.54	1.76	0.34	1.42
Central America and the Caribbean	1.25	0.54	0.71	1.57	0.34	1.23

Source: Authors' elaboration.

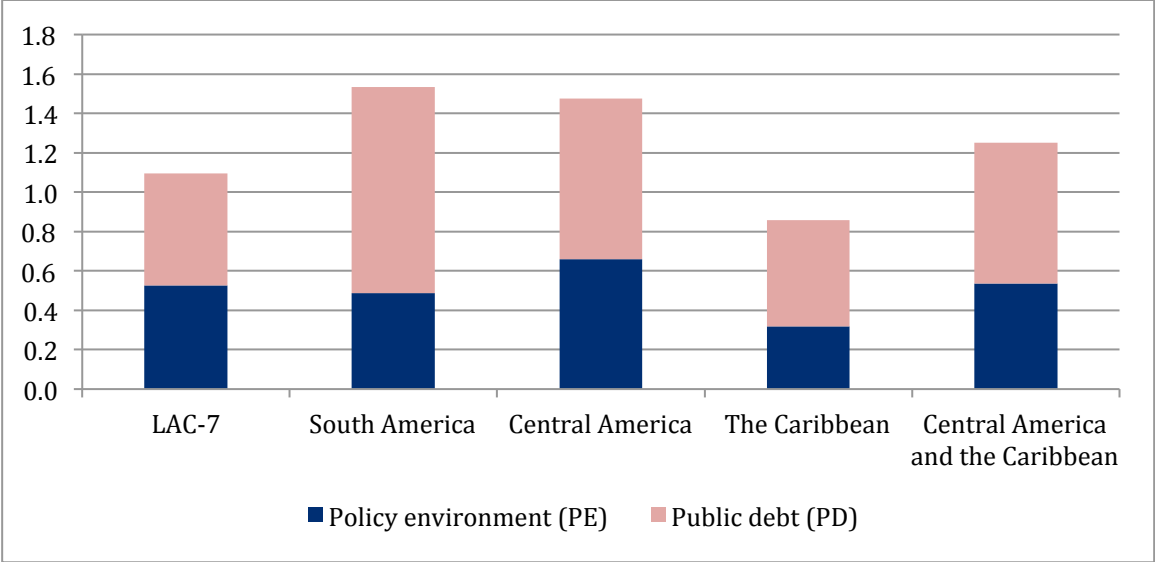
Examining LAC countries closely, Nicaragua, Haiti, Bolivia, and Peru are among the largest growth gainers from prospective debt reduction and improved PE according to the continuous trends scenario. Their growth rate would be higher by more than 4 percentage points. Countries where growth prospects would deteriorate include the Dominican Republic, Panama, and Venezuela. For Jamaica, this is attributed to rising public debt (see Table 11).

Under the scenario of sharp progress to the 90th percentile, Haiti and Nicaragua are the top growth gainers, with an increase in rates of growth per capita exceeding 4 percentage points. In addition, the contribution of debt to growth is positive; this means that all countries would experience a debt reduction under this scenario.

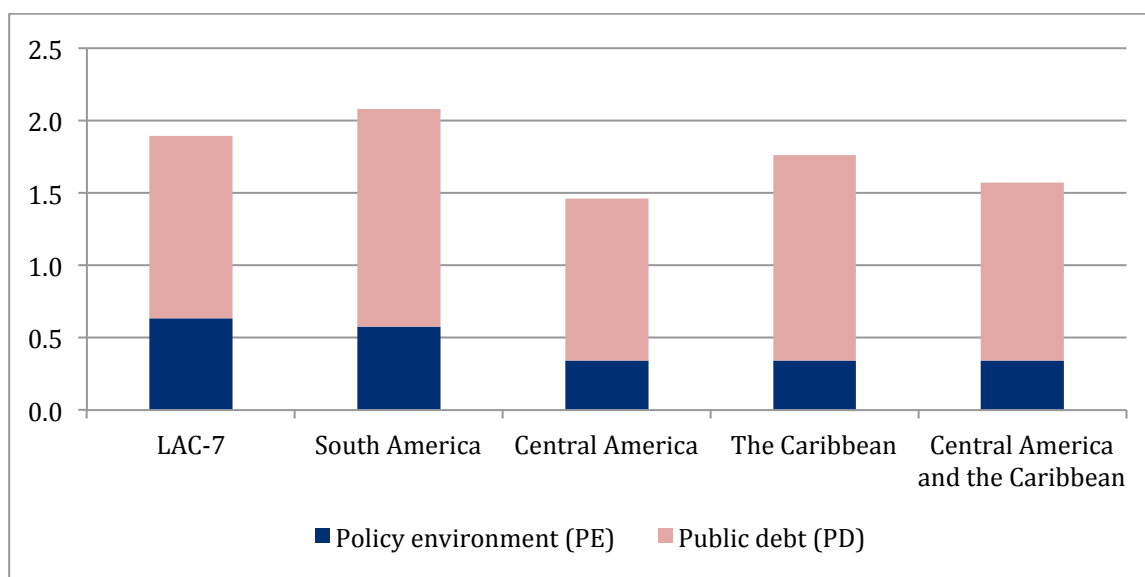
Figure 5 depicts the likely growth benefits if public debt and the quality of policies were to improve following their historical trend or by a faster speed of progress—that is, the trend of the top decile of the distribution. Under the scenario of continuous trends, on average, if debt reduction and improvement in the PE follow their historical trends, the growth rate increases on average by 1.1 percentage points for the LAC-7 countries. Within LAC, the largest improvement, by 1.5 percentage points, would be in South America, and the smallest, by 0.9 percentage points, would be in the Caribbean. Under the sharp progress scenario, average growth for LAC-7 countries would increase by 1.9 percentage points. Within the LAC regions, South America would enhance its growth per capita by 2.1 percentage points, while Central America would do so only by 1.5 percentage points.

Figure 5. Potential Growth Benefits from Changes in Policy Environment and Public Debt, Comparing 2011–20 vis-à-vis 2001–10

I. Continuing trends



II. Sharp reform (90th percentile)



Source: Authors' elaboration.

6. Summary and Conclusions

Theory posits several arguments on the adverse effects of public debt on future growth and its various channels of transmission. The empirical literature suggests that either the negative effect of public debt on growth is dubious or public debt may hurt growth at very high levels of indebtedness. This paper empirically examines this relationship using a large panel data of countries for 1970-2010. It focuses on how some structural factors, like quality of institutions, financial market development, or the level of GDP per capita, may ameliorate or exacerbate the negative effect of public debt on growth. It also explores how the quality of macroeconomic policy and outward orientation may affect this effect. Finally, it takes a closer look at the LAC region, as well as its sub-regions, under the lenses of the econometric results obtained in the previous analysis.

Our empirical analysis yields the following results for the relationship between public debt and growth: first, there is a robust negative relationship between public debt and growth; second, there is evidence of non-linearity in this relationship by the level of development and public debt; third, structural factors such as quality of institutions, domestic financial market development, and the level of GDP per capita reduce the negative effect of public debt on growth; fourth, when all the interactions between public

debt and these factors are included, only the quality of institutions seems to have a robust effect on ameliorating the negative impact of public debt; fifth, the PE is important in assessing this relationship, and outward-oriented environments substantially reduce the negative effect of public debt on growth.

We use our econometric analysis to magnify the growth effects of rising public debt on the LAC region. We undertake the following exercises: (a) assess the contribution of the policy environment and the ratio of public debt to GDP in explaining the changes in economic growth between 2001–05 versus 1991–95, and (b) forecast future growth under different scenarios of changes in public debt and the PE, assuming all other factors are at the sample's median level. The assumed scenarios are: (a) that PE and debt-to-GDP ratio evolves according to linear and quadratic trends, and (b) that economies experience a sharp improvement in the PE and debt-to-GDP ratio, reaching the top decile of distribution of countries.

Our findings are the following. First, for industrial economies, the PE largely contributes to a rise in the growth rate in the second period, mainly due to amelioration of the effect of public debt. We did not compare the 2006–10 period to isolate the international crisis effect. The effect was also important for the non-LAC developing economies and for the LAC-7 group, consisting of Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. The evolution of PE and public debt had a negative effect for Central American and Caribbean economies. Second, within Latin America, Brazil experiences a large growth effect thanks to PE and public debt reduction. Panama has a negative growth effect due to these two variables. The other countries experienced milder effects, with Honduras and Haiti benefiting more by debt management and PE. The latter two countries are heavily indebted poor countries (HIPC), and debt reductions may be explained partly by debt forgiveness.

Third, one of the main lessons from the forecasting scenarios is that there are large potential growth benefits for the LAC region from improving PE and reducing public debt in our continuous trend scenario, where the evolution of PE and public debt follows its historical trend. These benefits are even larger for the sharp progress-forecasting scenario in which these variables follow the trend of the top decile country in the distribution. Bolivia, Brazil, Haiti, Nicaragua, and Peru show the largest potential benefit in the region.

Countries with good PE and low public debt, such as Chile, Colombia, and Costa Rica, are expected to have little increase in the growth rate in the present decade compared to the previous one. The effect of public debt on growth is robustly negative. The quality of institutions, sound domestic policy, and outward-oriented policies will help to reduce this negative effect. Finally, further research should aim at examining the impact of public debt on a country's resilience to external volatility and its ability to mitigate adverse and volatile shocks on income inequality and poverty.

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Appendix I: Definitions and Sources of Variables Used in Regression Analysis

Variable	Definition and construction	Source
GDP per capita	Ratio of total GDP to total population. GDP is in USD at 2005 prices.	Authors' elaboration using the World Bank's <i>World Development Indicators</i> .
GDP per capita growth	Log difference of real GDP per capita.	Authors' elaboration using the World Bank's <i>World Development Indicators</i> .
Initial GDP per capita	Initial value of ratio of total GDP to total population. GDP is in USD at 2005 constant prices.	Authors' elaboration using the World Bank's <i>World Development Indicators</i> .
Growth volatility	Standard deviation of the growth rate in real GDP per capita over a 5-year window	Authors' elaboration using the World Bank's <i>World Development Indicators</i> .
Education	Ratio of total secondary enrollment, regardless of age, to the population of the age group that officially corresponds to that level of education.	Barro and Lee (2001) and the World Bank's <i>World Development Indicators</i> .
Financial depth	Ratio of domestic credit claims on private sector to GDP	Author's calculations using data from IFS and Central Bank publications. The method of calculations is based on Beck, Demiguc-Kunt, and Levine (2000).
Trade openness	Log of the ratio of exports and imports (in 2005 USD) to GDP (in 2005 USD).	Authors' elaboration using the World Bank's <i>World Development Indicators</i> .
Financial openness	Log of the Stock of Equity-based Foreign Liabilities to GDP (both expressed in 1995 USD). Following Eichengreen and Irwin (1998), we add the value of 1 to the stock in order to include the cases where the stock of foreign liabilities is 0.	Lane and Milesi-Ferreti (2001; 2007); IMF's <i>Balance of Payments Statistics</i> .
Fiscal balance	Ratio of overall budget balance to GDP	Authors' construction using the World Bank's <i>World Development Indicators</i> .
Government burden	Ratio of gross government debt to GDP	Abbas, et al. (2010)
CPI	Consumer price index (1995 = 100) at the end of the year	Author's calculations with data from IFS.
Inflation rate	Log differences of CPI	Author's calculations with data from IFS.
Institutions	Log of the ICRG political risk rating index.	International Country Risk Guide (ICRG) compiled by the PRS Group.
Period-specific shifts	Time dummy variables.	Authors' elaboration.

Appendix II. Basic Statistics

Sample: 136 countries, 1960–2010 (5-year period non-overlapping information)

Regions	Averages					Medians				
	Economic growth	Public debt	Policy environment			Economic growth	Public debt	Policy environment		
			Overall	Domestic	Outward			Overall	Domestic	Outward
All countries	1.81 (3.43)	3.64 (0.84)	9.37 (3.39)	-5.97 (1.56)	15.05 (2.86)	1.91	3.71	9.22	-5.94	15.10
Industrial countries	2.35 (1.78)	3.66 (0.70)	9.08 (3.02)	-6.03 (1.27)	14.92 (2.68)	2.23	3.82	9.01	-5.95	14.94
Developing countries	1.69 (3.68)	3.63 (0.88)	9.46 (3.48)	-5.95 (1.64)	15.08 (2.91)	1.82	3.67	9.38	-5.93	15.16
Latin America (LAC)	1.44 (2.63)	3.53 (0.73)	9.04 (3.08)	-6.02 (1.40)	14.87 (2.54)	1.58	3.58	9.21	-5.82	14.72
East Asia and the Pacific (EAP)	4.08 (2.89)	3.41 (0.78)	11.81 (3.92)	-5.45 (1.05)	16.95 (3.51)	4.00	3.52	11.29	-5.56	16.64
Eastern Europe and Central Asia (ECA)	2.11 (4.70)	3.39 (0.77)	9.90 (3.36)	-6.17 (0.99)	15.99 (3.15)	2.84	3.37	11.12	-6.09	17.08
Latin America (LAC)	1.44 (2.63)	3.53 (0.73)	9.04 (3.08)	-6.02 (1.40)	14.87 (2.54)	1.58	3.58	9.21	-5.82	14.72
- LAC-7	1.63 (2.42)	3.34 (0.71)	7.35 (3.10)	-6.03 (1.18)	13.00 (2.44)	1.54	3.56	8.01	-5.80	13.47
- South America	1.51 (2.47)	3.48 (0.68)	8.09 (2.88)	-5.85 (1.05)	13.66 (2.28)	1.47	3.60	8.38	-5.70	13.86
- Central America (excl. Mexico)	1.39 (2.53)	3.64 (0.83)	9.99 (3.30)	-6.37 (2.00)	16.24 (2.18)	1.89	3.65	10.08	-5.97	15.90
- Central America and the Carribean (excl. Mexico)	1.33 (2.84)	3.60 (0.77)	10.21 (2.91)	-6.18 (1.72)	16.25 (2.06)	1.82	3.57	10.16	-5.91	16.04

Note: Figures in parentheses below the averages are computed standard deviations.

Source: Authors' elaboration.