

Allocative Efficiency of Government Spending for Growth in Latin American Countries

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ABSTRACT*

There is scant empirical economic research on how governments in the Latin American countries efficiently allocate their spending across different functions to achieve higher growth. This paper sheds light on how allocating expenditures to investment in quality human and physical capital and avoiding waste on inefficient expenditures enhance growth in the region. It exploits a novel dataset covering 42 OECD and Latin American countries between 1985 and 2017 with data on physical and human capital and detailed public spending that disaggregates government expenditure into economic and functional headings (e.g., wages vs. investment). There are four main results. First, the estimated growth equations show significant positive effects of the factors of production on growth and plausible convergence rates. The estimated effect of the physical investment rate is positive and significant with a long-run elasticity of 1.2. The addition of a new variable that measures quality-adjusted years of schooling as a proxy for human capital has a positive and significant effect across all specifications with a long-run elasticity of 1.1. Physical and human capital are equally important for growth: the effect of increasing one standard deviation of physical capital or

human capital statistically has the same impact on growth. Second, if public spending on education (excluding infrastructure spending) is added to the factor specification, growth is not affected. Therefore, the key is to increase quality, not just education spending. Third, increasing public investment spending (holding public spending constant) is positive and significant for growth (a 1 percent increase in public investment would increase long-term GDP per capita by about 0.3 percent), in addition to the effect of the private investment rate. However, the effect of public spending on payroll, pensions, and subsidies does not contribute to economic growth. Fourth, the overall effect of the size of public spending on economic growth is negative in most specifi-

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cations. An increase in the size of government by about 1 percentage point would decrease 4.1 percent the long-run GDP per capita, but the more effective the government is, the less harmful its size for long-term growth.

Keywords: government size, growth, human capital, Latin America, public spending

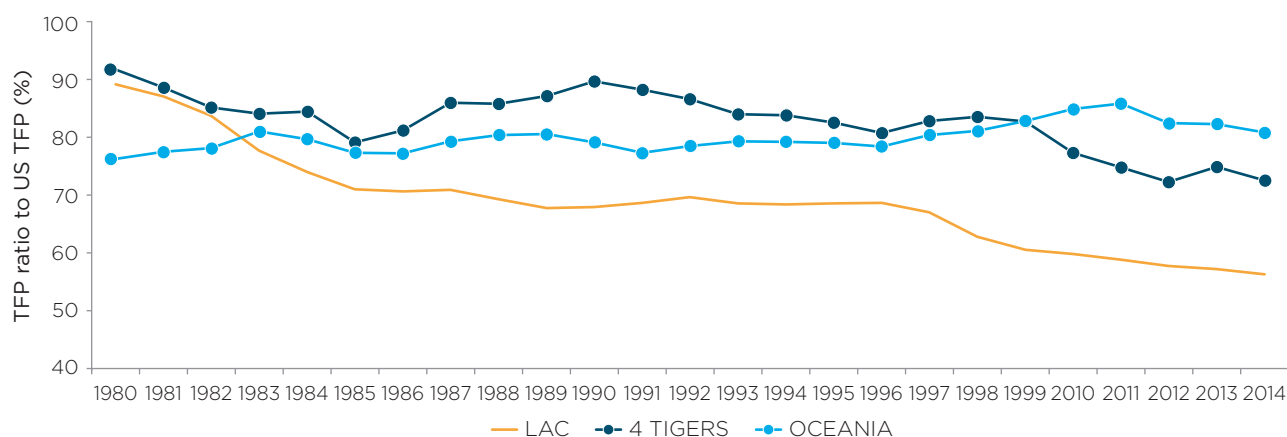
JEL classification: H5; I2; O40; O54



INTRODUCTION

This paper tackles the question of how investment in physical and human capital, including public spending, boosts growth. Latin American countries have been experiencing long-term stagnation or low growth due to the low productivity of its factors of production despite an increase in the number of workers and the capital stock (Crespi, Fernández-Arias, and Stein, 2014). Fiscal policy and public spending played an important role in the region's low growth in recent decades. There is likely a trade-off between current public spending (whose purpose is income redistribution and payment of wages and salaries) and capital spending aimed at raising growth and income levels. Moreover, the mix and the quality of physical and human capital investment also influence growth rates and income levels. Hence, this paper analyzes the allocative efficiency of spending on physical capital (investment), human capital, and current spending, including public sector wages and transfers.

In the last 60 years, growth in Latin America has been low compared to the growth in much of the rest of the world. Most Latin American countries have not risen to the higher-income country category. In 1960, the region was expected to be on the verge of significant economic growth. Both school attainment and income levels were well ahead of those of the four Asian Tiger countries (South Korea, Taiwan, Singapore, and Hong Kong) and Oceania. By 2000, those countries had far surpassed Latin American countries in terms of growth and income (Izquierdo, Pessino, and Vuletin, 2018). The reason for this disappointing performance seems to lie in the low quality of human and physical capital, and total factor productivity (TFP), or “efficiency” (see **Figure 1**). The hypothesis is that besides how inputs contribute to growth in Latin America, inefficient government spending in the region did not lead to higher incomes. This paper estimates a model of conditional growth convergence to analyze the role of

Figure 1 >> **Evolution of Total Factor Productivity (TFP), Ratios to U.S. TFP**

Source: Authors' calculation based on Penn World Tables 9.0.

public spending. Based on the results, it derives policy recommendations on how to efficiently allocate public spending to promote economic growth in LA. Not much is known about the best composition of public spending for long-term growth. Indeed, spending on education or investment is expected to boost economic growth, while redistributive spending may not have a strong and positive effect on the economic development of economies.

One of the main contributions of this paper is that it uses a novel panel dataset on physical and human capital and detailed public spending, which is categorized by a cross-classification that breaks down government expenditure into both economic and functional headings. This makes it possible to separate wages from investment in each spending category. This cross-classification is very important, especially for Latin America where there is a marked wage premium of about 25 percent of public sector employees compared to private sector employees implying that there are allocative inefficiencies within each category of spending (Izquierdo, Pessino, and Vuletin, 2018). It also includes a novel updated variable harmonizing

achievement tests data between Organization for Economic Co-operation and Development (OECD) and Latin American countries to proxy the quality of education. This database covers about 42 OECD and Latin American countries of between 1985 and 2017, combining two different sources from OECD and the Inter-American Development Bank (IDB), where the methodology of data construction is roughly the same.¹ To our knowledge, this is the largest and most complete database on public spending with disaggregated data on spending items. Based on a simple regression model, the results show that considerable growth effects can be obtained by shifting public spending from public wages to infrastructure or quality human capital.

The paper concludes that public spending policy could help reduce the persistent income gap by (i) improving the quantity, but mainly the quality, of factor accumulation, in particular accumulation of skills; (ii) improving the alloca-

¹ We thank Debbie Bloch, Peter Hoeller, Jean-Marc Fournier, and Isabelle Joumard from OECD for sharing the baseline OECD expenditure database.

tive efficiency of public spending; and (iii) avoiding too large a total spending ratio, especially if a country suffers from poor governance. Physical and human capital are both important for growth, and the allocation of government spending to each of them should be based on rates of return and contribution to growth. An investment strategy that emphasizes physical capital to the exclusion of human capital fails to capture the benefits that can arise from a more balanced investment strategy. It takes skilled workers to make the most efficient use of modern digital technologies. Additionally, the

paper estimates how much each type of investment affects growth and how much is gained and lost in terms of growth by concentrating too much on current “populist” expenditure versus investment. If Latin America overinvests in one type of capital or underinvests in another, opportunities for improvement in wealth are lost.

The remainder of the paper is structured as follows. Section 2 outlines the methodology, Section 3 introduces the data, Section 4 presents the results of the baseline scenarios and the growth projections, and Section 5 concludes.



METHODOLOGY

This paper focuses on two questions: (i) the role of human and physical capital in economic growth and (ii) how to efficiently allocate public spending to promote economic growth in Latin America. To address the first question, it includes both human capital (measured in terms of student achievement rather than only school attainment) and physical capital as important for economic growth. In early growth regression models, average years of schooling was used as a proxy for human capital. Only a few studies of cross-national differences (Barro and Lee, 1993; 2010) found a significant positive association between level of education and growth rates. However, the use of years of schooling as the measure of educational attainment does not incorporate any adjustment for variations in the quality of education. This is likely to be a serious problem for Latin American countries for two reasons: first, the lack of comparability of educational quality with that of developed countries over an extended period, and second, the wide gap in quality as measured by school achievement tests between OECD

and Latin American countries. This renders years of education an inaccurate proxy for human capital in this context. However, in the most recent models, when the quality of education is considered, the effect of years of schooling is greatly reduced, leaving it mostly insignificant for economic growth (Hanushek and Woessmann, 2010). This reflects the fact that a year of schooling does not produce the same cognitive skills everywhere. Therefore, this paper uses a newly constructed quality of human capital variable harmonized from different data sources (see Section 3).

Regarding the efficient allocation of public spending, the paper follows the empirical public finance literature analyzing the effect of fiscal policy on long-term growth. A number of papers investigate the relationship between the size of government and economic growth (see Bergh and Henrekson, 2011, and Johansson, 2016, for an overview). Most of them find a significant negative correlation between government size and growth. Gupta et al. (2005) find that the adverse growth effect of having a large

government can be offset if countries have well-functioning governments.

Most papers that analyze the composition of government spending and growth divide public spending into productive and non-productive spending, depending on whether they are included in the production function (e.g., Barro 1990). A significant number of papers find that while productive spending has a positive effect on economic growth, non-productive spending does not lead to additional growth (e.g., Kneller, Bleaney, and Gemmell, 1999). However, these papers do not separate wages from investment spending. For instance, Gemmell, Kneller, and Sans (2016) and Chu et al. (2018) show that reallocating total spending to infrastructure and education would raise income in the long run, but they do not take into account the difference between spending on teachers' wages and investment in education, nor do their estimations control for education quality. However, Gupta et al. (2005) find that countries that concentrate spending on wages tend to have lower growth, while those that allocate higher shares to capital and non-wage goods and services enjoy faster output expansion. Using a cross-classification that provides the breakdown of government expenditure into economic and functional headings for OECD countries, Fournier and Johansson (2016) find that increasing the share of public investment yields large growth gains. On the other hand, Gemmell, Kneller, and Sanz (2016) find that increasing the share of social welfare spending is associated with lower long-run GDP. Ormaechea and Morozumi (2017) show that reallocating spending from health and social protection to education has significant growth-promoting effects.²

This paper includes both OECD countries and 13 Latin American countries with novel spending data. The estimation strategy is based on a neoclassical growth model, where the underlying basic aggregate production function can be written as:

$$Y = F(L, K) \quad (1)$$

where Y is the real aggregated output, L the labor force or population, and K capital (physical and human). Mankiw, Romer, and Weil (1992) show that in the steady state, the logarithm of GDP per capita depends linearly on the logarithm of the stock of human capital and on the logarithm of the savings rate. In general, investment rate is preferred over savings rate because it is more closely related to the accumulation of capital in the case of persistent imbalances.

The estimation of the standard and extended growth model is based on a conditional convergence equation that relates real growth of GDP per capita to the initial level of per capita income, the investment-to-GDP ratio, a measure of human capital, and the population growth rate, augmented with government expenditures and some control variables.

The convergence growth equation augmented with government size and different items of public spending follows an error correction form (Barro, 2015):

$$\begin{aligned} \Delta \ln(y_{i,t}) = & \phi [\ln(y_{i,t-1}) \\ & + a_1 \ln(\text{attainment}_{i,t-1} \times \text{quality}_{i,t-1}) \\ & + a_2 \ln(I_{i,t-1} / Y_{i,t-1}) + \dots + a_3 X_{i,t-1} + a_4 G_{i,t-1} + a_5 S_{i,t-1}] \\ & + b_1 \Delta \ln(I_{i,t} / Y_{i,t}) + a + v_t + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where i indicates the country, t is time, y is GDP per capita in 2011US\$ purchasing power parity (PPP), *attainment* is the average years of schooling of the working-age population; *quality* is a proxy for education quality,³ and the interaction

² This paper does not control for the quality of education, nor does it separate wages from investment in each spending category.

³ The quality of education variable is proxied by PISA scores in the OECD and harmonized with Latin American scores according to Altinok, Angrist, and Patrinos (2018). It is a newly updated dataset of 163 countries including 18 Latin American countries, constructed by linking standardized, psychometrically robust international and regional achievement tests.

TABLE 1 
Breakdown of Public Expenditure

Item	Label	Comments
1	Education	Includes wages, intermediate consumptions and transfers
2	Health	Includes wages, intermediate consumptions and transfers
3	Other wages and intermediate consumption	Wages and intermediate consumption that are not in items 1, 2, 5, and 7
4	Old-age and survivor pensions	Includes transfers only
5	Sickness and disability	Includes wages, intermediate consumptions and transfers
6	Unemployment benefits	Includes transfers only
7	Family and children	Includes wages, intermediate consumptions and transfers
8	Subsidies	
9	Investment	
10	Other primary expenditure	Includes capital transfers and other elements
11	Interest payments	

Source: Bloch et al. (2016).

between *attainment* and *quality* is a proxy for human capital; I/Y is the total investment rate and X is a set of control variables including rule of law; openness (measured as the sum of exports and imports to GDP), employment protection legislation, population size, old-age dependency ratio and financial development (measured with the credit to GDP ratio); G is the size of the government (total underlying primary spending to GDP), and S is the structure of primary spending (each spending share in total spending). In this specification, v_t is a time fixed effect and $\epsilon_{i,t}$ the standard errors adjusted for country clusters to allow for serial correlation of the residuals. As usual, in error correction models, a_j are the long-run coefficients that capture the long-run equilibrium relationship between y and dependent variables, b_1 is the coefficient of the short-run dynamic, in this case, the investment rate coefficient, and ϕ is a measure of the speed at which the model returns to equilibrium after a shock to exogenous variables, which in this model is the convergence rate.

Following recent literature, this paper controls for the size of government to account for the government's budget constraint (e.g. Gemmell, Kneller, and Sanz, 2016).⁴ The structure of spending is captured by the detailed spending items presented in **Table 1**. The spending items are measured by the spending shares of different spending items in GDP.

Our estimation strategy is mainly based on the recent work of Barro (2015) to ensure that the estimation of the convergence coefficient ϕ is unbiased. While year fixed effects are included in all estimations, country fixed effects are not included because there is a Hurwicz (1950)-type bias of the estimated coefficient for the convergence term (Nickell, 1981; Arellano and

⁴ See Gemmell et al. (2016) for the interpretation that holding constant the government budget constraint, the estimated parameter obtained from introducing each spending component separately can be interpreted as the effect of increasing that component and decreasing the rest, while maintain average or total spending constant.

Bond, 1991). Since this bias is much larger than the convergence coefficient itself, the inclusion of country fixed effects might lead to an overestimation of the convergence coefficient (Barro, 2015). Moreover, Nerlove (2000) shows that this bias not only affects the convergence coefficient, but also the estimates of the coefficients of all variables that are correlated with the level of GDP. The exclusion of country fixed effects enables us to capture a convergence process conditional only on the control variables. Thus, countries converge to the productivity frontier if these control variables converge to those of the country at the technology frontier. If country fixed effects are included, what is measured empirically is the deviation from country averages and not the long-run growth effect. There is a trade-off between the Hurwicz bias and the omitted variable bias.

This paper uses two different methods to estimate the effect of the size and the structure of public spending on GDP per capita. The first approach employs an OLS estimation with year fixed effects but without country fixed effects. This approach is better than an alternative estimator with country fixed effects when the omitted variable bias is small. Since the estimation includes a large set of control variables, then it is a better strategy than including country fixed effects. The second approach controls for unobserved country characteristics. This approach includes country fixed effects, but the convergence coefficient is constrained to be equal to the one estimated in the regression without country fixed effects. This second approach has two main advantages: it controls for country unobserved characteristics, and it avoids the risk of a Hurwicz-type bias for the convergence coefficient.

To strike a balance between the importance of the omitted variable bias and the convergence bias, it is relevant to look at the correlation between the public spending data and some country-specific characteristics (**Table 2**). The correlation is low for most variables regard-

less of the sample of countries included. The different specifications in this paper include a large set of controls, including the rule of law index, which shows the strongest correlation with the public finance variables. Moreover, given the stability of the coefficient estimates, with and without the large set of control variables and regardless of the inclusion of country fixed effects or not, it can be reasonably assumed that the omitted variable bias is not a major issue in the estimation strategy.

Hence, the estimation without country fixed effects is the better approach because it captures the impact of fundamental cross-country differences in the design of public finance on economic growth. Indeed, most public finance items vary only very slowly over time within a country, suggesting that cross-country heterogeneity is much larger than within-country variability (**Table 3**). The estimated coefficient for government size may capture structural differences of spending policies across countries, which may not be captured by a country fixed-effects estimation. Since the estimation without country fixed effects exploits both between- and within-country variability, the standard errors of the coefficient estimates are lower.

Another potential bias is that the estimation with ordinary least squares (OLS) may be subject to reverse causality, especially in the case of estimation with yearly data. Endogeneity may occur due to business cycle effects and Wagner's law, or the tendency for government expenditure to increase at higher levels of GDP per capita (Easterly and Rebelo, 1993; Knepper, Bleaney, and Gemmell, 1999). Wagner's law suggests that the increase in income may result in higher political pressure for social programs. This should lead to a positive link between the size of the government and growth, going against the negative effect of government size found in the current study and in most previous papers (see Bergh and Henrekson, 2011, for a literature review).

TABLE 2 >>**Correlation between Public Spending Items and Country-specific Factors**

	Rule of law	Years of schooling	Cognitive skills	Quality + years of schooling	Employment protection	Credit ratio
Total sample						
Public spending size	0.58***	0.29***	0.46***	0.36***	0.37***	0.22***
Education	0.36***	0.15***	0.26***	0.20***	0.15***	0.18***
Health	0.65***	0.41***	0.49***	0.46***	0.21***	0.44***
Other wages and intermediate consumption	0.55***	0.48***	0.59***	0.54***	0.33***	0.32***
Old-age and survivor pensions	0.29***	0.13***	0.39***	0.21***	0.47***	0.20***
Sickness and disability	0.67***	0.39***	0.57***	0.48***	0.27***	0.25***
Unemployment benefits	0.53***	0.07*	0.44***	0.19***	0.21***	0.19***
Family and children	0.66***	0.34***	0.50***	0.41***	0.13***	0.17***
Subsidies	0.36***	0.08**	0.23***	0.13***	0.27***	0.21***
Public Investment	0.25***	0.22***	0.37***	0.30***	0.23***	0.29***
Other primary expenditure	-0.60***	-0.43***	-0.60***	-0.54***	-0.23***	-0.43***
Latin American countries						
Public spending size	0.11	0.35***	0.23***	0.38***	0.12	0.11
Education	0.09	0.01	0.28***	0.11	0.23***	-0.06
Health	0.44***	0.32***	0.49***	0.43***	-0.16**	0.24***
Other wages and intermediate consumption	-0.12	0.26***	-0.05	0.22***	0.13	-0.05
Old-age and survivor pensions	0.27***	0.46***	0.42***	0.53***	0.12	0.14*
Sickness and disability	-0.06	-0.06	-0.14*	-0.10	-0.37***	0.16**
Unemployment benefits	0.04	0.18**	0.09	0.19**	0.04	0.02
Family and children	0.61***	0.47***	0.56***	0.59***	0.13	0.27***
Subsidies	-0.04	0.34***	-0.02	0.29***	0.36***	-0.13*
Public Investment	-0.21***	0.07	-0.34***	-0.04	0.24***	0.07
Other primary expenditure	-0.13*	-0.20**	-0.04	-0.19**	-0.23***	0.13*

Note: Expenditure items are measured as shares of GDP. Source: Calculations are based on combined IDB/OECD database on public spending. Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%).

TABLE 3 >>**Between- and Within-country Variability of Public Spending Items**

Item	Variable	Share of between-country variance in total variance		
		Total	OECD	LA
Total	Public spending size	92	88	86
1	Education	86	88	78
2	Health	88	80	90
3	Other wages and intermediate consumption	90	74	88
4	Old-age and survivor pensions	90	88	94
5	Sickness and disability benefits and services	92	88	90
6	Unemployment benefits	88	84	80
7	Family and child benefits and services	94	94	72
8	Subsidies	74	74	68
9	Public investment	64	56	66
10	Other primary expenditure	84	86	68

Note: Expenditure items are measures as shares of GDP. Between-country variance measured as the intraclass correlation).
Source: Calculations based on combined IDB/OECD database on public spending.

To attenuate this bias, this paper uses cyclically adjusted spending items whenever possible⁵ and includes a short-term dynamic control for investment. The short-term dynamic measure is included to control for the fact that countries with low investment are also the ones where investment is progressing more rapidly. This short-term dynamic control for investment is even more important when the sample of countries included in the estimation is not homoge-

nous and includes both middle- and low-income countries, such as Latin American countries.

⁵ While the data from OECD provided cyclically adjusted items for the relevant spending variables, we failed to obtain similar adjusted variables from the IDB database. However, only items 6 and 10 are subject to business cycles. Since Latin American countries do not spend much on these items, it may not be important to use non-cyclically adjusted items in our estimations.



DATA

The public spending indicators are constructed from a combined IDB/OECD database. The OECD Public Finance dataset is a recent effort to bring together a detailed breakdown of fiscal data designed for the analysis of the effect of public finance on growth and equity (Bloch et al., 2016). The OECD dataset started from earlier work on fiscal consolidation for which a single-year data file was constructed (Cournède, Goujard, and Pina, 2013). It provides a breakdown of fiscal items by policy area and includes time variation, cycle variation, and structural factors that affect the quality of public finance. In parallel to the OECD Public Finance dataset, a more recent effort by the IDB extended the same data for 13 Latin American countries (Argentina, Brazil, Chile, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Mexico, Panama, Peru, Paraguay, and Uruguay). The OECD data covers a larger period. While OECD countries have data between 1985 and 2014, Latin American countries only have data for the period between 1995 and 2015.

For each expenditure item, the database has approximately 550 observations for all years and countries for the OECD sample, compared to 170 observations for Latin American countries. This yields a sample of approximately 700 observations between 1985 and 2017 for each expenditure item. Aggregate public spending data are available for about 850 combinations of years and countries. To our knowledge, this is the largest database on public spending where data are available for each expenditure item.

Public expenditure is classified into 10 primary expenditure items plus interest payments (**Table 1**). The OECD Public Finance dataset is based on several data sources. Specifically, subsidies, public investment, total public expenditure, and interest payments are taken from the OECD Economic Outlook Database based on the National Accounts. Spending on education, health, sickness and disability, pensions, unemployment benefits, family and child benefits and other wages, and intermediate consumption expenditure are from the

National Accounts Classification of the Functions of Government (COFOG). Where data are missing, imputations are done. Detailed information about this database can be found in Annex 1 of Bloch et al. (2016).

The main idea behind the choice of this breakdown is related to the theoretical impact of different public expenditure items on economic growth. Indeed, the breakdown distinguishes between public spending that provides a production input, such as education and public investment, and other current expenditure, such as subsidies and survivor pensions. It should be noted that the items do not overlap. For instance, physical investment in health, such as building a new hospital, is included in the public investment item. Thus, the health spending item only focuses on current health spending, which is mainly made up of health care workers' wages and subsidies.⁶ Similarly, most education spending goes to wages. For example, in 2015 Argentina spent 6.5 percent on education (5.1 percent on salaries, 0.3 percent on capital).

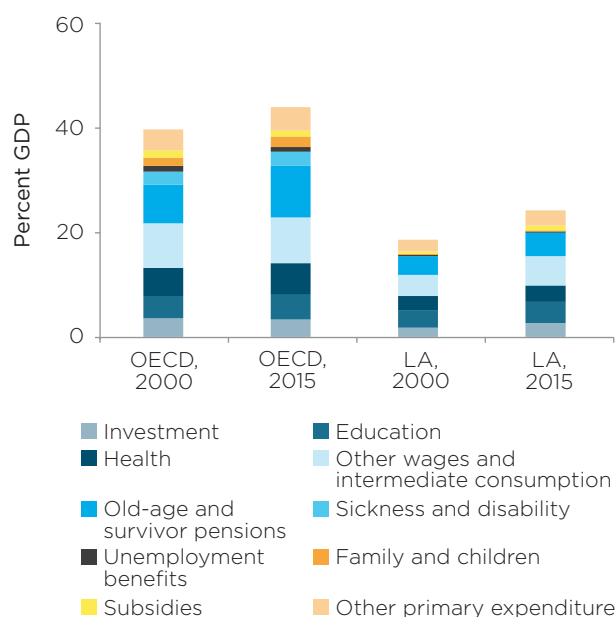
The public expenditure database is based on several existing data sources, including the OECD Economic Outlook databases and the Classification of the Functions of Government (COFOG) SNA2008 database. The extension produced by the IDB is instead directly based on government data. Expenditure categories are based on crossed economic-functional classifications, following the methodology used by the OECD. However, the classifications used by Latin American countries are not homogeneous, and many of them have not yet adopted COFOG. Thus, only 13 countries could be included and, in some of them, the full detailed spending classification could not be analyzed as in the case of OECD countries.

A few items of public expenditure are sensitive to business cycles. This is the case for items 6 and 10 (unemployment benefits and other primary expenditure, respectively). These spending items are cyclically adjusted for all OECD

countries using the methodology of Price, Dang, and Botev (2015).⁷

Total spending relative to GDP differs greatly between OECD and Latin American countries⁸ (Figure 2). While on average, OECD countries devoted 40 percent of their GDP to public spending,

Figure 2 >> **Structure of Spending in OECD and Latin American countries, 2000 vs. 2015 (average % of GDP)**

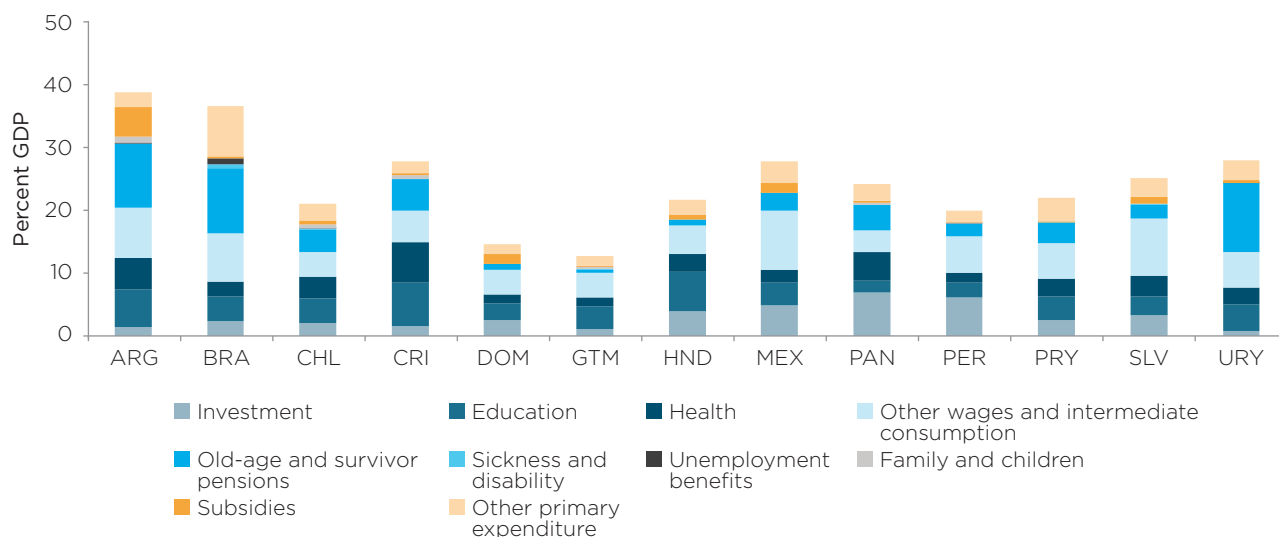


Source: Authors' calculation based on Penn World Tables 9.0.

⁶ Expenditures not explicitly reported in Table 1, like defense or justice, are mainly included in item 3, 'other wages and intermediate consumption,' following the methodology of Bloch et al. (2016).

⁷ Unfortunately, it is not possible to make the same adjustment for Latin American countries since data for potential GDP is lacking for most developing countries. However, given that these countries only spend a very low proportion in such items, the lack of a specific adjustment is not an issue for our analysis. Moreover, we are more focused on other items, such as education, investment, pensions, and subsidies, which are less affected by these cycles.

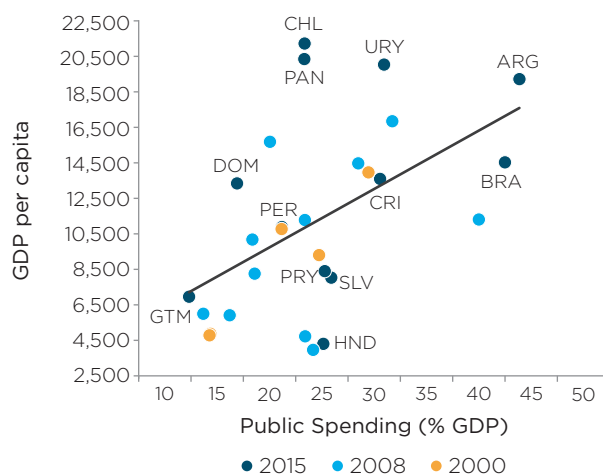
⁸ Chile and Mexico were not included in the OECD category to be counted only in the Latin American countries group.

Figure 3 >> **Structure of Spending in Individual Latin American countries (% of GDP)**

Source: Authors, based on combined IDB/OECD database.

Note: Data for 2013. The figure shows cyclically adjusted spending items. ARG = Argentina, BRA = Brazil, CHL = Chile, CRI = Costa Rica, DOM = Dominican Republic, SLV = El Salvador, GTM = Guatemala, HND = Honduras, MEX = Mexico, PAN = Panama, PER = Peru, PRY = Paraguay, URY = Uruguay.

ding in 2000, its share increased to roughly 45 percent in 2015. The 13 Latin American countries in the sample increased spending from 19 percent in 2000 to 24 percent in 2015. However, there is a large heterogeneity in the size of total spending in Latin America countries (**Figure 3**). Some countries devote more than 25 percent of their GDP to public spending (i.e., Argentina, Brazil, Costa Rica, El Salvador, Mexico and Uruguay), while others, such as the Dominican Republic and Guatemala, spend less than 15 percent of the GDP on public spending. The remaining countries—Chile, Honduras, Panama, Peru, and Paraguay—are somewhere between the two extremes (**Figure 4**). Some countries dramatically increased their spending. In Argentina, for example, public spending grew from 29 percent to 43 percent of GDP in this period. In Chile, the change was more modest: public spending rose from 21 percent of GDP in 2005 to only 23 percent by 2016.

Figure 4 >> **Total Government Spending in Latin American countries (% of GDP) and GDP Per Capita**

Source: Authors, based on combined IDB/OECD database.
Note: Coefficient of correlation = 0.52 (28 observations).

Public investment represents about 3.5 percent of the GDP for OECD countries. In comparison, Latin American countries devote less than 2.7 percent.

Finally, we construct a novel human capital variable as the interaction between years of schooling and quality proxied by a newly constructed dataset that harmonizes school achievement tests from different sources for OECD and Latin American countries. The quality of education variable is proxied by mean PISA scores in OECD countries. Since PISA is not surveyed in all Latin American countries, the Latin

American Laboratory for Assessment of the Quality of Education (LLECE), Trends in International Mathematics and Science Study (TIMSS), and Progress in International Reading Literacy Study (PIRLS) scores are harmonized with PISA (Altinok, Angrist, and Patrinos, 2018). The globally comparable achievement outcomes were constructed by linking standardized, psychometrically robust international and regional achievement tests. It is a newly updated dataset of 163 countries including 18 Latin American countries covering more than 95 percent of the region's population.



RESULTS

The empirical strategy first estimates the standard convergence growth model using only the factors of production and physical and human capital investment on economic growth. The model is extended to include the size of government spending (total underlying primary spending to GDP) and the composition of primary spending. Moreover, some robustness checks are provided to test for the stability of results when additional restrictions are made.

4.1. Baseline Results

The estimated standard growth equations (**Table 4a**) show significant positive effects of the production factors on growth and plausible convergence rates. According to the “iron law of convergence,” countries converge to the productivity frontier at about 2 percent per year (Barro, 2015), which is roughly the rate estimated in the regressions. Thus, it takes approximately 35 years to close half of the initial GDP per capita

gap. The coefficients estimated directly through the model ϕa_j are the effects of the j variable on the yearly growth rate. The long-run steady-state coefficients (a_j) can be recovered as ratios of the estimated coefficient to the negative of the convergence coefficient and express the effect of the j variable over the long-run GDP per capita.

The elasticity of the investment rate is positive and significant: a 1 percent increase in the investment rate would increase the long-run level of GDP per capita by close to 1.2 percent (0.025/0.021).⁹ The theoretical effect for total investment derived from the prediction of Solow (1956) assuming the widely believed capital share to be 0.3 would predict, according to the formula, $0.3/(1-0.3)$ an elasticity equal to 0.43. However, the estimated average

⁹ The specification in Table 4a column 2 includes a large set of controls such as openness, population size, average rule of law, average employment protection, credit ratio, and old-age dependency ratio. The inclusion of these controls does not affect either the human capital or the investment variable, although the breadth of the effect is reduced (by about one-fifth).

capital share for years 1995 to 2015 and most of the countries in the database of this paper is 0.49, in which case the elasticity would be 0.96 closer to 1.¹⁰ Besides, based on national accounts, labor shares appear *prima facie* to be lower in developing countries than in developed countries (Gollin, 2002). There is also substantial evidence suggesting that the labor share is declining all over the world. There is growing consensus about the decline of the labor share in developed countries, particularly during the 2000s (Autor et al., 2017; IMF, 2017). The labor share seems to have also declined in developing countries, but its evolution has been more heterogeneous. Karabarbounis and Neiman (2014) argue that the rapid advance in technology has affected factor shares through reductions in the relative price of investment goods, lowering firms' cost of capital and giving them incentives to replace labor. All in all, the current elasticity of GDP per capita to investment for Latin America is close to 1. This underscores the importance of investment to promote growth in Latin America, the effect of which is potentially larger than in developed countries and has been growing along with the growth in the share of capital in these economies.

The estimated effect of human capital proxied by school attainment interacted with quality is always significant, regardless of whether control variables are included. The human capital coefficient is the long-term elasticity of GDP per capita to human capital;¹¹ a 1 percent increase in human capital would increase the long-run level of GDP per capita by nearly 1.1 percent (0.024/0.021). As suggested by Krueger and Lindahl (2001), the effects of the level of human capital on growth may be partly an indirect effect of the influence of the level of human capital on other factors, such as the quality of institutions or governance effectiveness. Thus, an estimation with many institutional controls may yield a downward bias for the human capital coefficient. Therefore, this paper uses a parsimonious strategy to avoid potential estimation bias in different specifications. The Uzawa (1965) and Lucas (1988) growth models

predict that the coefficient on the level of human capital (proxied by education) should be equal to one in the long run. The results of this paper confirm the results from these models, in line with recent empirical findings by Fournier and Johansson (2016) and Arnold, Bassanini, and Scarpetta (2011). Moreover, Baldacci et al. (2008) show a significant and positive effect on growth of human capital, measured only as educational attainment without adjusting for education quality.

Human and physical capital coefficients are not strictly comparable in **Table 4a** because the variables use different units of measurement. However, a variable can be standardized by subtracting from it its mean and then dividing by its standard deviation. After being standardized, the variable has a mean of zero and a standard deviation of one, and the regressor whose coefficient is the highest in absolute value will have the greatest impact on the dependent variable. **Table 4b** shows the same regression as **Table 4a**, but human capital and physical capital variables are standardized. These coefficients are the long-term semi-elasticity of GDP per capita to each of these factors of production. Hence, an increase of one standard deviation in human capital has a long-term effect of 31.6 percent (0.006/0.019) in GDP per capita.¹² This

¹⁰ Authors' calculations based on The Conference Board Total Economy Database.

¹¹ Taking a simple example and assuming that only human capital impacts growth, the growth equation in the steady state converges to the log GDP per capita depending on the factors of production, in this case, only on human capital. That is,

$$\ln(y_{it}) = -\phi [\ln(y_{it-1}) - a_1 \ln(\text{human capital}_{it-1})],$$

in the steady state, hence: $y_{it} = y_{it-1}$,

$$0 = -\phi [\ln(y_{it}) - a_1 \ln(\text{human capital}_{it-1})], \text{ and then}$$

$$\ln(y_{it}) = a_1 \ln(\text{human capital}_{it-1}),$$

¹² Additionally, it is difficult to prove with this panel data the complementarity of physical and human capital because the complementarity depends on economics sectors, type of work (skilled-unskilled), but the results show that both are equally important to economic growth.

TABLE 4A **Growth Regression: The Role of Input Factors (in Logs) and Government Size**

Dependent variable: annual growth of GDP per capita	(1) Full	(2) Full	(3) OCDE	(4) LA	(5) Full	(6) Full	(7) OCDE	(8) LA
Production function								
$\ln(\text{GDP pc}_{it-1})$	-0.021*** (0.003)	-0.016*** (0.004)	-0.026*** (0.007)	-0.005 (0.011)	-0.017*** (0.003)	-0.016*** (0.004)	-0.027*** (0.006)	-0.016 (0.014)
$\ln(\text{Human capital}_{it-1})$	0.024*** (0.006)	0.021*** (0.006)	0.003 (0.010)	0.022* (0.011)	0.024*** (0.006)	0.021*** (0.006)	0.010 (0.009)	0.039** (0.015)
$\ln(\text{Inv}_{it-1}/\text{GDP}_{it-1})$	0.025*** (0.007)	0.021*** (0.007)	0.017** (0.007)	0.024 (0.018)	0.021*** (0.006)	0.018*** (0.006)	0.010 (0.007)	0.033* (0.018)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$	0.224*** (0.039)	0.219*** (0.036)	0.217*** (0.043)	0.178*** (0.052)	0.219*** (0.037)	0.213*** (0.035)	0.208*** (0.042)	0.178*** (0.048)
Control variables								
Openness _{it-1}		0.007 (0.006)	0.015** (0.006)	-0.022 (0.022)		0.006 (0.006)	0.013** (0.006)	-0.000 (0.024)
$\ln(\text{population size})_{it-1}$		0.001 (0.001)	0.002* (0.001)	-0.007 (0.005)		0.001 (0.001)	0.002** (0.001)	0.001 (0.007)
Average rule of law _{it-1}		0.001 (0.002)	0.005 (0.003)	0.002 (0.006)		0.004 (0.003)	0.010*** (0.004)	0.002 (0.005)
Average employment protection _{it-1}		0.001 (0.002)	-0.001 (0.003)	0.002 (0.008)		0.002 (0.002)	0.001 (0.002)	-0.011 (0.010)
Credit ratio _{it-1}		-0.005 (0.005)	0.001 (0.006)	-0.035 (0.052)		-0.014** (0.006)	-0.009 (0.007)	-0.056 (0.048)
Old-age dependency ratio _{it-1}		-0.059 (0.038)	-0.102** (0.040)	-0.112 (0.177)		0.023 (0.034)	-0.001 (0.036)	0.167 (0.287)
Public spending variables								
Spending to GDP ratio _{it-1}					-0.036** (0.015)	-0.066*** (0.019)	-0.078*** (0.017)	-0.080* (0.042)
Countries	42	42	29	13	42	42	29	13
Observations	934	934	772	162	934	934	772	162
Adjusted R-squared	0.555	0.562	0.626	0.516	0.563	0.575	0.639	0.526
Country FE	no	no	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016	2016	2016	2016

Source: Authors' elaboration.

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients.

Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters.

means that GDP per capita would be 31.6 percent higher than the counterfactual of an unchanged human capital. In the case of physical investment,

the long-term effect is 26 percent (0.005/0.019). The human capital coefficient appears to be larger than the physical investment coefficient, but

TABLE 4B >>**Growth Regression: The Role of Input Factors (Standardized) and Government Size**

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)
Production function				
$\ln(\text{GDP pc}_{it-1})$	-0.019*** (0.003)	-0.015*** (0.004)	-0.015*** (0.003)	-0.014*** (0.004)
Human capital _{it-1}	0.006*** (0.002)	0.005*** (0.002)	0.005*** (0.002)	0.005*** (0.002)
$\text{Inv}_{it-1}/\text{GDP}_{it-1}$	0.005*** (0.001)	0.004*** (0.001)	0.004*** (0.001)	0.004*** (0.001)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$	0.224*** (0.038)	0.219*** (0.036)	0.220*** (0.037)	0.214*** (0.035)
Control variables				
Openness _{it-1}		0.007 (0.007)		0.006 (0.006)
$\ln(\text{population size})_{it-1}$		0.001 (0.001)		0.001 (0.001)
Average rule of law _{it-1}		0.003 (0.002)		0.005* (0.003)
Average employment protection _{it-1}		0.001 (0.002)		0.002 (0.002)
Credit ratio _{it-1}		-0.007 (0.005)		-0.015** (0.006)
Old-age dependency ratio _{it-1}		-0.054 (0.036)		0.023 (0.034)
Public spending variables				
Spending-to-GDP ratio _{it-1}			-0.030* (0.015)	-0.063*** (0.019)
Countries	42	42	42	42
Observations	934	934	934	934
Adjusted R-squared	0.552	0.559	0.558	0.571
Country FE	No	no	no	no
Year FE	Yes	yes	yes	yes
Latest year	2016	2016	2016	2016

Source: Authors' elaboration.

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters.

they are not statistically different when using a student's t-test. Therefore, it is not rejected that both variables have a similar and relevant effect

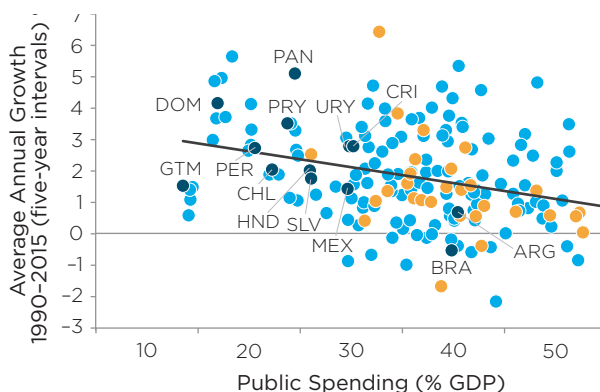
on economic growth. It is important to highlight this, since there is a tendency in the literature on physical investment to emphasize *only* this aspect

to foster growth. Similarly, the literature on human capital only emphasizes the increase and improvement of the quality of human capital.¹³

Government spending as a share of GDP is also added onto the specification to estimate the effect of public spending on economic growth. Governments in rich economies spend on average 40 percent of their GDP on the provision of public goods, services, and transfers. While some countries (e.g., Denmark) devote more than 52 percent of their GDP to public spending, others (e.g., South Korea) allocate only a quarter of the GDP to these expenditures. In developing countries, the variability of public spending is greater. In LA, countries such as Brazil and Argentina spend about 40 percent of their GDP on public goods, services, and transfers, while countries such as Guatemala and the Dominican Republic spend less than 15 percent. Figure 5 and Table 4a columns 3 and 4 present the relationship between government size and economic growth for the period 1975 to 2016. They show alternative estimations on the effect of government size on economic growth. The results in column 3 indicate a negative and significant effect of government size on economic growth. Even when control variables are added (column 4), the coefficient associated with government size is not only significant, but its breadth is roughly doubled, indicating that the potential endogeneity issue matters mainly when institutional variables are not controlled for.¹⁴ In sum, the results indicate that an increase in government spending by about 1 percentage point would decrease growth by about 0.03 to 0.06 percent per year, and a long-term effect of a decrease by about 2 to 4.5 percent in GDP per capita.¹⁵ In addition, estimated separately, the results from columns 7 and 8 tend to confirm that government size is negatively and significantly correlated with economic growth both for OECD and Latin American countries when included separately.

However, countries with the same size of government may obtain significantly different

Figure 5 >> **Government Expenditure and Economic Growth (1990–2015)**



Source: Authors' elaboration based on combined IDB/OECD database.

Note: In blue, values for 2010–2015 for Latin America countries. Coefficient of correlation = -0.32 (173 observations).

levels of economic growth. Several factors may explain these differences: complementarities may still exist between the size of government and other policies and institutions, affecting this relationship. For example, Freeman (1995) analyzed the case of Sweden and showed that the mix of growth-friendly structural policies with a high level of trust in public institutions may offset the adverse growth effect of a

¹³ It is important to analyze both types of investment together since sustained growth requires continued investment in both factors: continued investment in technology is profitable only because human capital is growing, and continued investment in human capital is worthwhile only because technology is growing (Stokey, 2017).

¹⁴ Omitted variable bias can also mitigate the real effect of public spending on economic growth.

¹⁵ This negative relationship corroborates main findings in the literature. Bergh and Henrekson (2011) show that the most recent studies find a significant negative correlation: an increase in government size by 10 percentage points is associated with a 0.5% to 1% lower annual growth rate. A recent OECD study also found a negative relationship between public spending and GDP growth in a sample of OECD countries (Fall and Fournier (2015)).

large government sector. Confirming Freeman's (1995) results, Fournier and Johansson (2016) find that there is an adverse effect of government size on growth where government effectiveness is low. On the contrary, in countries with high government effectiveness, no negative growth effects are found for large governments.

The World Bank's Worldwide Governance Indicators (WGI) database provides indicators

on the perception of various aspects of the governments' capacity to implement and formulate policies. They include government effectiveness, voice and accountability, political stability, control of corruption, and regulatory quality. To test the hypothesis that the impact of the size of government on growth may vary according to the effectiveness of the public sector, in **Table 5**, the size of government is interacted with various

TABLE 5
The Role of Government Size and Interaction with Governance Effectiveness

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)
Production function					
$\ln(\text{GDP}_{it-1})$	-0.018*** (0.004)	-0.018*** (0.004)	-0.015*** (0.004)	-0.017*** (0.004)	-0.014*** (0.004)
$\ln(\text{Human capital}_{it-1})$	0.025*** (0.004)	0.023*** (0.005)	0.024*** (0.004)	0.027*** (0.005)	0.026*** (0.006)
$\ln(\text{Inv}_{it-1}/\text{GDP}_{it-1})$	0.015** (0.007)	0.014** (0.006)	0.013* (0.007)	0.015** (0.007)	0.016** (0.007)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$	0.165*** (0.019)	0.166*** (0.019)	0.166*** (0.019)	0.164*** (0.019)	0.167*** (0.020)
Public spending & governance variables					
Spending to GDP ratio $_{it-1}$ (a)	-0.103*** (0.023)	-0.096*** (0.020)	-0.103*** (0.023)	-0.108*** (0.021)	-0.074*** (0.022)
Interaction (a) + (b ₁)	0.047** (0.018)	0.053*** (0.016)	0.075*** (0.021)	0.050*** (0.014)	0.024 (0.020)
Government effectiveness (b ₁)	-0.014* (0.008)				
Voice and accountability (b ₂)		-0.017** (0.007)			
Political stability (b ₃)			-0.026*** (0.008)		
Control of corruption (b ₄)				-0.016** (0.006)	
Regulatory quality (b ₅)					-0.007 (0.009)
Dummy for Latin America (c)	-0.054** (0.023)	-0.028* (0.015)	-0.017 (0.015)	-0.057*** (0.016)	-0.019 (0.014)
Interaction (a) + (c)	0.226** (0.099)	0.117* (0.059)	0.062 (0.060)	0.244*** (0.073)	0.082 (0.061)

(continued on next page)

TABLE 5 >> (continued)**The Role of Government Size and Interaction with Governance Effectiveness**

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)
Interaction (b) _i + (c)	0 (0.013)	0.015 (0.010)	0.032*** (0.012)	-0.003 (0.013)	0.005 (0.011)
Interaction (a) + (b) _i + (c)	0.035 (0.053)	-0.024 (0.034)	-0.093** (0.043)	0.052 (0.051)	-0.014 (0.033)
Countries	40	40	40	40	40
Observations	704	704	704	704	704
Adjusted R-squared	0.673	0.675	0.682	0.678	0.666
Country FE	No	No	no	no	no
Year FE	Yes	Yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016

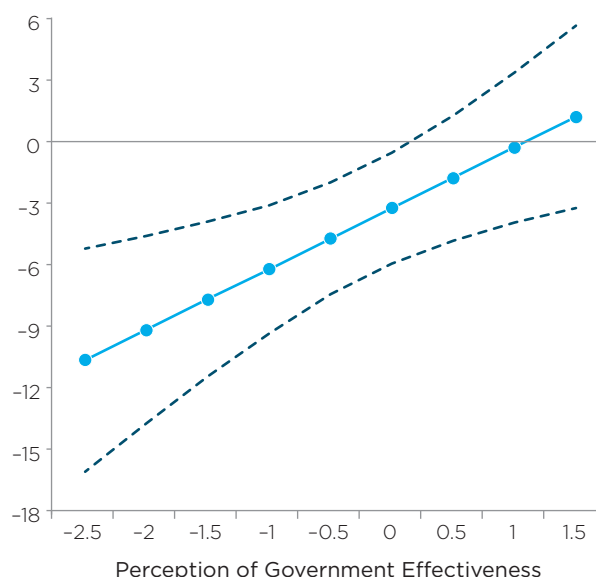
Source: Authors' elaboration.

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters. Control variables are included, but not shown for saving space. All results can be found in Table A.4.

indicators from the WGI database. Following the methodology of Afonso and Jalles (2011), each governance indicator is included separately. In addition, these indicators are interacted with a dummy variable for Latin American countries because the sample of Latin American countries may be subject to reverse causality, since more growth may induce more government effectiveness. The effect of government size is negative and significant in all estimations, and the interaction between government size and government effectiveness variables has a positive and significant effect on economic growth.

As **Figure 6** shows, the adverse effect of the size of public spending on economic growth is mitigated in countries with higher government effectiveness. After controlling for government effectiveness, an increase of one percentage point of public spending would have an impact on GDP per capita that could be much worse than the average effect of -4.5 percent¹⁶

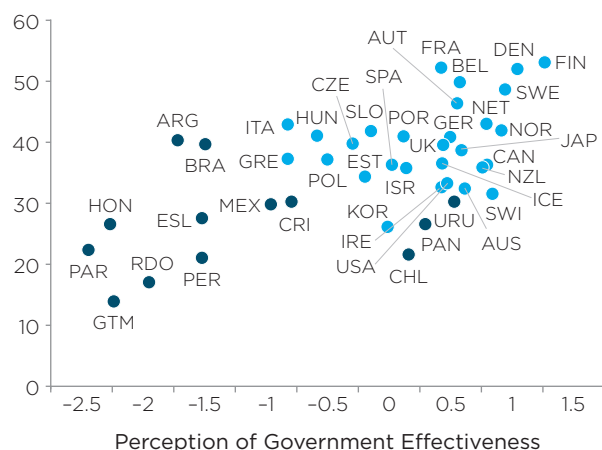
¹⁶ When government effectiveness takes a value of zero, then the effect of government size is similar to that found in Table 4a, of about 4.5 percent.

Figure 6 >> **Marginal Effect of Public Spending on GDP Per Capita on Government Effectiveness**

Source: Authors' elaboration based on combined IDB/OECD database.

Note: The dashed lines indicate the 95 percent confidence interval.

Figure 7 >> **Size of Government and Citizens' Perception of its Effectiveness, 2013**



Source: Authors, based on combined IDB/OECD database.
Note: Red markers are Latin American countries.

(including control variables), reaching a marginal effect of -10 percent for countries with the lowest effectiveness in the sample and reaching a positive effect of increasing government spending to 1 percent in the long-term for developed countries such as the Scandinavian countries (**Figure 7**).

Other dimensions of governance besides effectiveness are tested. Effects of voice and accountability, control of corruption, and political stability appear to be important for the relationship between public spending and economic growth (Table 5, columns 2 to 4). All these variables are standardized, so their coefficients are comparable. The political stability index has the largest effect, whereas governance effectiveness, voice and accountability, and the control of corruption have a similar effect on reducing the negative effect of the government spending size. Trust in the government is a key ingredient behind citizen demands; when lack of trust is high—either due to government inefficiency or blatant corruption—citizens prefer transfers

over long-term investment. This political equilibrium could be highly detrimental for growth and development, since everybody may end up shortchanging the future with lower investments in both physical and human capital (Izquierdo, Pessino, and Vuletin, 2018).

Spending allocation, which is how allocative efficiency is (or is not) achieved, also affects economic growth. **Table 6**¹⁷ shows the effect of different allocative spending mixes on economic growth. All regressions control for the size of public spending. Results are shown only for those spending items that present significant effects or for aggregated items.¹⁸ Given that each regression includes the size of government and one spending share, the estimates provide the effect of increasing this kind of spending while decreasing spending on the remaining items to keep the spending-to-GDP ratio unchanged. Moreover, similar to **Table 4** and **5**, all regressions include a large set of control variables used in the literature to avoid omitted variable bias.

After controlling for the effect of the factors of production and for the size of government,¹⁹ the effect of public investment on economic growth is still significant but with a much lower effect on growth than private investment. An increase in the share of public investment in primary spending by one percentage point would increase long-term GDP per capita by about 2.9 percent (0.05/0.17). Since the average share of public investment in primary spending is equal to 10.3 percent, this effect corresponds to a rise in public investment of about 9.7 percent (1/10.3). Hence, the actual elasticity of public investment

¹⁷ The investment rate is replaced by the private investment rate in the regressions that include public investment to avoid double counting.

¹⁸ Results for all items can be found in Appendix Table A.6, Table A.7, and Table A.8.

¹⁹ Now, one of the original factors of production is private investment instead of total investment over GDP, since public investment as a share of spending is added in specification (1).

TABLE 6 
Growth Regression:
The Role of Spending Mix

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)
Production function			
$\ln(\text{GDP pc}_{it-1})$	-0.017*** (0.003)	-0.015*** (0.003)	-0.013*** (0.003)
$\ln(\text{Human capital}_{it-1})$	0.023*** (0.005)	0.027*** (0.004)	0.026*** (0.004)
$\ln(\text{Inv Priv}_{it-1}/\text{GDP}_{it-1})$	0.011** (0.004)		
$\Delta \ln(\text{Inv Priv}_{it}/\text{GDP}_{it})$	0.144*** (0.014)		
$\ln(\text{Inv}_{it-1}/\text{GDP}_{it-1})$		0.023*** (0.005)	0.017*** (0.006)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$		0.180*** (0.014)	0.172*** (0.013)
Public spending variables			
Spending to GDP ratio $_{it-1}$	-0.035** (0.015)	-0.047*** (0.016)	-0.040*** (0.013)
Public Investment $_{it-1}$	0.051*** (0.018)		
Wages (Health and Education) $_{it-1}$		-0.011 (0.010)	
Pensions and subsidies $_{it-1}$			0.000 (0.007)
Countries	42	39	39
Observations	816	583	670
Adjusted R-squared	0.690	0.761	0.746
Country FE	no	no	no
Year FE	yes	yes	yes
Latest year	2016	2016	2016

Source: Authors' elaboration.

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters. Control variables are included, but not shown for saving space. All results can be found in Table A.5.

to GDP per capita is 0.3 (2.9/9.7), implying that a 1 percent increase in public investment increases GDP per capita in about 0.3 percent in the

long run.²⁰ This is an average of the elasticity in OECD and Latin American countries: in fact, the elasticity is less than 0.2 percent in Latin America and close to 0.5 percent in the OECD, as in Fournier (2016). This reflects the much lower efficiency of public investment in Latin America noted in several empirical studies including the IMF (2015), which estimates that a 1 percent of GDP increase in public investment increases output by just 0.3 percent for countries in the bottom efficiency quartile but by 0.6 percent for countries in the top efficiency quartile. Overall, public investment as a share of total investment and its impact on growth are lower in Latin America than in the OECD. It would be important to increase its efficiency while increasing its share to spur growth.

On the other hand, education, health, and other spending reflect mainly wages of public officials (teachers, health workers, etc.), since public investment includes actual investment in the education and health sectors. An increase in government spending in these sectors is equivalent to an increase in public wages and does not increase growth once the equation controls for the quality of human capital. Hence, the global public policy that countries should increase spending on education as a percentage of GDP to promote human capital and growth is quite misleading, since it would have no effect if it were not accompanied by an increase in the quality of that spending (e.g., with tests showing higher achievement). The estimation results suggest that spending on quality public investment and on improving the quality of human capital, rather than on wages, pensions, and subsidies, can boost long-term economic growth.

The lack of significance for some spending items, reflecting more current spending than

²⁰ This long-run elasticity (0.3) should be compared to the long-run elasticity of private investment (0.6), rather than the long-run elasticity of total investment (1.2), because they are estimated with different model specifications.

capital spending, may be related to non-linear effects. **Table A.8** presents an additional analysis where current spending items are added as a quadratic term. This allows for the possibility of turning points and differential effects regarding some threshold value. Results show that for some items, like old-age and survivor pensions (column 5) or disability and sickness (column 6), a significant U-shaped (i.e., quadratic) relationship can be found. Indeed, the positive effects are very mild in the first years and turn negative after a few periods.

Hence, while allocative efficiency among spending components is important for growth, when considering high-quality human capital rather than higher spending on education, total investment, and quality spending on infrastructure, a government that is too big or that spends heavily on transfers may reduce growth. How can governments make room in their budgets to increase human and physical capital expenditures? One way is by decreasing leakages in transfers, corruption in public procurement, and the high public sector wage premium in the region. In LA, when these inefficiencies are added up, they amount to approximately 4.4 percent of GDP (Izquierdo, Pessino, and Vuletin, 2018). Governments can also shift their expenditures, mainly on transfers, particularly those that are less effective in reducing extreme poverty and inequality.

The findings in this section show that both high-quality human and physical capital matter for economic growth. Human capital is found to be positively correlated with economic growth when it is a measure of the stock of education adjusted for the quality dimension (i.e., quality-adjusted years of schooling). Government size is negatively associated with economic growth. When spending is done efficiently (i.e., with higher government effectiveness), public spending can have a positive effect on economic growth. Public investment is important for growth, especially when it is of high quality;

spending on wages, or on pensions and subsidies, does not contribute to economic growth. In the next section, some additional robustness tests are performed to check the stability of the coefficients.

4.2. Robustness check

As noted previously, three potential sources of endogeneity arise in this growth regression. The first is reverse causality, since growth may affect government size or vice versa, and the cyclicity of some public expenditure items may generate a potential reverse causality problem. Some variables may be omitted, such as some country characteristic correlated with an included relevant variable; and there may be temporary measurement errors in the independent variables. First, to deal with potential reversal causality issues, an IV estimation is performed. Second, country-fixed effects are used to purge any country specific characteristic from the analysis. Third, five-year interval regressions are performed to reduce the effect of business cycle.

IV estimations for government size are presented in **Table 7**. The instruments used are the second period lags of government size, human capital, and physical capital. The argument for using these instruments is that although current values might be endogenous to growth, it is unlikely that past values of these variables are subject to the same problem. Moreover, the use of these lags helps to alleviate problems of temporary measurement errors.

The under-identification tests show that none of the instruments are irrelevant. However, a weak identification test cannot be used because there are three endogenous variables and country-clustered errors. Thus, we can only show that all F-tests of excluded instruments are rejected, these tests show that in each first stage, each instrument is not a weak instrument, nevertheless, due to the strong positive serial correla-

TABLE 7 >>

Robustness Check: Government Size, IV and Country Fixed Effects

Dependent variable: annual growth of GDP per capita	(1) Full	(2) OECD	(3) LA	(4) Full	(5) OECD	(6) LA
Production function						
$\ln(\text{GDP pc}_{it-1})$	-0.015*** (0.004)	-0.027*** (0.006)	-0.012 (0.015)	-0.021(c) —	-0.021(c) —	-0.021(c) —
$\ln(\text{Human capital}_{it-1})$	0.023*** (0.006)	0.013 (0.008)	0.042** (0.017)	0.000 (0.012)	-0.007 (0.014)	0.131* (0.067)
$\ln(\text{Inv}_{it-1}/\text{GDP}_{it-1})$	0.009 (0.006)	0.002 (0.006)	0.028** (0.013)	0.016 (0.011)	0.014 (0.011)	0.046 (0.036)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$	0.212*** (0.036)	0.204*** (0.044)	0.196*** (0.044)	0.205*** (0.036)	0.201*** (0.042)	0.193*** (0.057)
Control variables						
Openness _{it-1}	0.007 (0.005)	0.013** (0.006)	0.008 (0.025)	0.005 (0.007)	0.008 (0.006)	0.022 (0.056)
$\ln(\text{population size})_{it-1}$	0.001 (0.001)	0.002* (0.001)	0.002 (0.007)	0.027 (0.027)	-0.014 (0.025)	0.096 (0.085)
Average rule of law _{it-1}	0.003 (0.003)	0.010*** (0.003)	0.000 (0.003)	— —	— —	— —
Average employment protection _{it-1}	0.002 (0.002)	0.002 (0.002)	-0.010 (0.011)	— —	— —	— —
Credit ratio _{it-1}	-0.014** (0.006)	-0.009 (0.006)	-0.056 (0.041)	— —	— —	— —
Old-age dependency ratio _{it-1}	0.007 (0.036)	-0.011 (0.038)	0.183 (0.278)	— —	— —	— —
Public spending variables						
Spending to GDP ratio _{it-1}	-0.070*** (0.019)	-0.080*** (0.016)	-0.093** (0.041)	-0.115*** (0.037)	-0.140*** (0.032)	0.140 (0.189)
Countries	42	29	13	42	29	13
Observations	892	743	149	934	772	162
Estimation method	IV	IV	IV	Cons. OLS	Cons. OLS	Cons. OLS
Adjusted R-squared	0.604	0.66	0.616	0.804	0.835	0.811
Country FE	no	no	no	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016	2016
Kleibergen-Paap rank LM – under identification test (p-value)	< 0.001	< 0.001	0.02	—	—	—
F test of excluded instruments (p-value) ^a	< 0.001	< 0.001	< 0.001	—	—	—

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters. “Cons. OLS” = “Constrained OLS estimation” where we constrain the coefficient of convergence to be equal to 2.1 percent. ^aStock and Yogo (2005) critical values are not useful with clustered errors, hence the test assumes conditional homoskedasticity of the error term. The Olea Montiel and Pflueger (2013) test allows for heteroskedastic and autocorrelated errors, but this test is only for one endogenous regressor. Thus, we only can show that all F-tests of excluded instruments are rejected. These tests show that in each first stage, each instrument is not a weak instrument, but we cannot perform a global weak instrument test.

tion, weak instruments tend not to be a problem in this context (Barro, 2015).²¹ Control variables are included but not instrumented because the availability of real panel data is complicated in such institutional variables. The results in **Table 7**, column 1, are similar in most respects to the OLS results (**Table 4a**), except that the estimated coefficient of the investment ratio is no longer statistically significant different from zero. This result is likely to reflect the joint short-run determination of GDP with investment (Barro, 2015). Hence, the effect of government size on economic growth remains negative and significant. The restriction to the samples of OECD or Latin American countries confirms the negative effect of government size on economic growth similar to the results found in **Table 4a**.

In addition, a control for country fixed effects is performed. As was explained in Section 3, the convergence coefficient is constrained to be equal to the level found in column 1 of **Table 4a** (i.e., 0.021). Similar to the results found in the literature, the impact of government size on growth

is more significant in the specifications with country fixed effects. However, in this case, the estimated coefficients of the investment ratio and human capital are no longer statistically significant different from zero. This is a consequence of most of the variability of investment rate and human capital are across countries. Therefore, the country fixed effects drastically reduce the variability (there is insufficient within-country variation) and eliminate some control variables because of multicollinearity.

Table 8 provides the results for the effect of the spending mix on economic growth. The lag of each public expenditure item is added as an instrument. Neither the IV estimation (columns 1 to 3) nor the country fixed-effect (columns 4 to 6) estimations change the overall effect of either public investment, wages, or pensions and subsidies.

²¹This approach still relies on serial independence of the error terms and also maintains the assumption that lagged values of the X variables do not directly influence the dependent variable (Barro 2015).

TABLE 8 >>

Robustness Checks: Spending Mix, IV and Country Fixed Effects

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)
Production function						
$\ln(\text{GDP}_{pc,t-1})$	-0.013*** (0.003)	-0.015*** (0.003)	-0.016*** (0.003)	-0.021 (c) —	-0.021 (c) —	-0.021 (c) —
$\ln(\text{Human capital}_{it-1})$	0.027*** (0.004)	0.030*** (0.004)	0.025*** (0.005)	0.016 (0.014)	0.039 (0.024)	0.024*** (0.005)
$\ln(\text{Inv}_{it-1}/\text{GDP}_{it-1})$	0.013** (0.006)	0.018*** (0.006)	0.005 (0.005)	0.004 (0.010)	0.018* (0.009)	0.011** (0.004)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$	0.167*** (0.014)	0.178*** (0.014)	0.139*** (0.014)	0.161*** (0.013)	0.168*** (0.014)	0.145*** (0.014)
Control variables						
Openness _{it-1}	-0.004* (0.003)	-0.005* (0.003)	0.001 (0.003)	0.008 (0.006)	0.004 (0.006)	0.001 (0.004)
$\ln(\text{population size})_{it-1}$	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)	0.031 (0.023)	0.027 (0.024)	0.001 (0.001)

(continued on next page)

TABLE 8  (continued)**Robustness Checks: Spending Mix, IV and Country Fixed Effects**

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)
Average rule of law _{it-1}	0.003 (0.002)	0.004 (0.003)	0.004* (0.002)	-0.239 (0.195)	-0.208 (0.206)	0.005*** (0.002)
Average employment protection _{it-1}	0.000 (0.001)	-0.000 (0.001)	0.002* (0.001)	0.036 (0.026)	0.039 (0.028)	0.001 (0.001)
Credit ratio _{it-1}	-0.019*** (0.005)	-0.016*** (0.005)	-0.016*** (0.004)	0.344 (0.284)	0.293 (0.300)	-0.015*** (0.005)
Old-age dependency ratio _{it-1}	-0.028 (0.034)	-0.019 (0.037)	0.011 (0.034)	3.757 (3.027)	3.323 (3.212)	0.035 (0.028)
Public spending variables						
Spending to GDP ratio _{it-1}	-0.040*** (0.014)	-0.038** (0.018)	-0.036** (0.015)	-0.070** (0.035)	-0.104** (0.052)	-0.035** (0.015)
Pensions and subsidies _{it-1}	0.006 (0.007)			-0.013 (0.028)		
Wages _{it-1}		-0.0071 (0.011)			0.017 (0.034)	
Public Investment _{it-1}			0.052** (0.021)			0.053*** (0.017)
Countries	39	39	42	39	39	42
Observations	639	555	786	670	583	816
Estimation method	IV	IV	IV	Cons. OLS	Cons. OLS	Cons. OLS
R-squared	0.747	0.766	0.693	0.795	0.812	0.716
Country FE	no	no	no	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016	2016
Kleibergen-Paap rank LM – under-identification test (p-value)	< 0.001	< 0.001	< 0.001	—	—	—
F test of excluded instruments (p-value) ^a	< 0.001	< 0.001	< 0.001	—	—	—

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters. “Cons. OLS” = “Constrained OLS estimation” where we constrain the coefficient of convergence to be equal to 2.1 percent. The investment rate is replaced for the private investment rate in the regressions that include public investment to avoid double counting. ^aStock and Yogo (2005) critical values are not useful with clustered errors, the test assumes conditional homoskedasticity of the error term, additionality, the Olea Montiel and Pflueger (2013) test allows for heteroskedastic and autocorrelated errors, but this test is only for one endogenous regressor; hence, we only can show if all the F test of excluded instruments are rejected, these test show that in each first stage, each instrument is not a weak instrument; but we cannot perform a global weak instrument test.

Finally, in **Table A.9** (in the appendix), a five-year interval estimation is performed because just controlling using cyclically adjusted items may not

be sufficient to control for endogeneity; the drawback of these estimations is the drastic reduction of observations; however, the main results hold.

4.3. Simulation of growth effects of public spending reforms

This section makes some simulations to illustrate the potential impact of a change in the factors of production and, more importantly, on the size and the structure of public spending. The simulations consider the impact of a change in the size of inputs or expenditure on the long-run level of GDP per capita. The end of the time horizon in these simulations is 2065. As the convergence rate is close to 2 percent, it takes a very long time to reach the long-term effect. The effect after 50 years of a reform that is phased in instantaneously represents roughly two-thirds of the long-term effect.²² Growth gains are interpreted as how much higher the

GDP per capita would be if the country implemented the reform, relative to a counterfactual without the reform.²³

Table 9 presents the levels of inputs in 2015 (columns 1 to 4) for each country. Four countries present the highest investment in human capital (Argentina, Chile, Mexico, and Panama) while investment in physical capital is highest in Panama and lowest in Guatemala. Then, three alternative scenarios for the input factors are simulated. In each scenario, the human capital and the physical capital investment levels converge to differ-

²² $e^{-\phi t} = e^{-0.02 \times 50} \cong 2/3$.

²³ For example, a 50% growth gain in Guatemala's GDP per capita by 2065 implies that Guatemala's GDP per capita would grow 0.8 additional percentage points per year until 2065.

TABLE 9 >>

Growth Simulations: Long-Term GDP Effects of Alternative Scenarios for Inputs

Country	Level of inputs in 2015				1) Scenario 1: Top country of LA				2) Mean top half of the sample (LA)				3) Mean top half of the sample (FULL)			
	Schooling years	Education quality	Human Capital	Physical Capital	Human Capital	Physical Capital	Total		Human Capital	Physical Capital	Total		Human Capital	Physical Capital	Total	
Argentina	10	417	40	16	4	91	95	—	44	44	40	38	79			
Brazil	9	430	37	18	14	79	93	7	32	38	50	26	77			
Chile	10	447	44	24	—	55	55	—	8	8	36	2	39			
Costa Rica	8	449	35	20	17	71	88	9	23	33	53	18	71			
Dom. Rep.	8	376	32	24	27	55	82	20	8	27	63	2	66			
El Salvador	8	405	33	14	23	103	126	16	56	71	59	50	109			
Guatemala	5	403	21	13	62	107	169	55	60	114	98	54	152			
Honduras	6	395	25	24	48	55	103	41	8	48	84	2	87			
Mexico	9	440	40	22	5	60	65	—	12	12	42	7	49			
Panama	9	404	38	44	11	—	11	3	—	3	47	—	47			
Paraguay	8	392	30	16	33	88	121	25	41	66	69	35	104			
Peru	8	417	34	23	20	57	77	13	9	22	56	4	60			
Uruguay	8	445	37	20	11	71	82	3	24	27	47	18	65			

Source: Authors' elaboration.

rent targets. In the first scenario, the target is the top country of Latin America for each input factor (Chile and Panama, respectively); in the second scenario, the target is the average level of countries in the top half of the Latin America sample; in the third scenario, the target is the average level of countries in the top half of the full sample. Input factors will gradually converge to these levels, where the reform is phased in over 50 years. The third scenario seems to be a good benchmark for Latin American countries in the long-run converging to the mean top half of the full sample.²⁴

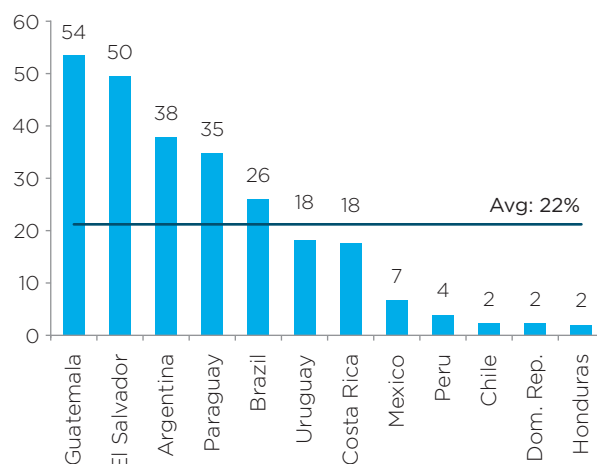
Using this last scenario and based on results from **Table 4a** (column 2) that the long-term effect of human capital or physical capital investment on GDP per capita is equal to 1.3 percent, the gains in GDP per capita vary across countries depending on their initial starting point. The countries with the most room for growth gains by increasing investment on physical capital (with a selected target for the investment rate of 24.3 percent of GDP) are Guatemala (54 percent), El Salvador (50 percent), Argentina (38 percent), Paraguay (35 percent) and Brazil (26 percent) (see **Figure 8**); instead, using also simulation (iii), increasing human capital would produce more growth gains in Guatemala (98 percent), Honduras (84 percent), Paraguay (69 percent), Dominican Republic (63 percent) and El Salvador (59 percent), (see **Figure 9**).

Regarding the size of government spending, **Table 10** shows the simulation on growth for each country where the primary spending to GDP ratio is above the average level of countries in the bottom half of the full sample, spending will gradually decline to this level (28.5 percent of GDP²⁵). Argentina and Brazil have

²⁴ Table 9 shows the remaining scenarios mentioned in the text that are less demanding than the third scenario, and that can be used for less demanding targets.

²⁵ This target is an average of spending between some developed countries and some Latin American countries which have a low public spending-to-GDP ratio, such as Chile (23%), Panama (23%), Peru (21%), Dominican Republic (17%) and Guatemala (12%).

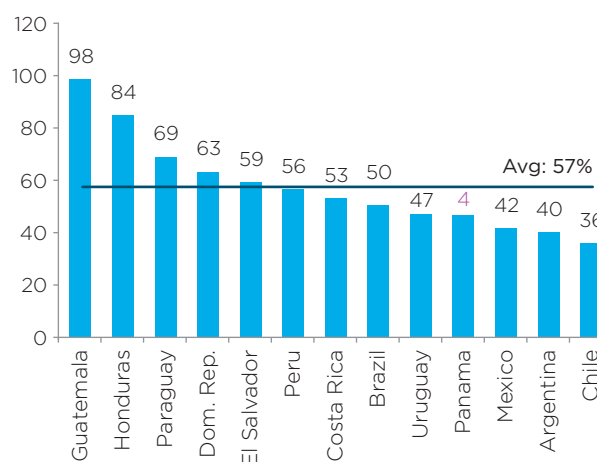
Figure 8 >> **Growth Simulations: Long-Term GDP Effects of Physical Capital Converging to Mean Top Half of the Sample**



Source: Authors' elaboration.

Note: The horizontal line is the average growth gain for LA.

Figure 9 >> **Growth Simulations: Long-Term GDP Effects of Human Capital Converging to Mean Top Half of the Sample**



Source: Authors' elaboration.

Note: The horizontal line is the average growth gain for LA.

TABLE 10 
Growth Simulations: Long-Term GDP Effects of Government Size and Government Effectiveness

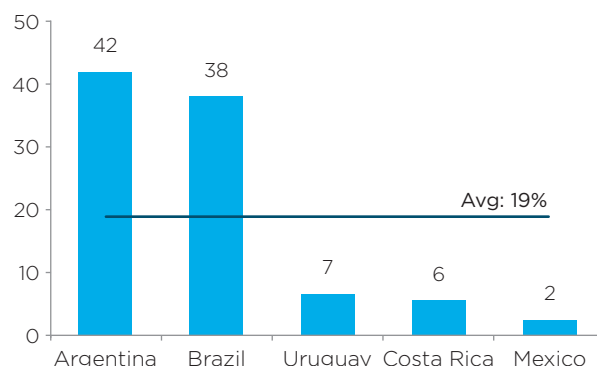
Country	Government size in % of GDP (2015)	Reach the bottom half of the sample on government size	Reach the top half of the sample on government effectiveness
Argentina	44	42	168
Brazil	42	38	170
Chile	23	—	12
Costa Rica	31	6	62
Dom. Rep.	17	—	—
El Salvador	26	—	59
Guatemala	12	—	—
Honduras	25	—	71
Mexico	29	2	64
Panama	23	—	30
Paraguay	25	—	76
Peru	21	—	27
Uruguay	31	7	56
Mean	27	19	72

Source: Authors' elaboration.

the most room for increasing their level of GDP per capita (42 and 38 percent respectively) by reducing the size of their government spending (see **Figure 10**).

However, what would be the potential outcome of an alternative reform that increases government effectiveness for certain levels of spending? If the worse-performing countries gradually converge to the average level of effectiveness of the top half of the full sample (close to the average government efficiency of Australia and Germany), and using the results provided in **Table 5**, in countries where government size is high, the expected gains from improving government effectiveness magnify economic growth.

Figure 10 
Growth Simulations: Long-Term GDP Effects of Physical Capital Converging to Mean Top Half of the Sample



Source: Authors' elaboration.

Note: The horizontal line is the average growth gain for LA.

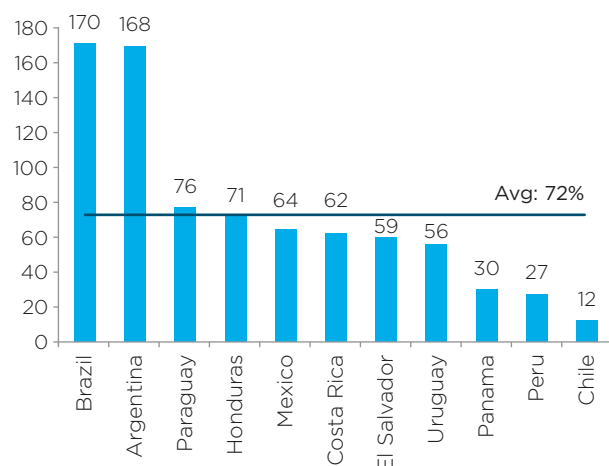
Growth gains would increase by about 170 percent in Argentina and Brazil, and 72 percent on average in Latin America (see **Figure 11**).²⁶ Moreover, as **Figure 6** shows, in countries with low government efficiency, the negative impact of the size of public spending on growth is much larger. In contrast, in other countries of the region, the adverse effects of having large governments are offset by having relatively well-functioning governments. For example, in Chile and Panama (see **Figure 11**), which have relatively high efficiency, increasing the size of public spending would not affect long-term GDP per capita.

Finally, **Table 11** shows the potential growth gains from convergence of the share of public investment to spending to the mean of the top half of the Latin American countries (16 percent share of primary spending).²⁷ The simulated

²⁶ Obviously, these results should be analyzed with caution since there may be some bias due to reverse causality, because countries with a larger size of public spending would benefit more from increasing government efficiency and vice versa.

²⁷ The mean of the top half of the full sample is 12.8 percent.

Figure 11 ➤ **Growth Simulations: Long-Term GDP Effects of Government Effectiveness Converging to Mean Top Half of the Sample**



Source: Authors' elaboration.

Note: The horizontal line is the average growth gain for LA.

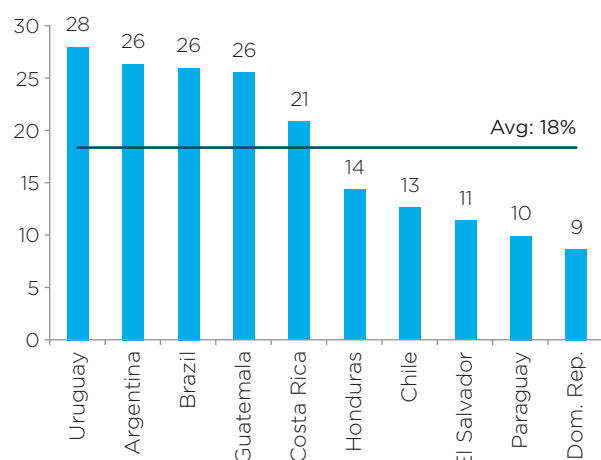
increase in public investment spending boosts GDP per capita on average by about 18 percent, with more space for growth gains in Uruguay (28 percent), Argentina (26 percent), Brazil (26 percent), Guatemala (26 percent), and Costa Rica (21 percent) (see **Figure 12**). Note that if public investment efficiency or quality could be boosted to OECD levels, the effect on GDP per capita could be substantially increased.

The summary of the simulations performed in this section is presented in **Table 12**, which shows which countries would experience the largest growth gains for each reform that brings them closer to the target of the best countries in that indicator. The main findings that emerge from the analysis are the following. First, gains in long-run GDP per capita from increasing the level of human capital investment (57 percent) are triple those from increasing physical capital investment (22 percent) to the level of each factor to the mean top half of the sample. This reflects the fact

TABLE 11 ➤ **Growth Simulations: Long-Term GDP Effects of Alternative Scenarios for Spending Allocation**

Country	Level of spending in 2015 (as a share of primary spending, %)		1) Top/bottom country of LA		2) Mean top/bottom half of the sample (LA)	
	Public Investment	Pensions and Subsidies	Public Investment	Pensions and Subsidies	Public Investment	Pensions and Subsidies
Argentina	3	36.2	43.8	10.5	26.4	8.2
Brazil	3.2	28.5	43.5	8.1	26	5.8
Chile	9.9	18.7	30.2	5.1	12.7	2.8
Costa Rica	5.8	16.9	38.4	4.6	20.9	2.3
Dom. Rep.	11.9	12.3	26.2	3.2	8.7	0.9
El Salvador	10.5	11.7	28.9	3	11.5	0.7
Guatemala	3.4	7.2	43.1	1.6	25.6	—
Honduras	9	2.3	31.9	0.1	14.4	—
Mexico	22.3	14.9	5.3	3.9	—	1.6
Panama	16.4	19.2	17.1	5.3	—	3
Paraguay	11.2	15.3	27.5	4.1	10	1.8
Peru	24.9	8.7	—	2	—	—
Uruguay	2.2	38.5	45.5	11.2	28	8.9

Figure 12 **»** **Growth Simulations: Long-Term GDP Effects of Public Investment Converging to Mean Top Half of the Latin America Sample**



Source: Authors' elaboration.

Note: The horizontal line is the average growth gain for Latin America.

that Latin American countries are further away from convergence to developed levels of human capital. Second, some Latin American countries (El Salvador, Guatemala, Paraguay) have a large investment gap in both physical and human capital or in increasing its quality. Other countries, such as Argentina and Brazil, have a large gap in achieving the average levels of physical investment of the top half of the sample (which, in this case, includes not only developed countries but also the largest investors in LA, such as Chile, Honduras, and Panama); while Honduras and Dominican Republic, without gaps in physical capital, have the highest gaps in human capital of the countries analyzed. Third, Argentina and Brazil exhibit the largest growth gains for reducing public spending and for increasing government efficiency because, until 2015, they had the largest governments in the region. Finally, an increase of public investment as a share of primary spending compared to the target would increase growth in the average Latin American

TABLE 12 **»** **Growth Simulations: Long-Term GDP Effects of Alternative Reform Scenarios**

Policy	Growth	Countries with the most room for growth gains ^a	Average growth gains for LA
Increasing investment	+	Guatemala, El Salvador, Argentina, Paraguay and Brazil	22%
Increasing human capital	+	Guatemala, Honduras, Paraguay, Dominican Republic and El Salvador	57%
Decreasing the size of government	+	Argentina and Brazil	19%
Increasing government effectiveness	+	Brazil, Argentina and Paraguay	72%
Increasing public investment	+	Uruguay, Argentina, Brazil, Guatemala and Costa Rica	18%

Source: Authors' elaboration.

^a Countries with the most room for growth gains are those whose effect on GDP per capita is larger than the average Latin America effect.

SELECTED TARGETS:

Investment	top half of the full sample
Human capital	top half of the full sample
Size of government	bottom half of the full sample
Government effectiveness	top half of the full sample
Public investment	top half of the sample LA

country by 18 percent, but would benefit Uruguay, Argentina, Brazil, Guatemala, and Costa Rica the most because they have the lowest initial levels. If

the efficiency of public investment could be doubled as in OECD countries, the growth effects would also double.



CONCLUSIONS

This paper uses a novel dataset on physical and human capital and detailed public spending that includes, for the first time, Latin American countries. It contains a cross-classification that provides a breakdown of government expenditure into both economic and functional headings. This database covers 42 countries of the OECD and LA, between 1985 and 2017.

Latin American governments suffer from both technical and allocative inefficiencies. Technical inefficiency is related to not doing things in the best way, given the available resources. Allocative efficiency, a matter largely disregarded in the region, aims to prioritize among alternative spending items based on evidence and to allocate expenditure to those programs with the highest rates of return. Budgets across different types of expenditure are typically allocated according to historical standards, regardless of where an additional dollar would be most useful. Latin American countries have had difficulty growing steadily with their own resources. Governments have a key role to play in avoid-

ing waste and in efficiently allocating their expenditures to achieve higher growth without undermining equity. Most of the theoretical and empirical literature on these matters focuses almost exclusively on technical efficiency, assuming that spending allocations are either optimal or too difficult to change. This paper sheds light on how allocating spending to investment in quality human and physical capital and avoiding waste in inefficient spending improves growth in Latin America, and by how much. It also provides evidence on which countries would benefit the most from different public expenditure reforms.

Physical investment and human capital investment have a similar long-run elasticity of somewhat more than 1 percent on GDP per capita. Moreover, the elasticity of GDP to total investment is higher than that estimated by Solow, making it even more important for governments to boost this factor of production. But it is important to highlight that increasing both physical capital investment and quality human

capital investment are equally important for the average country to foster growth and that their complementarity requires their parallel increase to maximize growth. As noted by Heckman and Yi (2012), complementarities between human and physical capital forge the huge early growth in China.

In addition, the amount of government spending and the technical and allocative efficiency of such expenditure have very important effects on growth. After controlling for the direct effect of the factors of production and for the size of government, the effect of public investment on economic growth is still significant, but with a much lower effect on growth than private investment. This reduction in the size of the elasticity is even more pronounced for Latin American countries: while elasticity of public investment is about 0.2 for Latin American countries, it is more than double for OECD countries, and is about half of the elasticity of private investment. This reflects the much lower efficiency of public investment in LA. Overall, public investment as a share of total investment, and its impact on growth, is lower in Latin America than in the OECD. It would be important to increase its efficiency while increasing its share to spur growth.

In contrast, an increase in education and health spending (which mainly consists of wages of public officials—teachers, health workers, and others—since public investment already includes all the actual investment in these sectors) does not increase growth once the equation controls for quality of human capital. Hence, the global public policy that countries should increase spending on education as percentage of GDP to promote human capital and growth is quite misleading; since it would not have any effect if it were not accompanied by an increase in the quality of that spending (i.e., with higher achievements tests). The estimation results suggest that spending on quality public investment and on improving the quality of human capital rather than on wages, pensions and subsidies

can boost long-term economic growth. Moreover, the overall effect of the size of public spending on economic growth is negative, but the more effective the government, the less harmful the government size for long-term growth.

These are average effects on growth of a common percentage increase in inputs of production, public spending, or effectiveness. To calculate which factors or which spending should be prioritized for the different Latin American countries based on their initial starting point and the gap they have with the target of the average of the best countries in the sample, the paper constructed simulated increases in human capital, physical capital, and a particular public spending item to close each gap. For instance, the simulated increase in total investment to 24.7 percent would increase the average level of GDP per capita by about 22 percent in Latin American countries but with much larger effects in some of them (e.g., Argentina, El Salvador, Guatemala, and Paraguay). From a public policy perspective, although the elasticity of growth to investment in physical and human capital is similar, countries should invest relatively more in the factor where they lag furthest behind to achieve allocative efficiency in growth. In fact, in Latin American countries' gains in long-run GDP per capita by increasing the level of human capital investment (57 percent) were triple those achieved by increasing physical capital investment (22 percent). This reflects the fact that Latin American countries are further away from convergence to developed levels of human capital. El Salvador, Guatemala, and Paraguay have a large investment gap in both physical and human capital and in increasing its quality. Argentina and Brazil have a large gap in achieving better levels of physical investment, while Honduras and Dominican Republic have the highest gaps in human capital and should devote relatively more effort to that factor. Regarding public investment spending, Argentina, Brazil, Costa Rica, Guatemala,

and Uruguay²⁸ would realize the largest gains by increasing it from its initial low levels; these gains could be duplicated if this increase were coupled with an increase in its efficiency.

The key policy lesson learned from this research is that when current spending (i.e., wages) is increased at the expense of productive investment, growth decreases. Thus, the way governments allocate their spending determines the long-run level of GDP per capita, and an efficient spending allocation across different areas would help to save resources but, more importantly, to achieve higher growth. This is easier said than done. Short-run-oriented politicians without constraints on their policies would try to maximize current spending to win over the electorate, sacrificing current investment in physical and human capital and jeopardizing growth (Ardanaz and Izquierdo, 2021). One possibility shows that growth-friendly fiscal rules can incentivize investment rather than wages, discouraging procyclical spending in Latin America (Ardanaz et al., 2021).

Another policy implication is that to allocate spending to achieve the highest social return, governments should evaluate the rates of return of different spending allocations. Examples include allocating more spending to human capital rather than physical capital in countries such as the Dominican Republic and Honduras. Independent assessment and evaluations by spending reviews or independent fiscal institutions would point in that direction, providing a medium and long-term vision to short-sighted politicians. The creation of Spending Quality Units within Ministers of Finance or Planning Ministries could help achieve this commitment in the short to medium run. Brazil, Chile, Ecuador, and Panama have recently created such units.

²⁸ In this case the simulation is to increase public investment as a share of spending which not necessarily translates into similar higher public investment as percentage of GDP.

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APPENDIX TABLES & FIGURES

TABLE A.1 
Public Spending Breakdown

Transactions/Function		Social benefits and transfers in kind (D62_D631XX)	Wages (D1)	Intermediate consumption (P2)	Subsidies (TSUB)	Public Investment (IGAA)	Interest payments (YPEPG)	Inventory changes	Capital transfers	Other primary expenditure
Education (090)		1	1	1	8	9	11	10	10	10
Health (070)		2	2	2	8	9	11	10	10	10
Social protection (100)	Sickness and disability (1001)	5	5	5	8	9	11	10	10	10
	Family and children (1004)	7	7	7	8	9	11	10	10	10
	Old age and survivors (1002 + 1003)	4	3	3	8	9	11	10	10	10
	Unemployment (1005)	6	3	3	8	9	11	10	10	10
	Other social protection (1006–09)	10	3	3	8	9	11	10	10	10

(continued on next page)

TABLE A.1  (continued)**Public Spending Breakdown**

Transactions/Function	Social benefits and transfers in kind (D62_D631XX)	Wages (D1)	Intermediate consumption (P2)	Subsidies (TSUB)	Public Investment (IGAA)	Interest payments (YPEPG)	Inventory changes	Capital transfers	Other primary expenditure
General public services (010)	10	3	3	8	9	11	10	10	10
Defense (020)	10	3	3	8	9	11	10	10	10
Public order and safety (030)	10	3	3	8	9	11	10	10	10
Economic affairs (040)	10	3	3	8	9	11	10	10	10
Environment protection (050)	10	3	3	8	9	11	10	10	10
Housing and community amenities (060)	10	3	3	8	9	11	10	10	10
Recreation, culture and religion (080)	10	3	3	8	9	11	10	10	10

Source: Bloch and et al. (2016). The numbers shown in the main body of the table refer to the expenditure items listed in Table 1. The columns in the table refer to national accounts transactions (codes in parentheses refer to SNA COFOG codes or OECD Economic Outlook database codes), while rows show the breakdown by function in the COFOG classification (the codes in parentheses refer to COFOG function codes).

TABLE A.2 >>**Composition of Public Primary Spending by Country**

Country	Education	Health	General Services	Pensions	Sickness And Disabilities	Unemployment	Family	Subsides	Public Investment	Others
Argentina	6.1	5	8.2	10.2	0	0.1	1	4.7	1.3	2.6
Brazil	3.9	2.7	7.9	10.7	0.7	0.9	0	0.5	2.1	7.5
Chile	3.9	3.7	4	3.6	0.1	0.1	0.6	0.7	2.1	2.9
Costa Rica	6.8	6.3	5.1	4.9	0	0	0.7	0.3	1.7	1.9
Dominican Rep.	2.7	1.6	3.9	0.8	0	0	0	1.7	2.7	1.6
El Salvador	3.0	3.2	8.9	2.2	0.4	0	0	1.0	2.8	2.6
Guatemala	3.2	1.2	3.7	0.7	0.1	0	0.2	0.2	1	1.9
Honduras	5.9	2.6	4.5	0.6	0	0	0	0.6	3	2.9
Mexico	3.8	2.2	9.1	2.8	0	0	0.1	1.5	5.3	2.7
Panama	2.1	4.5	3.1	4.2	0	0	0.2	0.3	5.3	3
Paraguay	3.8	3.3	5.9	3.3	0	0	0	0.2	2.6	5.2
Peru	2.6	1.7	5.9	1.9	0	0	0.2	0	5.7	1.8
Uruguay	4.3	2.7	5.6	11	0	0.1	0	0.5	0.7	3.1
Latin America	4	3.1	5.8	4.4	0.1	0.1	0.2	0.9	2.7	3.1
OECD	4.6	6.1	9	9.5	2.8	1	1.8	1.2	3.4	4.4

Source: Bloch et al. (2016) and IDB (2019).

Note: Spending items as a share of GDP, average over 2011 and 2012.

TABLE A.3 
Data Definitions and Sources

Variable	Definition	Source
GDP	Real GDP at constant 2011 national prices (in mil. 2011US\$)	Penn World Table 9.0 (rgdpna)
Population	Population (in millions)	Penn World Table 9.0 (pop)
Years of schooling	Average years of schooling (educational attainment for population aged 15 and over)	Barro and Lee (2013), Data version 2.2
Learning outcomes	Standardized results for learning achievement tests	Lim <i>et al.</i> (2018)
Quality adjusted years of schooling	Combination between years of schooling and learning outcomes	See above
Investment	Gross fixed capital formation (% of GDP)	World Development Indicators (NE.GDI.FTOT.ZS)
Private investment	Gross fixed capital formation, private sector (% of GDP)	World Development Indicators (NE.GDI.FPRV.ZS)
Spending shares	Ratio of various spending items to primary spending, cyclically adjusted when possible	Bloch <i>et al.</i> (2016) and IADB (2018)
Openness	Absolute share of exports and imports as a share of GDP	World Development Indicators (NE.EXP.GNFS.KD & NE.IMP.GNFS.KD)
Inflation	Consumer price inflation (annual %)	World Development Indicators (FP.CPI.TOTL.ZG)
Credit ratio	Private credit by deposit money banks and other financial institutions to GDP (%)	World Development Indicators (GFDD.DI.12)
Employment protection legislation	Employment protection legislation for regular contracts based on the second edition of the OECD indicator	OECD employment database
Government effectiveness	Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	Worldwide Governance Indicators, World Bank
Rule of law	Perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	Worldwide Governance Indicators, World Bank
Regulatory quality	Perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development	Worldwide Governance Indicators, World Bank
Political stability and absence of violence	Perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism	Worldwide Governance Indicators, World Bank
Voice and accountability	Perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media	Worldwide Governance Indicators, World Bank

TABLE A.4

The Role Of Government Size and Interaction with Governance Effectiveness

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Production function										
$\ln(\text{GDP pc}_{it-1})$	-0.016*** (0.004)	-0.017*** (0.004)	-0.014*** (0.004)	-0.015*** (0.004)	-0.013*** (0.004)	-0.018*** (0.004)	-0.018*** (0.004)	-0.015*** (0.004)	-0.017*** (0.004)	-0.014*** (0.004)
$\ln(\text{Human capital}_{it-1})$	0.025*** (0.006)	0.024*** (0.005)	0.027*** (0.005)	0.026*** (0.006)	0.025*** (0.006)	0.025*** (0.004)	0.023*** (0.005)	0.024*** (0.004)	0.027*** (0.005)	0.026*** (0.006)
$\ln(\text{Inv}_{it-1}/\text{GDP}_{it-1})$	0.017** (0.007)	0.016** (0.007)	0.015** (0.007)	0.017** (0.007)	0.018** (0.007)	0.015** (0.007)	0.014** (0.006)	0.013** (0.007)	0.015** (0.007)	0.016** (0.007)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$	0.169*** (0.020)	0.168*** (0.020)	0.169*** (0.020)	0.170*** (0.020)	0.171*** (0.020)	0.165*** (0.019)	0.166*** (0.019)	0.166*** (0.019)	0.164*** (0.019)	0.167*** (0.020)
Control variables										
Openness _{it-1}	-0.000 (0.003)	0.001 (0.003)	-0.001 (0.003)	0.000 (0.003)	-0.000 (0.003)	0.001 (0.003)	0.001 (0.003)	0.000 (0.003)	0.001 (0.003)	-0.000 (0.003)
$\ln(\text{population size})_{it-1}$	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)
Average employment protection _{it-1}	0.001 (0.002)	0.001 (0.001)	0.001 (0.002)	0.001 (0.002)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.002)
Credit ratio _{it-1}	-0.015*** (0.005)	-0.014*** (0.005)	-0.015*** (0.005)	-0.015*** (0.005)	-0.014** (0.005)	-0.016*** (0.006)	-0.015*** (0.005)	-0.016*** (0.005)	-0.018*** (0.005)	-0.015*** (0.005)
Old-age dependency ratio _{it-1}	0.023 (0.046)	0.011 (0.045)	0.008 (0.047)	0.022 (0.045)	0.020 (0.046)	0.080* (0.045)	0.070 (0.048)	0.081 (0.049)	0.097** (0.043)	0.063 (0.047)
Public spending & governance variables										
Spending to GDP ratio _{it-1} (a)	-0.048** (0.019)	-0.050*** (0.017)	-0.046*** (0.018)	-0.048** (0.019)	-0.041** (0.018)	-0.103*** (0.023)	-0.096*** (0.020)	-0.103*** (0.023)	-0.108*** (0.021)	-0.074*** (0.022)
Interaction (a) + (b)	0.000 (0.009)	-0.002 (0.009)	0.007 (0.008)	0.004 (0.010)	-0.001 (0.010)	0.047** (0.018)	0.053*** (0.016)	0.075*** (0.021)	0.050*** (0.014)	0.024 (0.020)
Government effectiveness (b)	0.003 (0.004)					-0.014* (0.008)				

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TABLE A.4  (continued)
The Role Of Government Size and Interaction with Governance Effectiveness

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Voice and accountability (b_2)		0.005 (0.003)					-0.017** (0.007)			
Political stability (b_3)			0.001 (0.003)					-0.026*** (0.008)		
Control of corruption (b_4)				0.001 (0.004)					-0.016** (0.006)	
Regulatory quality (b_5)					0.001 (0.004)					-0.007 (0.009)
Dummy for Latin America (c)						-0.054** (0.023)	-0.028* (0.015)	-0.017 (0.015)	-0.057*** (0.016)	-0.019 (0.014)
Interaction (a) + (c)						0.226** (0.099)	0.117* (0.059)	0.062 (0.060)	0.244*** (0.073)	0.082 (0.061)
Interaction (b_1) + (c)						0.000 (0.013)	0.015 (0.010)	0.032*** (0.012)	-0.003 (0.013)	0.005 (0.011)
Interaction (a) + (b_1) + (c)						0.035 (0.053)	-0.024 (0.034)	-0.093** (0.043)	0.052 (0.051)	-0.014 (0.033)
Countries	40	40	40	40	40	40	40	40	40	40
Observations	704	704	704	704	704	704	704	704	704	704
Adjusted R-squared	0.664	0.667	0.668	0.664	0.662	0.673	0.675	0.682	0.678	0.666
Country FE	no	no	no	no	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters.

TABLE A.5**Growth Regression: The Role of Spending Mix**

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)
Production function						
$\ln(\text{GDP pc}_{it-1})$	-0.017*** (0.003)	-0.015*** (0.003)	-0.013*** (0.003)	-0.016*** (0.003)	-0.016*** (0.004)	-0.015*** (0.003)
$\ln(\text{Human capital}_{it-1})$	0.023*** (0.005)	0.027*** (0.004)	0.026*** (0.004)	0.024*** (0.005)	0.027*** (0.005)	0.022*** (0.005)
$\ln(\text{Inv Priv}_{it-1}/\text{GDP}_{it-1})$	0.011** (0.004)			0.010** (0.004)		
$\Delta \ln(\text{Inv Priv}_{it}/\text{GDP}_{it})$	0.144*** (0.014)			0.143*** (0.014)		
$\ln(\text{Inv}_{it-1}/\text{GDP}_{it-1})$		0.023*** (0.005)	0.017*** (0.006)		0.023*** (0.005)	0.018*** (0.006)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$		0.180*** (0.014)	0.172*** (0.013)		0.181*** (0.014)	0.173*** (0.014)
Control variables						
Openness _{it-1}	0.001 (0.003)	-0.005* (0.003)	-0.005* (0.003)	0.002 (0.003)	-0.005* (0.003)	-0.004 (0.003)
$\ln(\text{population size})_{it-1}$	0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)
Average rule of law _{it-1}	0.004* (0.002)	0.004 (0.003)	0.003* (0.002)	0.004** (0.002)	0.004 (0.003)	0.003* (0.002)
Average employment protection _{it-1}	0.002 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.002 (0.001)	-0.001 (0.001)	-0.000 (0.001)
Credit ratio _{it-1}	-0.016*** (0.004)	-0.017*** (0.005)	-0.020*** (0.004)	-0.017*** (0.004)	-0.017*** (0.005)	-0.019*** (0.004)
Old-age dependency ratio _{it-1}	0.023 (0.033)	-0.011 (0.038)	-0.015 (0.034)	0.043 (0.030)	-0.013 (0.042)	-0.020 (0.032)
Public spending variables						
Spending to GDP ratio _{it-1}	-0.035** (0.015)	-0.047*** (0.016)	-0.040*** (0.013)	-0.032** (0.014)	-0.048*** (0.015)	-0.042*** (0.012)
Public Investment _{it-1} (a ₁)	0.051*** (0.018)			0.075*** (0.021)		
Wages (Health and Education) _{it-1} (a ₂)		-0.011 (0.010)			-0.010 (0.016)	
Pensions and subsidies _{it-1} (a ₃)			0.000 (0.007)			-0.005 (0.007)
Dummy for Latin America (b)				0.011* (0.006)	-0.001 (0.009)	-0.012* (0.006)
Interaction (a ₁) + (b)				-0.050* (0.028)	-0.001 (0.023)	0.031* (0.018)

(continued on next page)

TABLE A.5  (continued)**Growth Regression: The Role of Spending Mix**

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)
Countries	42	39	39	42	39	39
Observations	816	583	670	816	583	670
Adjusted R-squared	0.690	0.761	0.746	0.692	0.761	0.747
Country FE	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016	2016

Source: Authors' elaboration.

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions.

The standard errors are adjusted for country clusters.

TABLE A.6

Spending mix: results for each item added separately

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Production function														
$\ln(\text{GDP pc}_{t-1})$	-0.016*** (0.003)	-0.015*** (0.003)	-0.017*** (0.003)	-0.015*** (0.003)	-0.014*** (0.003)	-0.013*** (0.003)	-0.014*** (0.003)	-0.013*** (0.003)	-0.014*** (0.003)	-0.016*** (0.003)	-0.016*** (0.003)	-0.013*** (0.003)	-0.014*** (0.003)	-0.014*** (0.003)
$\ln(\text{Human capital}_{t-1})$	0.031*** (0.005)	0.028*** (0.005)	0.023*** (0.005)	0.027*** (0.004)	0.023*** (0.004)	0.026*** (0.004)	0.024*** (0.005)	0.026*** (0.004)	0.027*** (0.004)	0.023*** (0.005)	0.024*** (0.004)	0.026*** (0.004)	0.028*** (0.004)	0.028*** (0.004)
$\ln(\text{Inv}_{t-1}/\text{GDP}_{t-1})$	0.017*** (0.004)	0.023*** (0.005)	0.011** (0.004)	0.023*** (0.005)	0.022*** (0.006)	0.017*** (0.006)	0.018*** (0.006)	0.018*** (0.005)	0.018*** (0.005)	0.017*** (0.005)	0.016*** (0.005)	0.017*** (0.006)	0.019*** (0.005)	0.019*** (0.005)
$\Delta \ln(\text{Inv}_{t-1}/\text{GDP}_{t-1})$	0.143*** (0.015)	0.181*** (0.015)	0.144*** (0.014)	0.180*** (0.014)	0.179*** (0.015)	0.172*** (0.013)	0.176*** (0.014)	0.172*** (0.014)	0.177*** (0.014)	0.182*** (0.014)	0.178*** (0.013)	0.172*** (0.013)	0.177*** (0.015)	0.177*** (0.015)
Control variables														
Openness _{t-1}	-0.006* (0.003)	-0.005* (0.003)	0.001 (0.003)	-0.005* (0.003)	-0.004 (0.003)	-0.005* (0.003)	-0.005* (0.003)	-0.004 (0.003)	-0.005* (0.003)	0.002 (0.003)	0.002 (0.003)	-0.005* (0.003)	-0.005* (0.003)	-0.005* (0.003)
$\ln(\text{population size})_{t-1}$	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.000 (0.001)	-0.001* (0.001)	-0.001* (0.001)
Average rule of law _{t-1}	0.004 (0.003)	0.004 (0.003)	0.004* (0.002)	0.004 (0.003)	0.004* (0.002)	0.003 (0.002)	0.004** (0.002)	0.003 (0.002)	0.004* (0.002)	0.003 (0.002)	0.003 (0.002)	0.003* (0.002)	0.003 (0.002)	0.003 (0.002)
Average employment protection _{t-1}	-0.000 (0.001)	-0.000 (0.001)	0.002 (0.001)	-0.001 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.002 (0.001)	0.002* (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Credit ratio _{t-1}	-0.020*** (0.005)	-0.018*** (0.005)	-0.016*** (0.004)	-0.017*** (0.005)	-0.018*** (0.005)	-0.020*** (0.004)	-0.019*** (0.004)	-0.020*** (0.004)	-0.019*** (0.005)	-0.013** (0.005)	-0.013** (0.005)	-0.020*** (0.004)	-0.015*** (0.005)	-0.015*** (0.005)
Old-age dependency ratio _{t-1}	0.010 (0.045)	-0.004 (0.040)	0.023 (0.033)	-0.006 (0.037)	-0.009 (0.034)	-0.018 (0.034)	-0.011 (0.030)	-0.023 (0.030)	-0.012 (0.031)	0.002 (0.034)	0.011 (0.033)	-0.015 (0.034)	-0.027 (0.036)	-0.027 (0.037)
Public spending variables														
Spending-to-GDP ratio _{t-1}	-0.035* (0.018)	-0.043** (0.017)	-0.035** (0.015)	-0.048*** (0.015)	-0.038** (0.014)	-0.040*** (0.013)	-0.045*** (0.013)	-0.034** (0.013)	-0.038** (0.014)	-0.042*** (0.013)	-0.047*** (0.013)	-0.040*** (0.013)	-0.036** (0.015)	-0.036** (0.015)
Productive spending _{t-1}	0.033** (0.015)													
Education _{t-1}		0.018 (0.024)												
Investment _{t-1}			0.051*** (0.018)											

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TABLE A.6  (continued)

Spending mix: results for each item added separately

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Health _{it-1}				-0.029** (0.012)										
Other wages and intermediate consumption _{it-1}					0.032 (0.023)									
Old-age and survivor pensions _{it-1}						0.003 (0.008)								
Sickness and disability _{it-1}							0.024 (0.022)							
Unemployment benefits _{it-1}								-0.014 (0.043)						
Family and children _{it-1}									-0.009 (0.041)					
Subsidies _{it-1}										-0.002 (0.035)				
Property income paid _{it-1}											0.028 (0.029)			
Pensions and subsidies _{it-1}												0.000 (0.007)		
Health and pensions _{it-1}													-0.003 (0.008)	
Health, pensions and subsidies _{it-1}														-0.002 (0.008)
Countries	39	39	42	39	39	39	39	39	39	42	42	39	39	39
Observations	586	590	816	588	556	670	688	646	656	818	841	670	564	564
Adjusted R-squared	0.741	0.760	0.690	0.763	0.765	0.746	0.743	0.741	0.743	0.707	0.701	0.746	0.760	0.760
Country FE	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016

Source:

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters. The investment rate is replaced for the private investment rate in the regressions that include public investment to avoid double counting.

TABLE A.7

Spending mix: results for each item added separately, interactions with Latin American countries

Dependent variable: annual growth of GDP per capita	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Production function													
$\ln(\text{GDP pc}_{t-1})$	-0.016*** (0.003)	-0.016*** (0.003)	-0.015*** (0.003)	-0.012*** (0.003)	-0.014*** (0.003)	-0.015*** (0.003)	-0.014*** (0.003)	-0.014*** (0.003)	-0.016*** (0.003)	-0.016*** (0.003)	-0.015*** (0.003)	-0.014*** (0.003)	-0.014*** (0.003)
$\ln(\text{Human capital}_{t-1})$	0.031*** (0.005)	0.027*** (0.005)	0.027*** (0.005)	0.024*** (0.004)	0.023*** (0.005)	0.023*** (0.005)	0.024*** (0.004)	0.025*** (0.004)	0.023*** (0.004)	0.024*** (0.004)	0.022*** (0.005)	0.027*** (0.005)	0.026*** (0.005)
$\ln(\text{Inv}/\text{GDP}_{t-1})$	0.016*** (0.004)	0.023*** (0.005)	0.022*** (0.006)	0.020*** (0.005)	0.017*** (0.006)	0.018*** (0.006)	0.018*** (0.005)	0.018*** (0.005)	0.017*** (0.005)	0.016*** (0.005)	0.018*** (0.006)	0.019*** (0.005)	0.019*** (0.005)
$\Delta \ln(\text{Inv}/\text{GDP}_{t-1})$	0.142*** (0.015)	0.180*** (0.014)	0.180*** (0.014)	0.177*** (0.015)	0.172*** (0.014)	0.177*** (0.014)	0.170*** (0.014)	0.178*** (0.014)	0.183*** (0.014)	0.178*** (0.014)	0.173*** (0.014)	0.177*** (0.015)	0.177*** (0.015)
Control variables													
Openness _{t-1}	-0.005 (0.003)	-0.005 (0.003)	-0.005* (0.003)	-0.002 (0.003)	-0.005* (0.003)	-0.005* (0.003)	-0.004 (0.003)	-0.005* (0.003)	0.003 (0.003)	0.002 (0.003)	-0.004 (0.003)	-0.005* (0.003)	-0.005* (0.003)
$\ln(\text{population size})_{t-1}$	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Average rule of law _{t-1}	0.004 (0.003)	0.004 (0.002)	0.004** (0.003)	0.003 (0.002)	0.004* (0.002)	0.004** (0.002)	0.004** (0.002)	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)	0.003* (0.002)	0.003 (0.002)	0.002 (0.002)
Average employment protection _{t-1}	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.002 (0.001)	0.002* (0.001)	-0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Credit ratio _{t-1}	-0.020*** (0.005)	-0.019*** (0.006)	-0.017*** (0.004)	-0.015*** (0.004)	-0.020*** (0.004)	-0.020*** (0.004)	-0.020*** (0.004)	-0.019*** (0.005)	-0.012** (0.005)	-0.013** (0.005)	-0.019*** (0.004)	-0.015*** (0.005)	-0.015*** (0.005)
Old-age dependency ratio _{t-1}	0.029 (0.047)	0.007 (0.046)	-0.008 (0.040)	0.005 (0.034)	-0.022 (0.032)	-0.019 (0.030)	-0.021 (0.029)	-0.020 (0.031)	0.005 (0.035)	0.011 (0.033)	-0.020 (0.032)	-0.026 (0.037)	-0.023 (0.038)
Public spending variables													
Spending to GDP ratio _{t-1}	-0.032* (0.018)	-0.044*** (0.016)	-0.048*** (0.015)	-0.028* (0.014)	-0.042*** (0.012)	-0.045*** (0.013)	-0.041*** (0.013)	-0.034** (0.015)	-0.041*** (0.014)	-0.047*** (0.013)	-0.042*** (0.012)	-0.037** (0.015)	-0.037** (0.015)
Dummy for Latin American countries (a)	0.010 (0.009)	0.006 (0.009)	-0.002 (0.007)	0.025** (0.011)	-0.007 (0.005)	-0.003 (0.004)	-0.005 (0.004)	-0.004 (0.004)	-0.001 (0.004)	0.000 (0.004)	-0.012* (0.006)	-0.002 (0.008)	-0.007 (0.009)
Interaction (a) + (b)	-0.024 (0.026)	-0.045 (0.050)	-0.050* (0.028)	-0.087** (0.040)	0.017 (0.019)	-0.022 (0.357)	0.408** (0.188)	0.112 (0.129)	0.087 (0.065)	0.036 (0.467)	0.031* (0.018)	0.005 (0.020)	0.017 (0.019)

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TABLE A.7 *(continued)*

Spending mix: results for each item added separately, interactions with Latin American countries

Dependent variable: annual growth of GDP per capita	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Productive spending (b_1)	0.047** (0.020)												
Education (b_2)	0.045 (0.044)												
Investment (b_3)	0.075*** (0.021)												
Health (b_4)			-0.033* (0.018)										
Other wages and intermediate consumption (b_5)				0.085*** (0.030)									
Old-age and survivor pensions (b_6)					-0.001 (0.008)								
Sickness and disability (b_7)					0.020 (0.021)								
Unemployment benefits (b_8)						-0.021 (0.042)							
Family and children (b_9)							-0.021 (0.041)						
Subsidies (b_{10})								-0.028 (0.041)					
Property income paid (b_{11})									-0.009 (0.466)				
Pensions and subsidies (b_{12})										-0.005 (0.007)			
Health and Pensions (b_{13})											-0.004 (0.011)		
Health, Pensions and Subsidies (b_{14})												-0.008 (0.012)	
Countries	39	39	42	39	39	39	39	39	42	42	39	39	39

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TABLE A.7 >>> (continued)**Spending mix: results for each item added separately, interactions with Latin American countries**

Dependent variable: annual growth of GDP per capita	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Observations	586	590	588	556	670	688	646	656	818	841	670	564	564
Adjusted R-squared	0.741	0.760	0.763	0.769	0.747	0.742	0.742	0.742	0.708	0.701	0.747	0.759	0.760
Country FE	no	no	no	no	no	no	no	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016

Source: Authors' elaboration.

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters. The investment rate is replaced for the private investment rate in the regressions that include public investment to avoid double counting.

TABLE A.8

Robustness checks: results for each item added separately, non-linear test

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Production function														
$\ln(\text{GDP pc}_{t-1})$	-0.016*** (0.003)	-0.015*** (0.003)	-0.017*** (0.003)	-0.015*** (0.003)	-0.013*** (0.003)	-0.012*** (0.003)	-0.014*** (0.003)	-0.013*** (0.003)	-0.013*** (0.003)	-0.016*** (0.003)	-0.016*** (0.003)	-0.012*** (0.003)	-0.013*** (0.003)	-0.013*** (0.003)
$\ln(\text{Human capital}_{t-1})$	0.031*** (0.005)	0.028*** (0.005)	0.023*** (0.005)	0.028*** (0.004)	0.023*** (0.005)	0.025*** (0.004)	0.023*** (0.005)	0.026*** (0.004)	0.025*** (0.004)	0.023*** (0.005)	0.025*** (0.004)	0.025*** (0.004)	0.027*** (0.004)	0.027*** (0.004)
$\ln(\text{Inv}_{t-1}/\text{GDP}_{t-1})$	0.017*** (0.005)	0.023*** (0.006)	0.010** (0.004)	0.022*** (0.005)	0.024*** (0.006)	0.016*** (0.005)	0.018*** (0.006)	0.018*** (0.005)	0.018*** (0.005)	0.017*** (0.005)	0.016*** (0.005)	0.016*** (0.005)	0.019*** (0.005)	0.018*** (0.005)
$\Delta \ln(\text{Inv}_{t-1}/\text{GDP}_{t-1})$	0.143*** (0.015)	0.181*** (0.015)	0.143*** (0.014)	0.179*** (0.014)	0.180*** (0.015)	0.170*** (0.013)	0.177*** (0.014)	0.172*** (0.014)	0.176*** (0.014)	0.182*** (0.014)	0.177*** (0.014)	0.170*** (0.013)	0.176*** (0.015)	0.175*** (0.015)
Public spending variables														
Spending to GDP ratio $_{t-1}$	-0.035* (0.018)	-0.042** (0.017)	-0.036** (0.014)	-0.048*** (0.015)	-0.037*** (0.013)	-0.041*** (0.013)	-0.046*** (0.011)	-0.034*** (0.012)	-0.031** (0.015)	-0.041*** (0.013)	-0.047*** (0.013)	-0.043*** (0.013)	-0.038*** (0.015)	-0.039*** (0.014)
Quadratic term $(b_1)^*(b_1)$	0.036 (0.072)	-0.064 (0.295)	0.209 (0.126)	0.210 (0.175)	-0.499* (0.295)	-0.133* (0.073)	-0.612** (0.293)	0.011 (1.376)	-2.123** (0.808)	0.312 (0.885)	-0.332 (0.254)	-0.163** (0.070)	-0.065 (0.063)	-0.120** (0.055)
Productive spending $_{t-1}(b_1)$	0.012 (0.051)													
Education $_{t-1}(b_2)$		0.039 (0.104)												
Public Investment $_{t-1}(b_3)$			-0.016 (0.048)											
Health $_{t-1}(b_4)$				-0.085 (0.051)										
Other wages and intermediate consumption $_{t-1}(b_5)$					0.270* (0.143)									
Old-age and survivor pensions $_{t-1}(b_6)$						0.055* (0.029)								
Sickness and disability $_{t-1}(b_7)$							0.126** (0.056)							

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TABLE A.8 » (continued)**Robustness checks: results for each item added separately, non-linear test**

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Unemployment benefits (b_8)								-0.015 (0.105)						
Family and children (b_9)									0.194** (0.084)					
Subsidies (b_{10})										-0.039 (0.116)				
Property income paid (b_{11})											0.086 (0.060)			
Pensions and subsidies (b_{12})												0.077** (0.034)		
Health and Pensions (b_{13})													0.039 (0.040)	
Health, Pensions and Subsidies (b_{14})														0.080** (0.038)
Countries	39	39	42	39	39	39	39	39	39	42	42	39	39	39
Observations	586	590	816	588	556	670	688	646	656	818	841	670	564	564
Adjusted R-squared	0.741	0.760	0.692	0.764	0.767	0.748	0.744	0.740	0.745	0.707	0.702	0.749	0.760	0.762
Country FE	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016

Source: Authors' elaboration.

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients. Year fixed effects are included in all regressions. The standard errors are adjusted for country clusters. The investment rate is replaced for the private investment rate in the regressions that include public investment to avoid double counting.

TABLE A.9
Robustness checks: The effect of inputs and government expenditure on economic growth, 5-year interval estimation

Dependent variable: annual growth of GDP per capita	(1)	(2)	(3)	(4)	(5)
Production function					
$\ln(\text{GDP pc}_{it-1})$	-0.011*** (0.004)	-0.010** (0.004)	-0.013*** (0.004)	-0.017*** (0.003)	-0.013*** (0.004)
$\ln(\text{Human capital}_{it-1})$	0.028*** (0.005)	0.029*** (0.005)	0.026*** (0.007)	0.027*** (0.007)	0.025*** (0.006)
$\ln(\text{Inv}_{it-1}/\text{GDP}_{it-1})$	-0.007 (0.010)	-0.012 (0.010)	-0.006 (0.008)	-0.024** (0.009)	-0.009 (0.009)
$\Delta \ln(\text{Inv}_{it}/\text{GDP}_{it})$	0.041*** (0.012)	0.037*** (0.012)	0.031** (0.011)	0.012 (0.007)	0.026** (0.010)
Public spending					
Spending to GDP ratio _{it-1}		-0.037** (0.016)	-0.050*** (0.015)	-0.061** (0.023)	-0.041** (0.018)
Wages (Health and Education) _{it-1}			0.015 (0.012)		
Public Investment _{it-1}				-0.004 (0.042)	
Pensions and subsidies _{it-1}					-0.006 (0.010)
Observations	155	155	110	101	120
Adjusted R-squared	0.491	0.501	0.636	0.587	0.627
Country FE	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes
Latest year	2016	2016	2016	2016	2016

Source: Authors' elaboration.

Note: Asterisks (*, **, ***) indicate the significance level (10%, 5%, 1%) of the coefficients.

Year fixed effects and usual control variables (see Table 4) are included in all regressions. The standard errors are adjusted for country clusters.

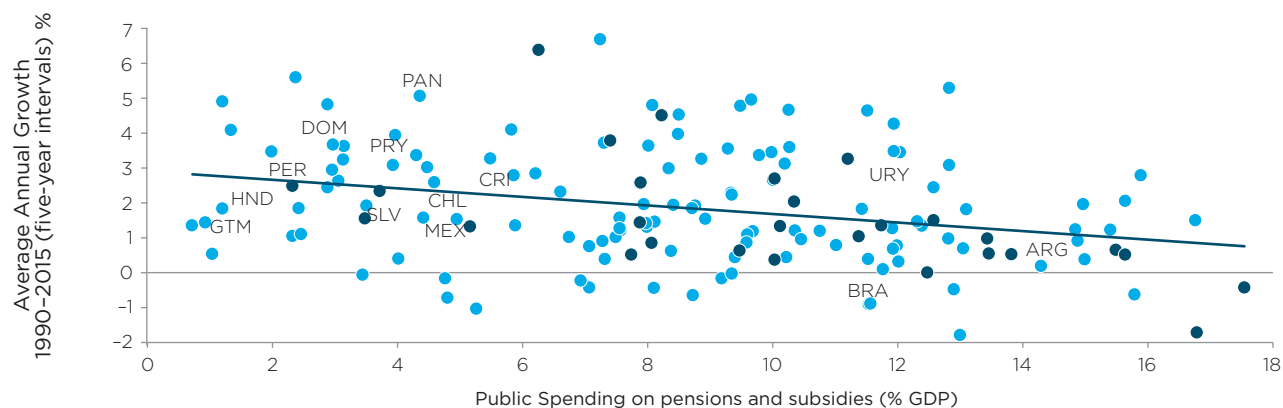
The investment rate is replaced for the private investment rate in the regressions that include public investment to avoid double counting.

TABLE A.10 
Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
GDP pc (level)	934	28659	13061	3324	81879
ln(GDP pc)	934	10.1	0.6	8.1	11.3
Years of Schooling	926	10.2	1.8	4.0	16.1
ln(population size)	934	2.3	1.4	-1.8	5.4
Education quality	934	499	44	371	572
Human capital	926	3.9	0.3	2.8	4.4
ln(Investment/GDP)	934	3.1	0.2	2.4	3.8
Openness	934	0.7	0.4	0.1	2.3
Average rule of law	934	1.2	0.8	-1.0	2.0
Average employment protection	897	2.2	0.7	0.6	4.3
Credit ratio	897	0.6	0.3	0.2	1.4
Old-age dependency ratio	934	0.2	0.1	0.1	0.3
Government effectiveness	741	0.0	1.0	-2.6	1.5
Voice and Accountability	741	0.0	1.0	-3.1	1.4
Political Stability	741	0.0	1.0	-3.3	1.6
Regulatory Quality	741	0.0	1.0	-3.3	1.5
Control of Corruption	741	0.0	1.0	-2.6	1.4
Education (spending in % of GDP)	652	4.4	1.1	1.8	7.9
Health (spending in % of GDP)	650	5.0	1.9	0.2	8.4
Other wages and intermediate cons. (in % of GDP)	615	8.0	2.2	2.1	12.4
Old-age and survivor pensions (in % of GDP)	719	7.1	3.7	0.1	16.7
Sickness and disability (in % of GDP)	736	2.2	1.7	0.0	8.7
Unemployment benefits (in % of GDP)	704	1.0	1.1	0.0	5.3
Family and children (spending in % of GDP)	717	1.4	1.2	0.0	5.1
Subsidies (in % of GDP)	873	1.3	1.0	0.0	5.1
Public Investment (in % of GDP)	904	3.5	1.2	0.4	7.3
Other primary expenditure (in % of GDP)	602	3.8	1.7	0.2	8.0
Property income paid (in % of GDP)	904	0.4	1.0	-0.8	7.3

Source: Calculations based on combined IDB/OECD database on public spending.

Figure A.1 >> **Public Spending on Pensions and Subsidies and Economic Growth (1990–2015)**



Source: Authors, based on IDB/OECD combined databases.

Note: Coefficient of correlation = -0.30 (162 observations).

