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AUTHOR'S NOTE

We are grateful to Alexandre Meira da Rosa, Gaston Astesiano, and Rúben Cuevas, and two anonymous referees for helpful comments. The views set out in this study are those of the authors and do not necessarily reflect the official opinion of the Inter-American Development Bank. The usual caveats apply.

1. Introduction

At the Rio+20 conference, which took place in Rio de Janeiro in June 2012, Member States called for a prioritisation of the sustainable development agenda. The conference eventually led to the 2015 UN Sustainable Development Summit and to the launch, on January 1 2016, of the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs).

Achieving the SDGs will require improved policies and governance and higher levels of public and private investment. Estimates of annual financing needs for meeting the SDGs range between USD 1.5 and USD 2.5 trillion. This paper contributes to the discussion by estimating public investment gaps for a large sample of developing and emerging market countries and describing a simple methodology for incorporating SDGs targets in these estimates. It also presents a detailed discussion of investment gaps in Latin America and the Caribbean (LAC).

We start by assessing demand for public investment in a sample of developing and emerging economies and then compute the public investment gap in each of them as the difference between estimated demand and observed public investment, using IMF data.[1] Based on our model and GDP projections, we forecast investment gaps up to 2030 and use

the relationship between public investment and selected SDGs (i.e. poverty ratios, child mortality rate under the age of 5 and lower secondary school completion) to assess the investment needed to reach these targets.

As public investment is a driver of economic growth (Abiad et al., 2016), policies that promote public investment can deliver high returns in terms of economic development.[2] Peter Drucker famously stated that what gets measured gets done. Hence, quantifying current and future needs for public investment is key to implementing policies to close these gaps and to identifying their financing. We also show that public investment can promote equitable growth by helping eradicate extreme poverty, reducing child mortality, and promoting education, as requested by the SDGs.

We find that public investment gaps vary significantly across regions. While the East Asia and Pacific region overinvests to the tune of 5.5 per cent of GDP, all other developing regions display large gaps. In LAC, the investment gap was above 3 per cent of GDP in 2015 and is expected to reach 4.4 per cent in 2030. If we factor in the public investment needed to eradicate extreme poverty, as requested by the SDGs, the 2030 gap reaches 7.0 per cent of GDP or USD 798 billion. If we add the infant mortality and lower secondary education completion targets, the gap increases to 12.4 per cent of GDP or USD 1,405 billion.

Data quality and our empirical methodology are not flawless. First, when measuring investment we normally assume that every dollar spent increases the value of the capital stock (investment is often referred to as 'gross fixed capital formation'). This assumption might be less realistic for public investment, especially in countries with poor institutions and low bureaucratic quality (Pritchett, 2000). Likewise, we face endogeneity problems in terms of our ability to measure public investment 'demand'. We discuss this in Section 3 and Appendix A. These caveats notwithstanding, our estimations are useful to establish a benchmark and guide policy making to promote greater public investment, especially in countries with large gaps.

We are not the first to assess public investment needs and their associated gaps. To estimate investment demand, we build on Fay (2000), Fay and Yepes (2003) and Ruiz-Nuñez and Wei (2015). Unlike these authors, we focus on total investment expenditure rather than estimating separate demand equations for different types of infrastructure. By focusing on total investment expenditure, we obtain direct estimates of the monetary value of investment demand without making assumptions on the unit cost of different infrastructure projects.

The launch of the Millennium Development Goals in 2000 led to a wave of 'needs assessment' for MDG investment areas (UN, 2005; UNDPI, 2008; Bourguignon et al., 2008) and similar assessments have also been developed for the SDGs (for a review, see Schmidt-Traub and Sachs (2015)). These studies are difficult to compare and aggregate as they propose different country coverage, methodologies and assumptions and mix quantitative estimates with expert assessments (see Schmidt-Traub (2015) for an attempt to aggregate different SDG estimates). Our methodology is instead purely quantitative and uniform across countries. It can thus be a useful complement, albeit not a substitute, to needs assessments based on expert judgment.

The reminder of the paper is organised as follows. Section 2 provides descriptive statistics on private, public and total investment and capital stocks across developing regions as well as among individual LAC countries. In Section 3, we present the empirical methodology for estimating current and projected public investment gaps. Section 4

describes the methodology used to predict the public investment needed to reach the selected SDG targets and provides estimates by region. Section 5 focuses on the role of multilateral lending institutions. Section 6 concludes.

2. Investment and Capital Stock in Developing Countries

The average capital stock in Latin American and Caribbean countries declined from nearly 250 per cent of GDP in 1990 to 190 per cent of GDP in 2010 and recovered slightly to 200 per cent of GDP over 2010-15 (Table 1; all averages are weighted by GDP measured in 2000 PPP US dollars).[3] While in 1990 Latin America was the developing region with the largest capital stock-to-GDP ratio, by 2000 it had been surpassed by both East Asia and Pacific (EAP) and Eastern Europe and Central Asia (ECA). By 2015 LAC ranked second, lagging 20 per cent behind EAP.

Table 1. Total capital stock-to-GDP ratio (%)

Region	1990	2000	2010	2015
Mean				
EAP	182	222	226	253
ECA	188	235	161	158
LAC	246	217	191	200
MNA	217	175	167	186
SAS	156	158	159	168
SSA	235	205	158	167
Median				
EAP	190	221	222	220
ECA	126	167	167	166
LAC	193	196	170	166
MNA	230	203	174	218
SAS	144	152	148	157
SSA	212	211	183	199

Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset, where capital stocks and GDP are measured in 2000 PPP[4] USD dollars.

All averages are weighted by GDP. East Asia and Pacific (EAP), Middle East and North Africa (MNA), Eastern Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), South Asia (SAS) and sub-Saharan Africa (SSA).

The decline in capital stock observed in LAC over 1990-2015 is not at odds with the trends in ECA, Middle East and North Africa (MNA), or sub-Saharan Africa (SSA). In 2015 the average capital stock ratio in LAC was similar to the developing country average (205 per cent). In terms of the median country, however, the decline in capital stock in the LAC region was more pronounced than in other regions.

In terms of private capital-to-GDP ratios, in 2015 LAC was the region with the highest average (Table 2), followed by EAP, whose ratio increased from 79 to 134 per cent between 1990 and 2015.

LAC performs particularly poorly in term of public capital. In 2015, the average public capital-to-GDP ratio in LAC (Table 3) was only 62 per cent: this was 40 per cent smaller than the ratio observed in MNA (a region with a large public capital stock and a small stock of private capital), half the average ratio in the EAP region (which has high private

and public capital), and even smaller than the average ratio in SSA. Only SAS and ECA show lower levels of public capital.

Table 2. Private capital stock-to-GDP ratio (%)

Region	1990	2000	2010	2015
Mean				
EAP	79	97	106	134
ECA	147	177	115	112
LAC	165	144	131	138
MNA	92	81	80	87
SAS	74	86	101	112
SSA	140	122	95	101
Median				
EAP	79	109	117	112
ECA	82	118	110	112
LAC	135	128	116	109
MNA	63	65	93	104
SAS	79	90	104	105
SSA	108	110	94	105

Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset, where capital stocks and GDP are measured in 2000 PPP USD dollars. All averages are weighted by GDP.

Table 3. Public capital stock-to-GDP ratio (%)

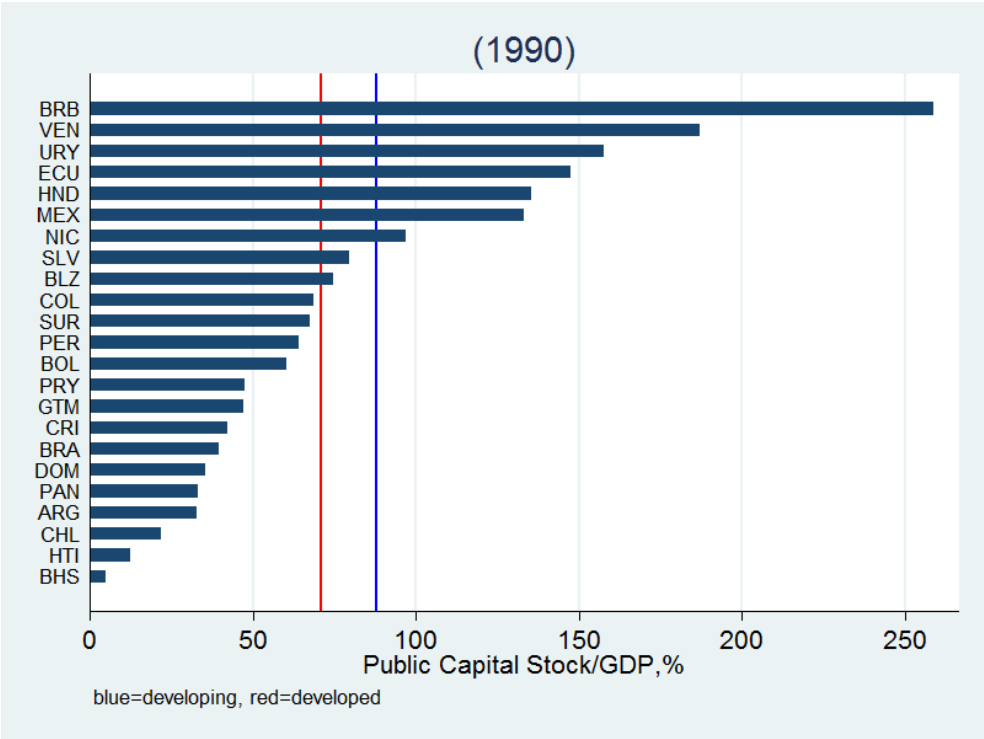
Region	1990	2000	2010	2015
Mean				
EAP	103	124	120	120
ECA	41	58	45	46
LAC	81	72	59	62
MNA	124	94	86	100

SA	82	72	58	56
SSA	95	83	63	66
Median				
EAP	51	60	66	65
ECA	35	50	44	45
LAC	66	59	58	62
MNA	109	81	80	94
SAS	59	64	55	52
SSA	77	94	74	87

Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset, where capital stocks and GDP are measured in 2000 PPP USD dollars. All averages are weighted by GDP.

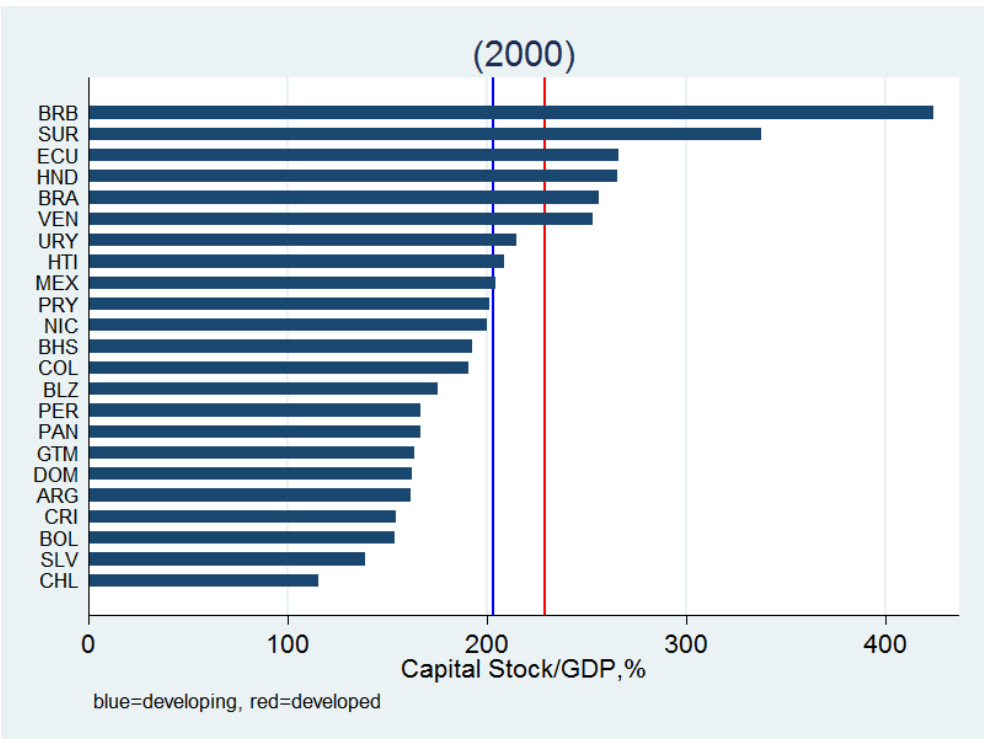
High public investment shares in East Asia and low public investment shares in Latin America are partly driven by outliers (Table 3. bottom panel). The median LAC country has a public investment share lower than the MNA and SSA medians, but well above the other medians. The large deviation between the average and median measures for Latin American capital stock suggests a substantial dispersion and skewness in the cross-country distribution of this indicator (Figures 1.1, 1.2, 1.3 and 1.4). In 1990, 13 countries in the region (out of 23 for which data are available) displayed a total capital stock-to-GDP ratio below the developing country average (the blue line in Figure 1.1). By 2000, 15 countries had capital stock-to-GDP ratios below the developing country average (Figure 1.2).

Figure 1.1. Total capital stock-to-GDP ratio by LAC country (%), 1990



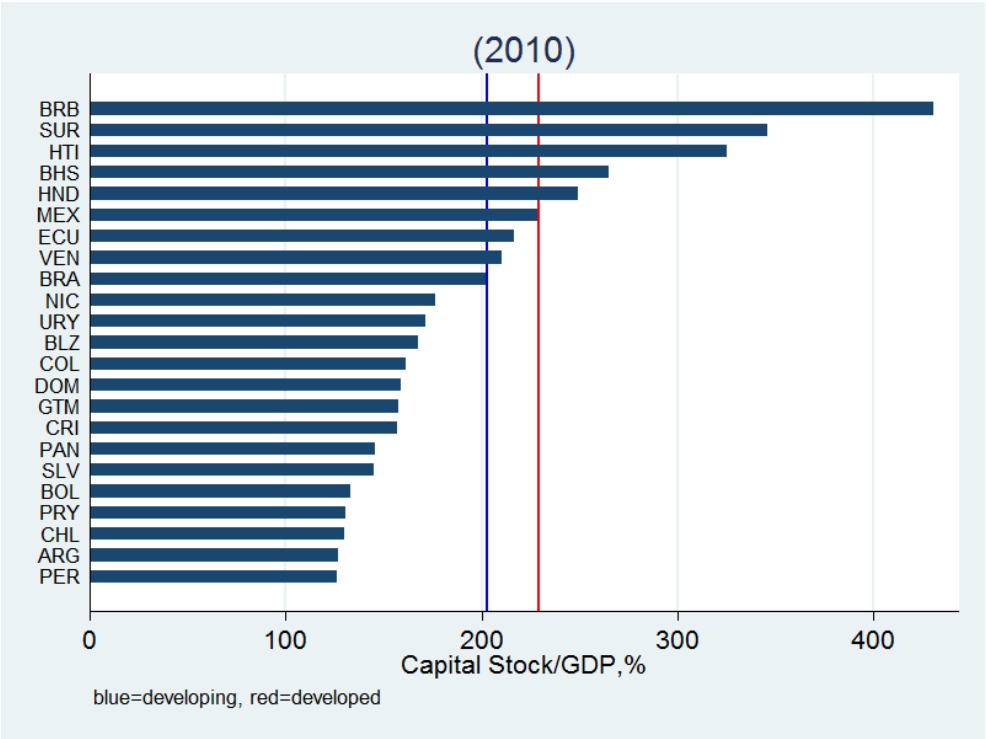
Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 1.2. Total capital stock-to-GDP ratio by LAC country (%), 2000



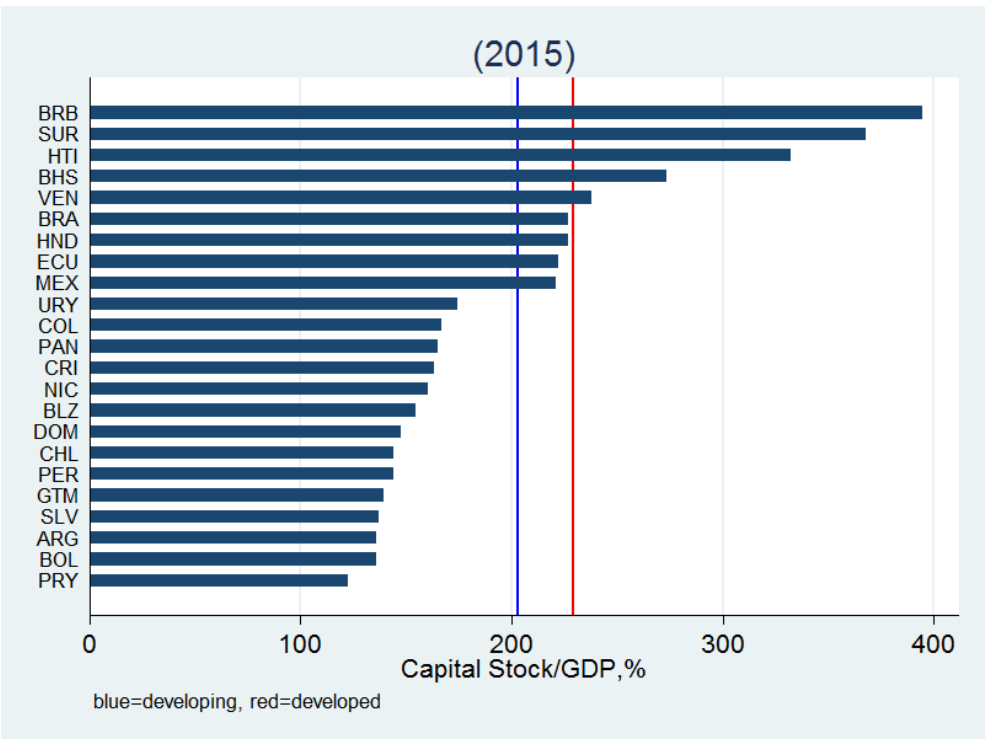
Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 1.3. Total capital stock-to-GDP ratio by LAC country (%), 2010



Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

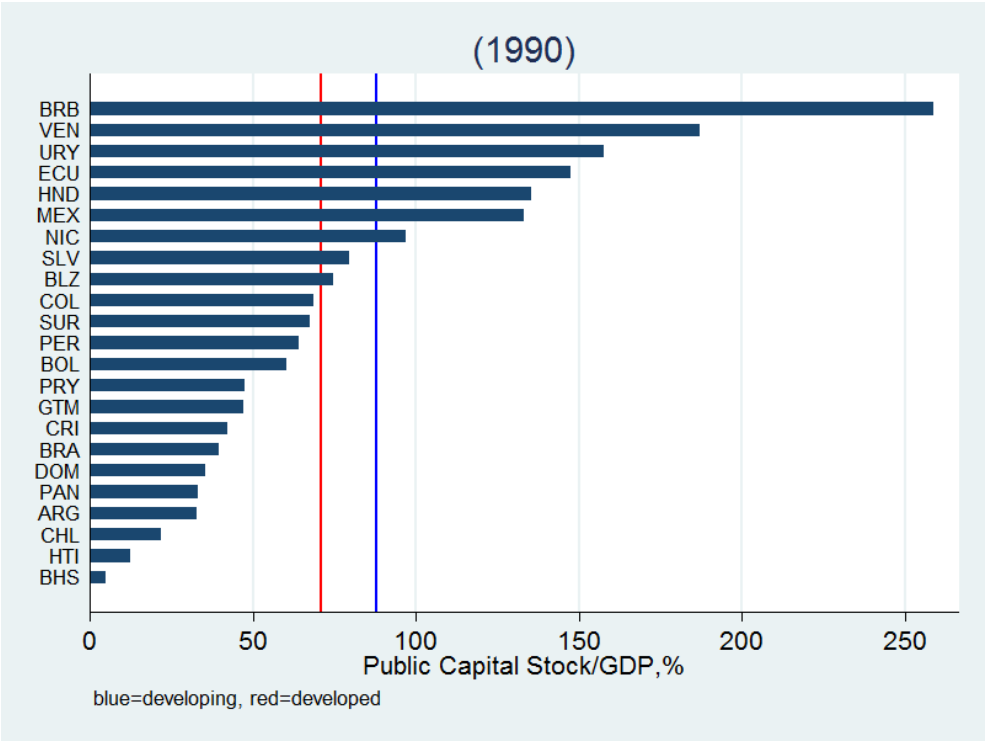
Figure 1.4. Total capital stock-to-GDP ratio by LAC country (%), 2015



Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

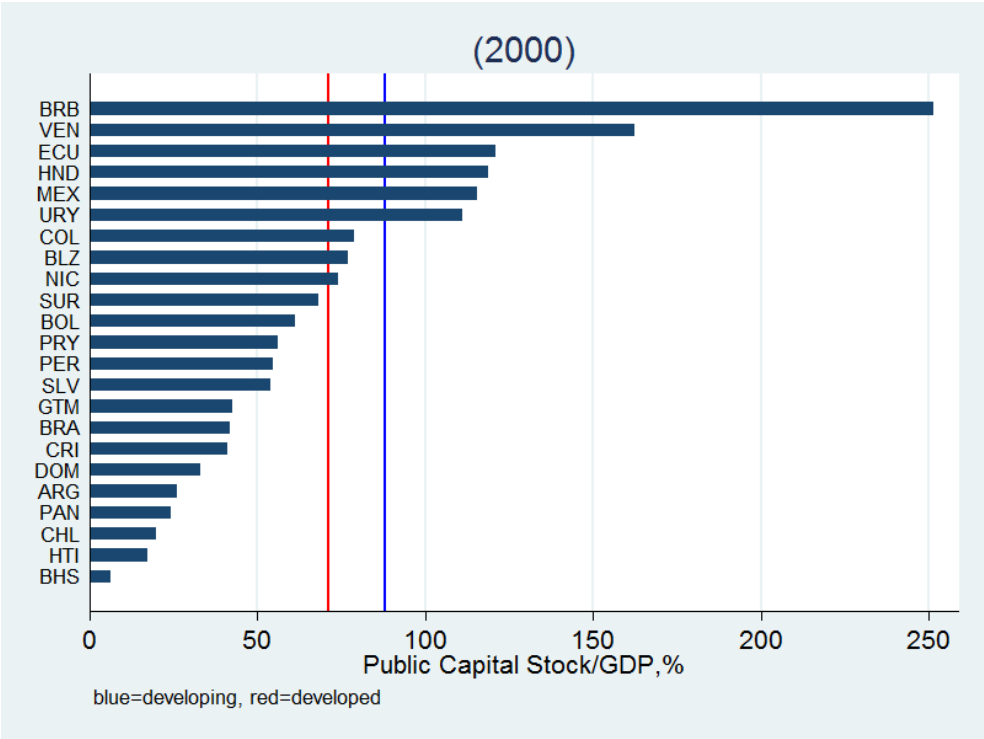
Figure 2.1-2.4 confirm that public capital explains the relatively low capital stock-to-GDP ratio in the LAC region. In 2015, only five countries in the region (Barbados, Venezuela, Ecuador, Haiti and Mexico) had a ratio of public capital-to-GDP above the developing country average (Figure 2.4). Public capital ratios were especially low in two of the region's three largest economies (Argentina and Brazil). Most countries are below the developing country average, even though the average LAC economy has a ratio that is slightly above the average for the developing country group.

Figure 2.1. Public capital stock-to-GDP ratio by LAC country (%), 1990.



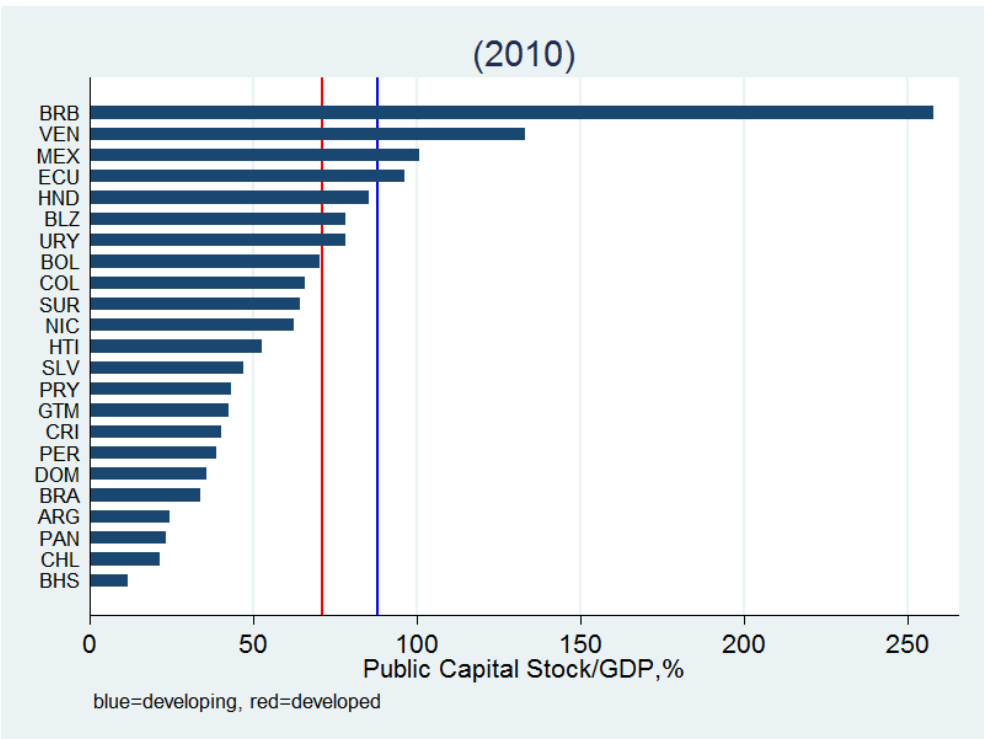
Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 2.2. Public capital stock-to-GDP ratio by LAC country (%), 2000.



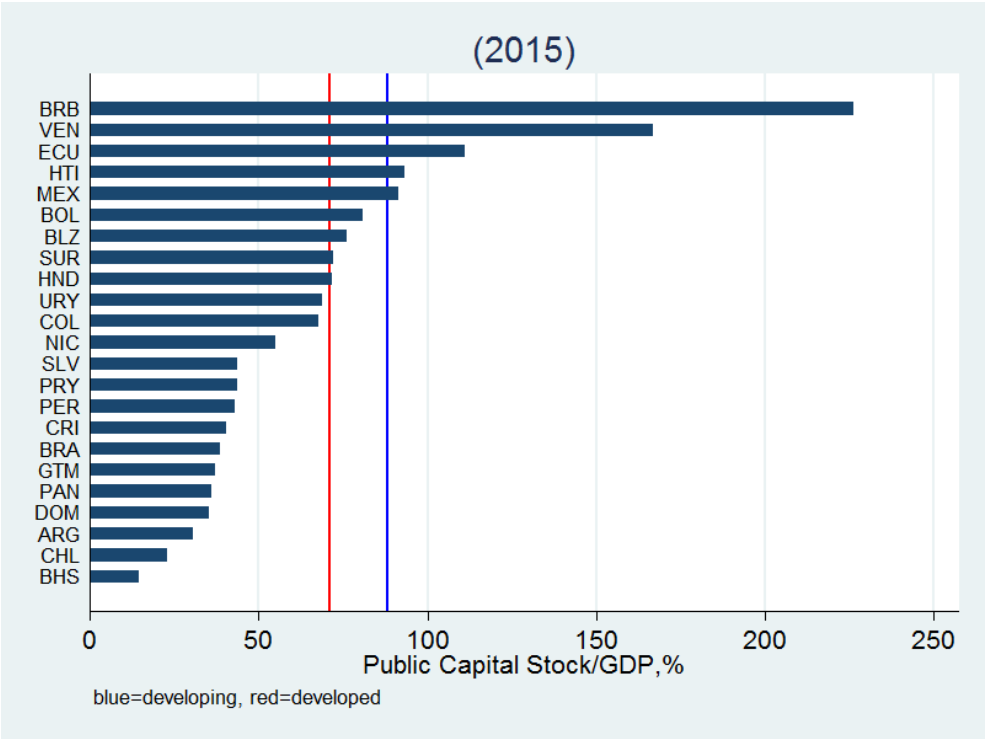
Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 2.3. Public capital stock-to-GDP ratio by LAC country (%), 2010.



Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 2.4. Public capital stock-to-GDP ratio by LAC country (%), 2015.



Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Investment flows show similar regional patterns. However, contrary to the capital stock, which has been declining in LAC over the last three decades, total investment-to-GDP ratios have increased from of 14 to 19 per cent (Table 4). Investment increased in most developing regions (the exception is ECA, where investment collapsed in the 1990s) and, throughout the period, the total investment-to-GDP ratio in LAC was similar to that of other regions. The exception is EAP, which, by 2015, had a total investment-to-GDP ratio twice as large as that of LAC.

Table 4. Total investment-to-GDP ratio (%)

Region	1990	2000	2010	2015
Mean				
EAP	22	26	36	37
ECA	23	13	14	15
LAC	14	17	19	19
MNA	13	13	20	19
SAS	16	17	24	22
SSA	12	13	18	18

Median				
EAP	18	20	22	24
ECA	13	13	16	18
LAC	14	16	18	20
MNA	18	14	21	20
SAS	14	15	18	19
SSA	13	13	18	19

Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset, where capital stocks and GDP are measured in 2000 PPP USD dollars.

Table 5. Public investment-to-GDP ratio (%)

Region	1990	2000	2010	2015
EAP	9	14	14	11
ECA	3	2	3	3
LAC	4	3	4	4
MNA	5	4	8	7
SAS	6	5	6	4
SSA	4	4	5	5
EAP	6	6	7	6
ECA	2	3	3	4
LAC	3	3	4	4
MNA	5	3	6	5
SAS	6	4	4	5
SSA	4	4	5	6

Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset, where capital stocks and GDP are measured in 2000 PPP USD dollars.

Table 6. Private investment-to-GDP ratio (%)

Region	1990	2000	2010	2015
Mean				
EAP	13	12	22	26
ECA	19	10	11	12
LAC	10	14	15	15
MNA	8	9	11	11
SAS	10	12	18	18
SSA	9	9	12	13
Median				
EAP	14	13	15	17
ECA	10	10	11	13
LAC	9	13	13	15
MNA	7	8	12	12
SAS	8	12	14	15
SSA	8	8	13	12

Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset, where capital stocks and GDP are measured in 2000 PPP USD dollars.

Table 7. Public investment/total investment (%)

Region	1990	2000	2010	2015
Mean				
EAP	40	53	39	29
ECA	15	20	21	21
LAC	30	18	21	20
MNA	40	32	43	40
SAS	39	27	25	20
SSA	29	30	30	28

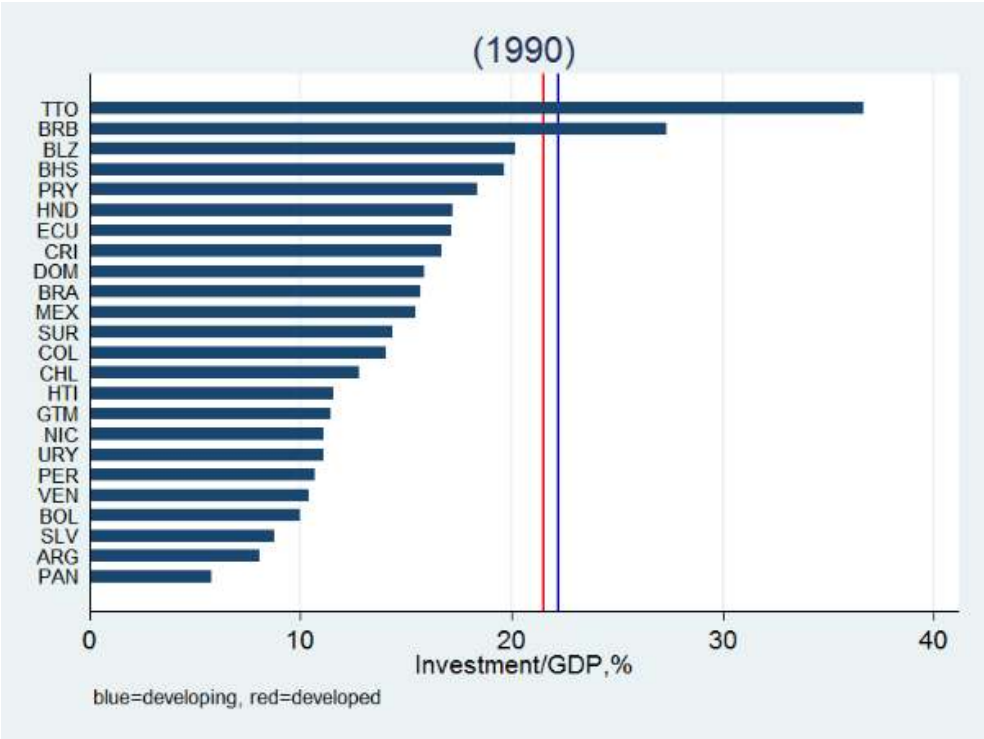
Median				
EAP	32	31	33	25
ECA	19	20	22	22
LAC	19	20	21	20
MNA	29	23	29	23
SAS	40	28	22	24
SSA	31	31	29	31

Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset, where capital stocks and GDP are measured in 2000 PPP USD dollars.

In terms of public investment-to-GDP, ratios remained relatively stable during the period and LAC is the region with the second lowest public investment-to-GDP ratio (after ECA, Table 5). The share of private investment to GDP increased throughout the period, from 10 per cent in 1990 to 15 per cent by 2015 (Table 6), confirming that private investment drove the increase in total investment. The average country in LAC shows a private investment-to-GDP ratio similar to that of the other regions. The exception, again, is EAP, where the private investment-to-GDP ratio is 11 percentage points (corresponding to 60 per cent of the investment ratio in LAC) larger than in LAC.

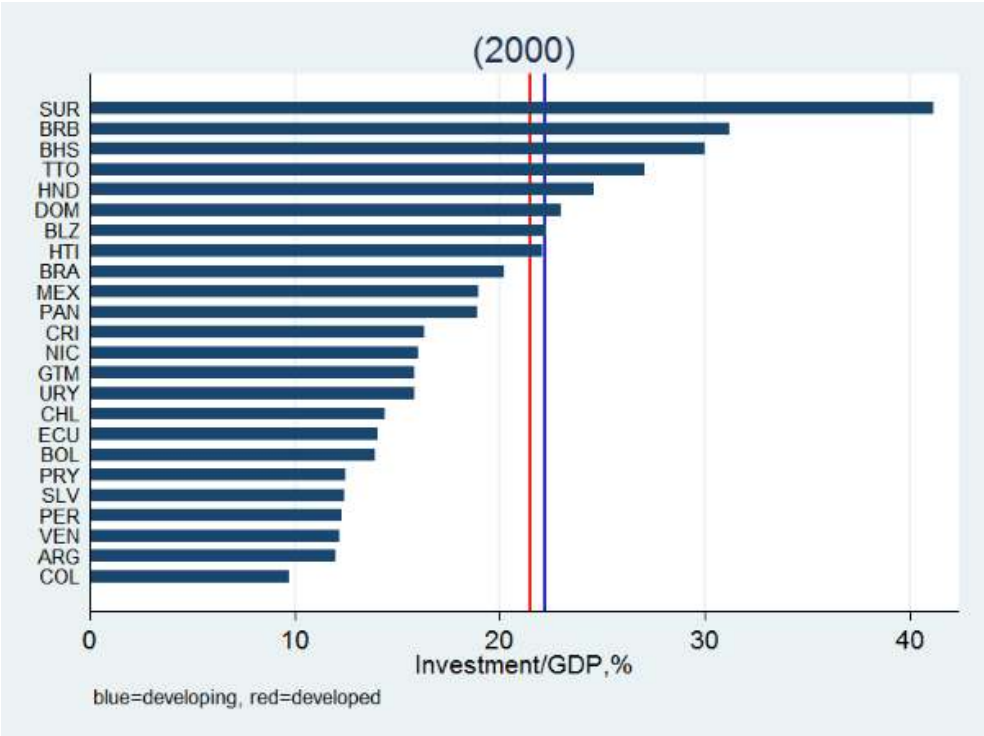
In 2015, all but five LAC countries (Panama, Bahamas, Barbados, Haiti and Suriname) had a total investment-to-GDP ratio that was below the developing country average of about 20 per cent of GDP (the blue line in Figure 3.4).

Figure 3.1. Total investment-to-GDP ratio by LAC country (%), 1990.



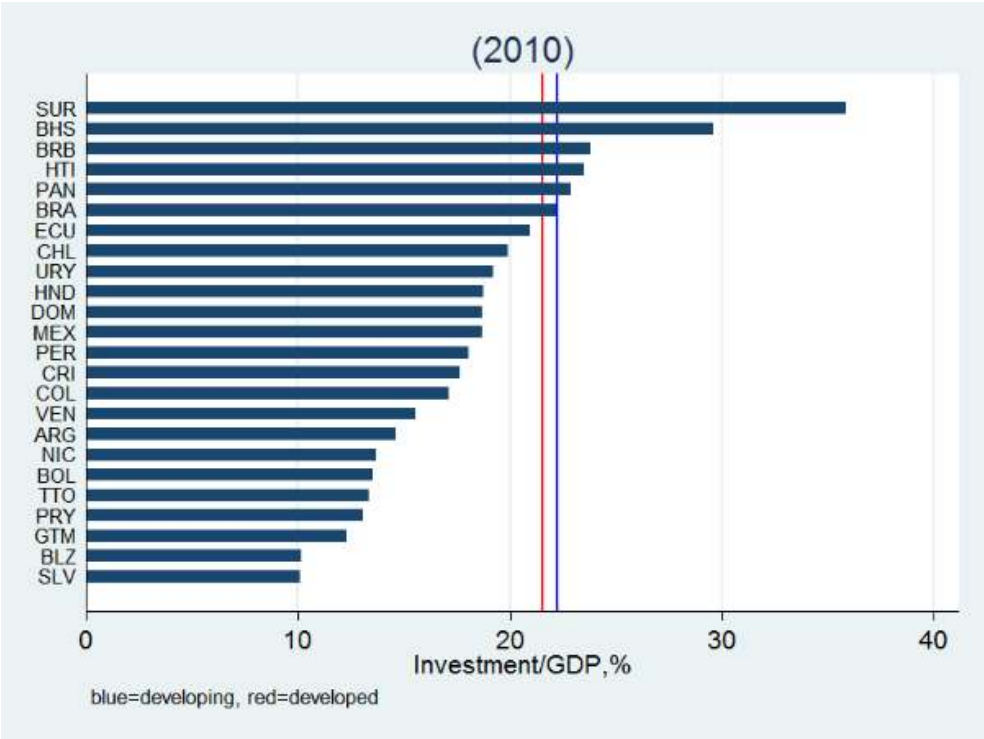
Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 3.2. Total investment-to-GDP ratio by LAC country (%), 2000.



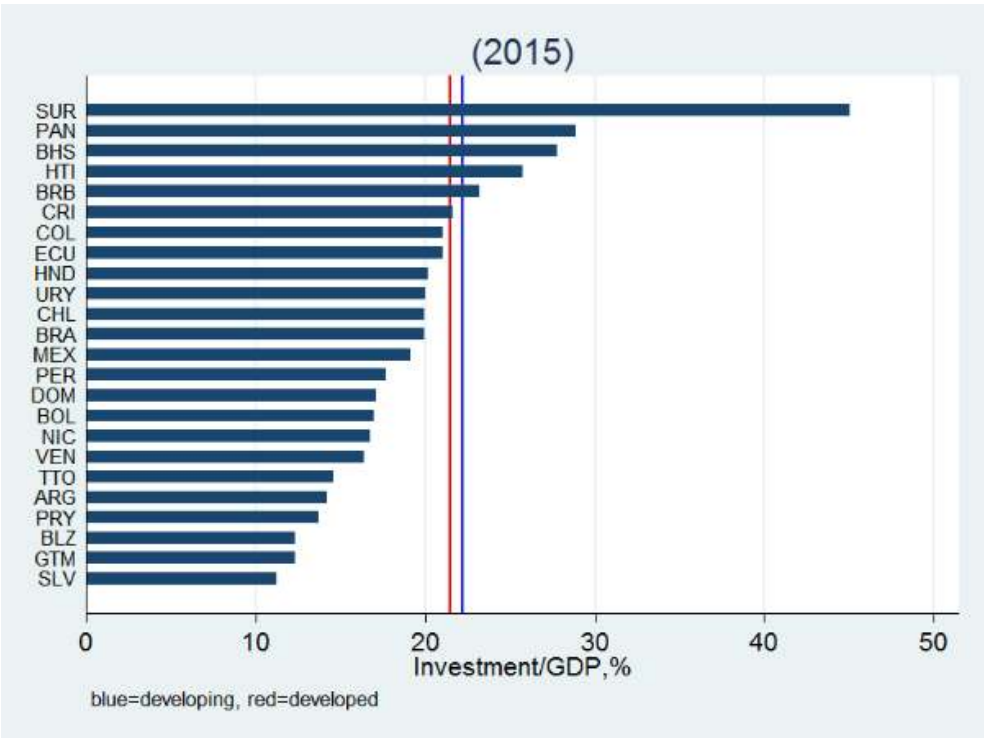
Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 3.3. Total investment-to-GDP ratio by LAC country (%), 2010.



Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

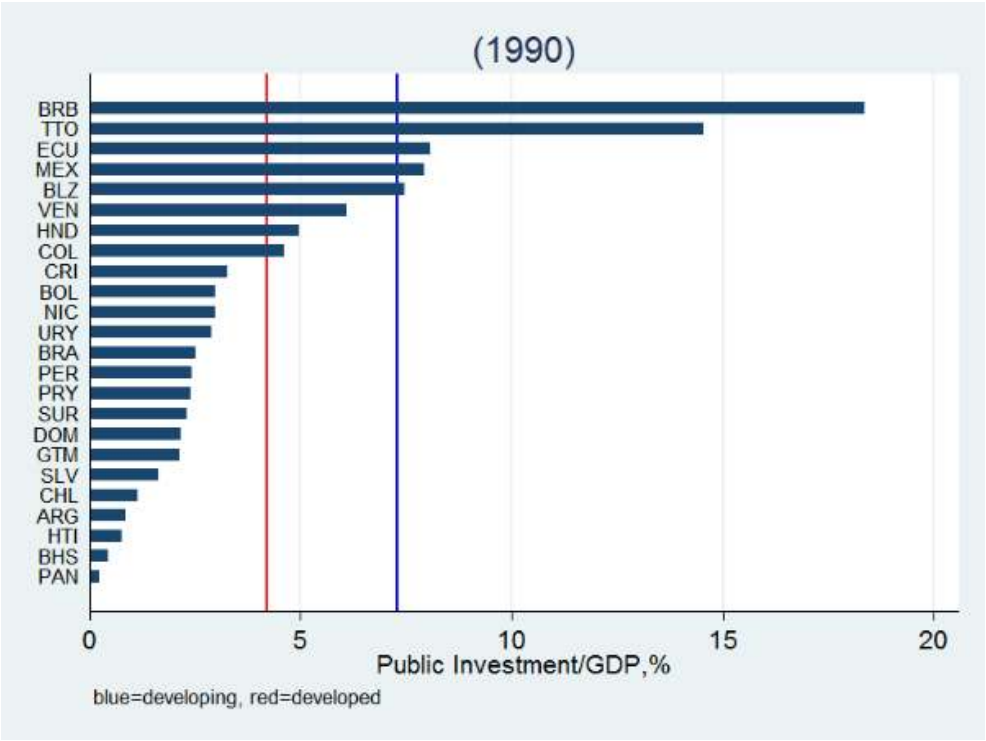
Figure 3.4. Total investment-to-GDP ratio by LAC country (%), 2015.



Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

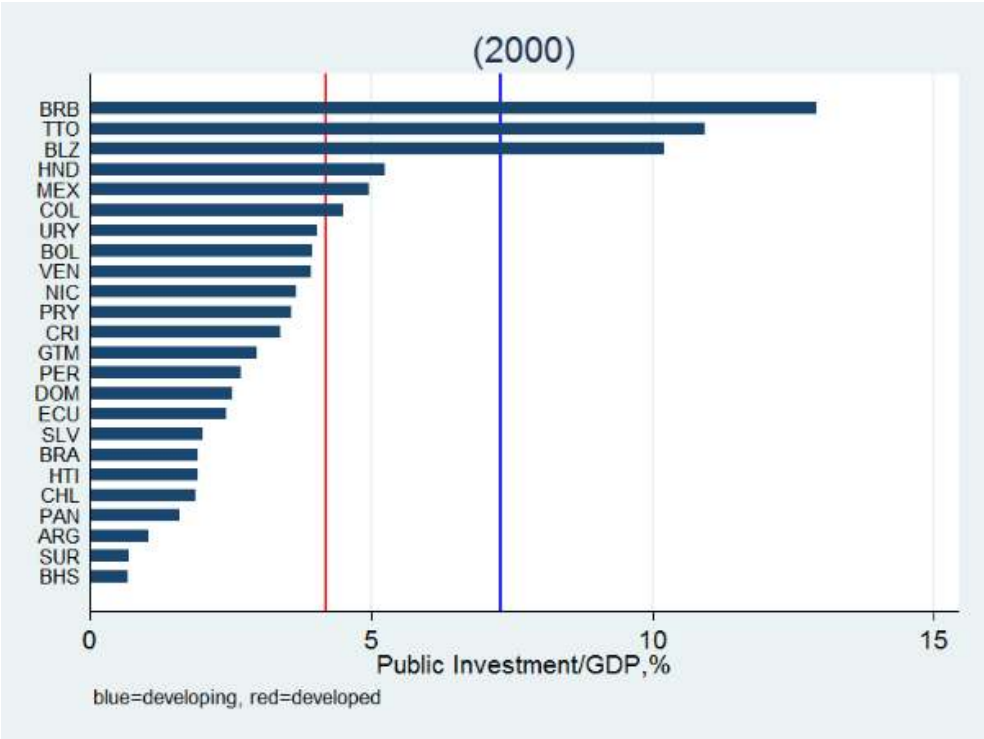
In terms of public investment-to-GDP ratio, only five LAC countries displayed a ratio above the developing country average in 2015: Bolivia, Ecuador, Haiti, Trinidad and Tobago and Venezuela (Figure 4.4).[5] Guatemala, Bahamas, El Salvador and Brazil were at the bottom of the distribution with ratios below 2 per cent.

Figure 4.1. Public investment-to-GDP ratio by LAC country (%), 1990.



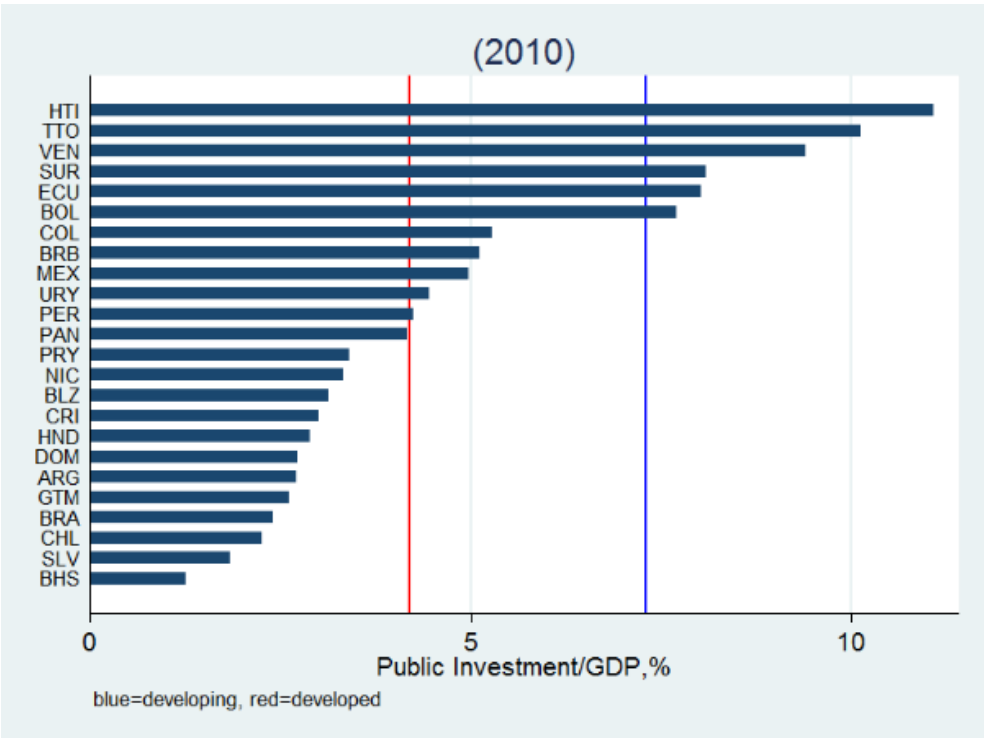
Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 4.2. Public investment-to-GDP ratio by LAC country (%), 2000.



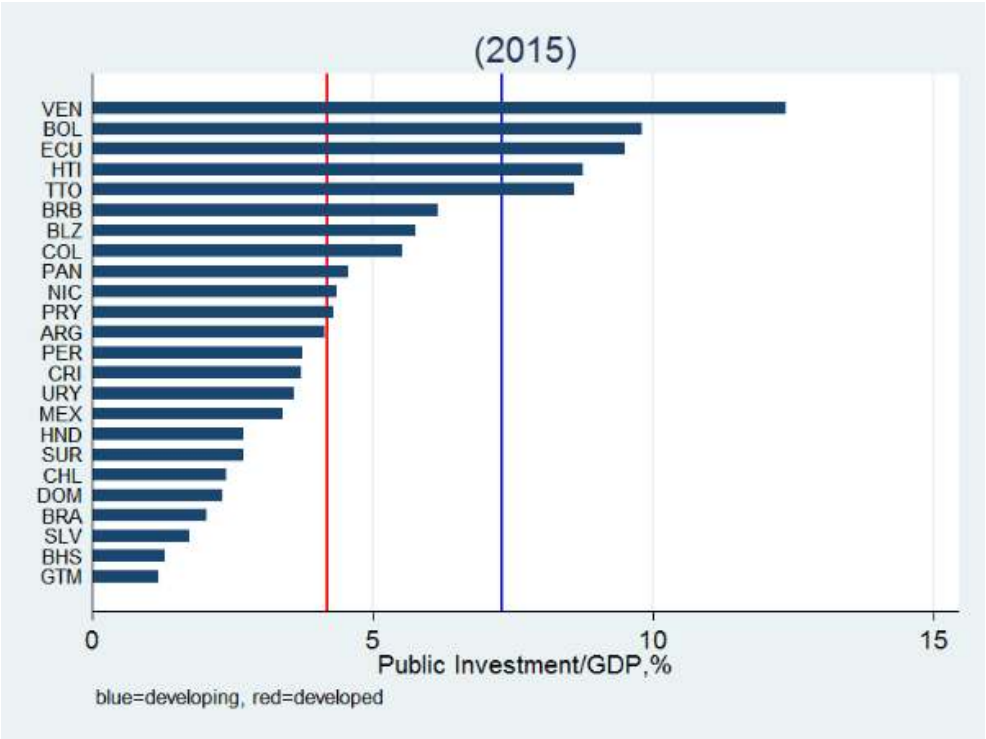
Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 4.3. Public investment-to-GDP ratio by LAC country (%), 2010.



Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

Figure 4.4. Public investment-to-GDP ratio by LAC country (%), 2015.



Source: Authors' calculations using the IMF's Investment and Capital Stock Dataset.

3. Estimating Public Investment Gaps

In this section, we estimate investment gaps for Latin America and the Caribbean and compare them with those of other developing regions. As a first step, we estimate public investment demand and compare it with actual investment. Next, we project future investment demand and compare it with a business-as-usual benchmark. Our approach builds on the methodology of Fay (2000) and Ruiz-Nuñez and Wei (2015). These authors first estimate the demand for different types of infrastructure by regressing the stock of existing infrastructure on lagged infrastructure stock, GDP per capita, the sectorial composition of GDP, and a set of country fixed effects. Next, they use projected GDP per capita growth to estimate future demand for infrastructure in each country and give a dollar value to these projections by making assumptions on the cost of production of different infrastructure projects. While we use a similar strategy, we recognise that there are three issues with the existing methodology.

First, estimating separate demand equations for different types of infrastructure overlooks their complementarities. Moreover, public money is fungible and governments face a budget constraint and trade-offs. The decision to invest in a certain type of public infrastructure requires an evaluation of its opportunity costs in terms of other types of public expenditure or, at minimum, alternative investment projects. It is also methodologically complicated to back up the monetary value of investment demand from regressions that do not include the monetary value of infrastructure investment.[6] Additionally, data availability is limited. Hence, demand estimates for different types of infrastructure are based on different samples. For instance, in Ruiz-Nuñez and Wei (2015),

96 countries (for a total of 926 observations) have available data for electricity generation capacity but only 57 countries (and 107 observations) for port infrastructure.

Second, existing empirical exercises are based on a business-as-usual scenario as they assume that future growth is equal to projected growth. Hence, they do not incorporate the idea that countries may be trying to meet certain development goals that may require higher public investment. Finally, there are econometric problems with the estimation of a fixed effects model in the presence of a lagged dependent variable. There is also an endogeneity problem, as it is not clear whether the estimates of Ruiz-Nuñez and Wei (2015) capture demand or supply effects.

To address the first issue, we focus on total public sector investment rather than estimating equations for different types of infrastructure. This strategy allows us to use data for 156 countries and provides direct predictions for investment-to-GDP ratios, which can be easily converted into dollar values using GDP data. We then compute investment gaps by comparing the estimated investment demand with realised investment.

We address the second issue by estimating the conditional correlation between public investment and an indicator of extreme poverty. Next, we use the SDG target to compute the amount of public investment necessary to close the gap between the current value of extreme poverty and the SDG goal. Finally, we add this amount to the estimated investment demand described above.

While we cannot fully address the endogeneity issue, we use the standard system GMM estimator of Arellano and Bover (1995) and Blundell and Bond (1998) to deal with problems that arise from the joint presence of country fixed effects and a lagged dependent variable. Under certain conditions, these estimators also mitigate the endogeneity problem. For a discussion of how our estimates are likely to be upward biased, please refer to Appendix A.

3.1 Baseline

We start with a basic investment demand equation

$$I_{c,t} = a_c + a_t + \beta_1 I_{c,t,-1} + \beta_2 \ln(y_{c,t}) + \beta_3 \ln(A_{c,t}) + \beta_4 \ln(M_{c,t}) + \varepsilon_{c,t} \quad (1)$$

where $I_{c,t}$ is public investment over the GDP of country c at time t, $y_{c,t}$ is GDP per capita, $A_{c,t}$ is the share of agriculture in GDP, $M_{c,t}$ is the share of manufacturing in GDP, a_c is a country fixed effect, a_t is a year fixed effect, and $\varepsilon_{c,t}$ is an i.i.d. error term.[7] Each observation is an average for a 5-year period (1990-94, 1995-99, 2000-04, 2004-009, 2010-14). In principle, we have five observations per country. However, since the equation is estimated in first differences we only use four observations per country. To control for the potential spurious effect of outliers, we winsorize all variables at 2 per cent.

Table 8 reports the results of our baseline estimates for a sample of developing and emerging market countries (125 countries and 466 observations), as well as for a sample of advanced and developing countries (156 countries and 581 observations). The estimates of the two samples are very similar and not statistically different from each other, except for GDP per capita, whose coefficient is statistically smaller in the full

sample. This is the reason why in the rest of this paper we only work with the estimates for the developing and emerging country sample.

The estimates suggest that as countries grow in terms of GDP per capita they need less public investment per unit of GDP. The point estimates imply that a 1 per cent increase in GDP per capita is associated with a decrease in public investment demand of approximately 0.4 per cent of GDP. The point estimates also indicate that as countries move from agriculture and manufacturing to services they need more public investment. The structural transformation away from agriculture and into services seems to require higher public investment than moving from manufacturing to services. However, the difference between the coefficients of the agriculture and manufacturing shares is not statistically significant.

The bottom panel of the table shows that our model satisfies the standard specification tests. Specifically, the Sargan tests do not reject the overidentification restrictions and the Arellano and Bond autocorrelation tests satisfy the assumption of statistically significant autocorrelation of order 1, but no autocorrelation of order 2.[8]

Next, we use the estimates of column 1 of Table 8 (the sample of developing and emerging market countries) to compute country-specific investment gaps as captured by the country fixed effects:

$GAP_c = a_c$

Table 8. Investment demand equation

	(1)	(2)
Lag of public investment/GDP	0.319**	0.293**
	(2.03)	(2.11)
ln(GDP per capita)	-0.426**	-0.536***
	(-2.46)	(-4.17)
Agriculture/GDP	-0.070***	-0.072***
	(-3.60)	(-4.42)
Manufacturing/GDP	-0.099***	-0.085***
	(-5.73)	(-6.15)
Sample	Developing	All
Country FE	Y	Y
Year FE	Y	Y
Observations	466	581
Number of countries	125	156

Sargan stat.	2.177	3.187
Sargan P-value	0.537	0.364
Arellano–Bond test for AR(1)	-2.564	-2.697
Arellano–Bond test for AR(1) P-value	0.010	0.007
Arellano–Bond test for AR(2)	-0.233	-0.660
Arellano–Bond test for AR(2) P-value	0.816	0.509
z-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1		

Source: Authors' calculations.

Note that, by construction, $E(GAP_c)$.[9] Hence, our gap estimate does not measure the absolute gap, but the relative investment gap. By construction, certain countries will have a positive investment gap and others will have a negative investment gap. Table 9 reports these relative investment gaps measured both in percentage of GDP and in USD dollars.

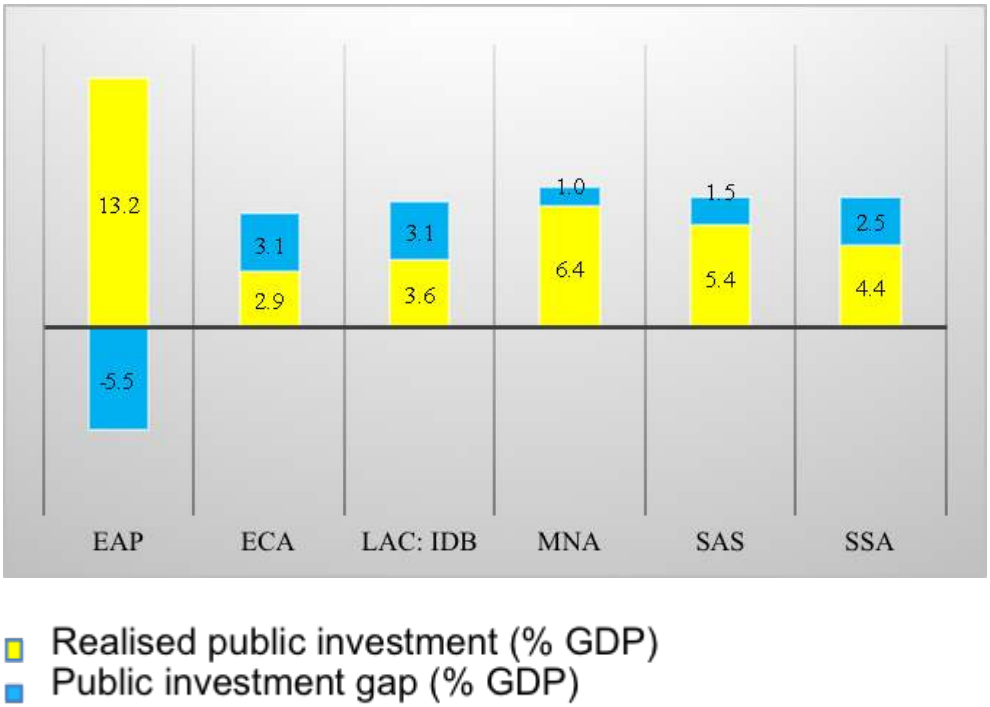
Table 9. Public investment demand and gaps, 2015

Region	Investment demand (% GDP)	Realised investment (% GDP)	Gap (% GDP)	Investment demand (bln USD)	Realised investment (bln USD)	Gap (bln USD)
EAP	7.7	13.2	-5.5	799	1367	-567
ECA	6.0	2.9	3.1	257	125	131
LAC	6.7	3.6	3.1	366	197	169
MNA	7.4	6.4	1.0	131	114	17
SAS	6.9	5.4	1.5	159	123	35
SSA	6.9	4.4	2.5	100	63	37

Source: Authors' calculations.

The EAP region has a negative investment gap (suggesting that in this region the public sector overinvests) and all others show positive gaps (Figure 5). LAC and ECA display the largest gap, both as a share of GDP and in US dollar terms. The gap represents 3.1 per cent of GDP in each region, equivalent to USD 169 billion for LAC and USD 131 billion for ECA. In SSA, the public investment gap represents 2.5 per cent of GDP, or USD 37 billion; in South Asia 1.5 per cent of GDP, or USD 35 billion; whereas in MNA it is 1 per cent of GDP, or USD 17 billion. At the other end of the spectrum, in East Asia public overinvestment is estimated at 5.5 per cent of GDP, or USD 567 billion.

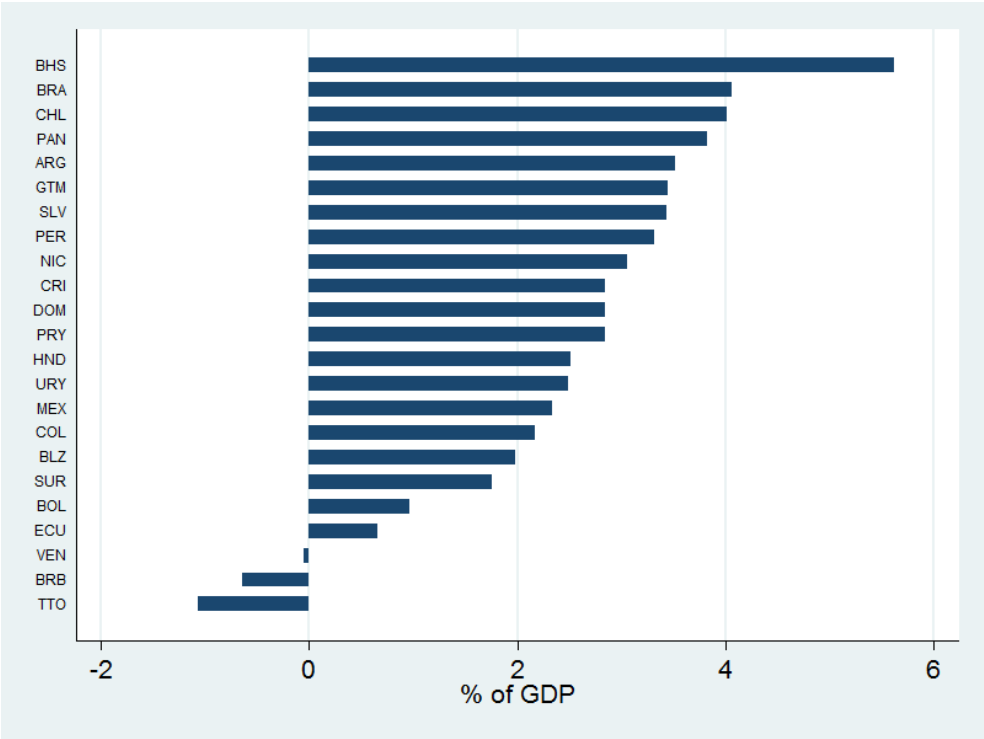
Figure 5. Realised public investment and public investment gap (% of GDP).



Source: Authors' calculations.

Barbados, Trinidad and Tobago, and Venezuela show a negative investment gap (Figure 6). One of these outliers is a high-income small country and the other two are important oil and gas producers with large public investment rates.[10] All other countries have positive, and often large, investment gaps. The gap is higher than 2 per cent of GDP in 16 countries. In Chile, Brazil and the Bahamas the gap reaches or surpasses 4 per cent of GDP.

Figure 6. Public investment gaps in LAC (% of GDP).



Source: Authors' calculations. A positive gap means underinvestment.

3.2 Investment Gap Projections

We predict future investment needs using the estimated parameters of Equation (1) and projections for GDP growth and the shares of agriculture and manufacturing in GDP. We use IMF World Economic Outlook GDP forecasts up to 2022. For the 2022-30 period we use Organisation for Economic Co-operation and Development (OECD) forecasts (which are available for OECD countries, Russia, and China) to predict GDP in non-OECD countries. Specifically, we start by estimating country-specific correlations between per capita GDP growth in developing countries and per capita GDP growth in the US, Russia, and China and then we use these correlations and OECD forecasts to predict GDP per capita in non-OECD countries. The shares of agriculture and manufacturing in GDP are predicted using their 2010-14 trend.

Table 10. Estimated public investment demand, 2022

	Estimated demand		**Business as usual**		
	Percentage of GDP	bln USD	Percentage of GDP	Gap (percentage of GDP)	Gap (bln USD)
EAP	6.3	1,472	13.2	-6.9	-1,613
ECA	7.3	461	2.9	4.4	278
LAC	7.7	578	3.6	4.1	308

MNA	8.5	227	6.4	2.1	56
SAS	7.2	352	5.4	1.8	88
SSA	7.9	201	4.4	3.5	89

Source: Authors' calculations.

Table 10 shows that by 2022 annual public investment demand in LAC countries will increase from its current level of 6.7 per cent of GDP (corresponding to USD 366 billion) to 7.7 per cent of GDP (or USD 578 billion). This increase is mainly explained by structural transformation. Projected increases in GDP per capita are likely to reduce public investment demand but, as the economy moves away from agriculture and manufacturing and into services, the demand for public investment is projected to increase.

Assuming a business-as-usual scenario where public investment remains at its 2015 level of 3.6 per cent of GDP, the public investment gap projected in 2022 in LAC reaches 4.1 per cent of GDP. This implies that the annual public investment gap is expected to increase from an estimated USD 169 billion in 2015 (Table 9) to USD 308 billion by 2022. This large increase is driven by the 1-percentage point increase in the estimated share in GDP of public investment demand, as well as the projected increase in GDP by 2022.

Table 11. Public investment demand, 2030

	Estimated demand		**Business as usual**		
	% GDP	bln USD	% GDP	Gap (% GDP)	Gap (bln USD)
EAP	5.5	1,927	13.2	-7.7	-2699
ECA	7.4	814	2.9	4.5	495
LAC	8.0	911	3.6	4.4	501
MNA	8.2	333	6.4	1.8	73
SAS	7.2	532	5.4	1.8	133
SSA	8.2	328	4.4	3.8	152

Source: Authors' calculations.

Longer term estimates calculated using the same approach but with GDP per capita projections obtained using the methodology explained above suggest that public investment demand in LAC will reach 8 per cent of GDP, or USD 911 billion, in 2030 (Table 11). With a business-as-usual public investment scenario representing, as in 2015, an investment rate of 3.6 per cent of GDP, the annual public investment gap reaches 4.4 per cent of GDP in 2030 (USD 501 billion). This is almost three times larger than the current public investment gap of USD 169 billion.

4. Public Investment and the Sustainable Development Goals (SDGs)

So far, we have estimated investment demand and investment gaps by using actual and projected data on GDP growth and economic structure. However, we did not consider the possibility that countries might have specific targets such as the SDGs. In this section, we propose a methodology to estimate the level of public investment necessary for reaching some of the SDGs. We use the first target of the first SDG—extreme poverty eradication (i.e. people living with less than USD 1.25 PPP per day).[11] We then include two additional SDGs and compute the additional public investment gap with regard to achieving the reduction of child mortality under the age of 5 to 25 per thousand lives[12] and the completion of secondary school education for all girls and boys.[13]

As a first step, we estimate the impact of public investment on the poverty ratio. Table 12 shows that, controlling for country and year fixed effects, GDP per capita, and the agriculture and manufacturing shares in GDP, public investment is negatively correlated with the poverty ratio.[14] If we interpret these correlations as causal (which, of course, is a strong assumption), we can use the estimates of Table 14 to back up the amount of investment necessary to reach a given poverty target, while controlling for the projected increases in GDP per capita as well as changes in agriculture and manufacturing shares.

Let us illustrate this procedure with an example. Consider the case of a country with a 9 per cent poverty rate (which is close to the average for LAC in the 2010-14 period). The first target of the first SDG is 'By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than USD 1.25 a day'. The estimates of Table 12 show that, controlling for GDP per capita, a 1-percentage point increase in the ratio of public investment-to-GDP is associated with a decrease in poverty of 0.8 percentage points. They also show that, controlling for the ratio of public investment-to-GDP, a 1 per cent increase in GDP per capita leads to a 15-percentage points reduction in poverty. Let us ignore the changes in the shares of agriculture and manufacturing value-added in GDP that are statistically insignificant. Assuming the country is projected to have an increase in GDP per capita of 50 per cent by 2030, we can then predict that this will reduce the poverty rate by 7.5 percentage points. To fully eradicate poverty, we need a further reduction of 1.5 percentage points. This can be achieved with an increase in the ratio of public investment-to-GDP of 1.9 percentage points (1.5/0.8=1.9). We can then add this 1.9 percentage points of additional public investment needed to eradicate poverty to the investment demand projected for 2030 in Table 13. So, if the country in question had a public investment demand of 8 percentage points, achieving this specific SDG would push the projected investment demand for 2030 to 9.9 per cent of GDP.

Table 12. Public investment and first SDG

Dependent variable: poverty rate (%)	
Public investment/GDP	-0.818***

	(-3.041)
Ln(GDP per capita)	-15.106***
	(-5.635)
Agriculture/GDP	0.134
	(0.811)
Manufacturing/GDP	-0.076
	(-0.366)
Country FE	Y
Year FE	Y
Observations	255

t-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

The estimates in Table 12 assume a linear relationship between public investment and poverty. As increasing public investment may lead to decreasing returns when it comes to poverty reduction, we introduce the squared term of public investment in the regression reported in Table 12. The coefficient on the squared term is positive, suggesting that there may be decreasing returns to public investment, but it is not statistically different from zero. We therefore decided to use the linear specification in Table 12 to calculate the public investment needed to achieve this first SDG.

Table 13 provides the estimates of public investment demand by region when we include the public investment needed to reach the target of extreme poverty eradication in the projected investment demand for 2030 (Table 11). Once we include the public investment demand needed to reach the objective of eradicating extreme poverty, LAC will face a public investment demand that will increase from 8 (Table 11) to 10.6 per cent of GDP. If public investment as a share of GDP remains at its 2015 level of 3.6 per cent of GDP, then the public investment gap reaches 7 per cent of GDP (USD 798 billion). This is significantly larger than the 4.4 per cent of GDP (USD 501 billion) projected for 2030 in Table 13, which did not include this specific SDG target.

Table 13. Public investment demand including eradication of extreme poverty (SDG 1)

	Estimated demand (percentage of GDP)	Business-as-usual investment (percentage of GDP)	Business-as-usual gap (percentage of GDP)	Business-as-usual gap (bln USD)
EAP	18.3	13.2	5.0	1759
ECA	7.5	2.9	4.5	497

LAC	10.6	3.6	7.0	798
MNA	8.3	6.4	1.9	77
SAS	29.2	5.4	23.8	1762
SSA	47.2	4.4	42.8	1712

Source: Authors' calculations.

Eradicating extreme poverty will require a large increase in public investment in LAC in spite of the projected increase in GDP per capita, which significantly contributes to poverty reduction, as shown in Table 14. This implies that the objective of poverty eradication will be not be achieved by simply relying on GDP per capita growth. Increases in public investment will also be needed.

The increase needed in public investment in LAC is smaller than in other regions such as South Asia or sub-Saharan Africa. This is because extreme poverty in LAC is not as high. The 2010-14 average for LAC countries is below 9 per cent, 6 per cent if we exclude Haiti—a lower level than the average for all developing and emerging market countries (20 per cent). In sub-Saharan Africa, the poverty rate is close to 50 per cent and eradicating extreme poverty will require a much larger increase in public investment. In this case, the investment gap increases from 3.8 (Table 11) to 42.8 per cent of GDP (Table 13). Another region that experiences a large increase in the public investment gap is South Asia, where the gap surges from 1.8 to 23.8 per cent of GDP.

Achieving other SDG goals may also imply large increases in public investment in Latin America. We estimate the impact of public investment on two additional SDGs: child mortality under five years of age, and lower secondary school completion rates. Table 14 provides the regression results. The first column reproduces the results for poverty rates, the second provides results for mortality rates, and the third for lower secondary school completion rates.

Table 14. Public investment and SDGs

Dependent variables:	(1)	(2)	(3)
	Poverty rate, %	Mortality rate, %	Education completion rate (lower secondary)
Public investment/GDP	-0.818***	-1.771***	0.436**
	(-3.041)	(-5.239)	(2.056)
Ln(GDP per capita)	-15.106***	-24.570***	16.896***
	(-5.635)	(-5.664)	(5.783)
Agriculture/GDP	0.134	1.181***	-0.252
	(0.811)	(4.778)	(-1.519)

Manufacturing/GDP	-0.076	0.963***	-0.586***
	(-0.366)	(2.956)	(-2.794)
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	255	468	382
R-squared	0.394	0.396	0.340
Number of id	103	124	121

t-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculations.

As expected, increases in the ratio of public investment to GDP are correlated with reductions in the mortality rate and increases in lower secondary education completion rates. A 1 per cent increase in public investment leads to a 0.18 percentage point reduction in the mortality rate and a 0.4 percentage point increase in the lower secondary completion rate.

To compute the additional public investment needed to achieve these two additional goals, we calculate the investment needed to reach each of the three goals (poverty, mortality under five, and completion of lower secondary school education) by 2030 as before, and then take the maximum investment needed. If public investment as a share of GDP remains at its 2015 level of 3.6 per cent of GDP in LAC, then achieving all three targets would imply an impressive public investment gap of 12.4 per cent of GDP (USD 1,406 billion) (Table 15).

Table 15. Public investment demand and reaching three SDG targets

	Estimated demand (percentage of GDP)	Business-as-usual investment (percentage of GDP)	Business-as-usual gap (percentage of GDP)	Business-as-usual gap (bln USD)
EAP	18.9	13.2	5.7	1983
ECA	10.9	2.9	7.9	874
LAC	16.0	3.6	12.4	1406
MNA	17.5	6.4	11.1	450
SAS	39.6	5.4	34.2	2534
SSA	62.8	4.4	58.4	2337

Source: Authors' calculations.

The increase in public investment needed to achieve the three SDG targets in LAC (12.4 per cent of GDP) is significantly larger than the increase needed to reach only the poverty target (7 per cent of GDP). This is mainly driven by the public investment needed to reach the infant mortality target, as can be seen from the Appendix tables that report the public investment needed by 2030 if mortality and secondary school completion targets are to be reached separately. The public investment needed to reach the targeted reduction in infant mortality is driving the results because the returns on public investment in achieving the infant mortality target are lower than those for the secondary school completion target. This is partly explained by the fact that the infant mortality target is further away from its current level than is the case for secondary school completion or poverty. A similar exercise can be undertaken for other SDG targets if quantitative indicators are available to evaluate the gap.

5. Closing the Investment Gap

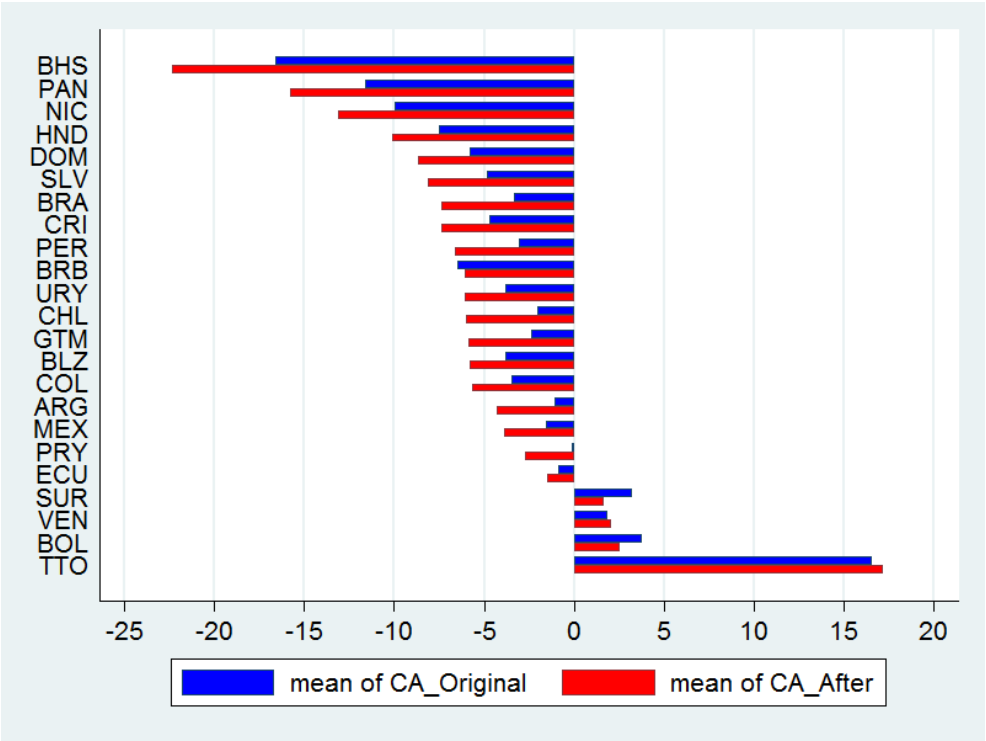
The previous sections showed that in 2015, Latin America and the Caribbean had an investment gap equal to 3.1 per cent of the region's GDP and that closing it would require an increase in investment of nearly USD 170 billion per year. Projections for 2030 indicate that the gap will reach 4.4 per cent of the region's GDP and that closing it will entail additional investment of more than USD 500 billion per year: the cumulative investment gap over 2015-30 is close to USD 5 trillion. This amount does not include the scaling up in investment necessary to reach the SDGs. Our simple exercise shows that reaching one of the least ambitious targets (from the region's point of view) would increase the 2030 gap by more than USD 20 billion and bring the cumulative gap over 2015-30 to USD 5.1 trillion.

To evaluate the effects of this required scaling up of public investment on external and fiscal sustainability, we conduct two simple exercises. First, we assume that countries

have constant savings rates and private investment. Given that the current account balance is equal to total savings minus private and public investment, we estimate the current account implications of closing the investment gap by subtracting the 2015 country-specific investment gap from the country's current account balance (we use the 2010-14 average).

The blue bars in Figure 7 measure the average currency account balance over 2010-14 and the red bars are equal to the blue bars minus the investment gap reported in Figure 6. Other things being equal, we find that there are four countries that, in order to close the investment gap, would need a current account deficit equal to or greater than 10 per cent of GDP. There are 12 other countries (including the region's six largest economies) for which closing the investment gap would require a current account deficit larger than 4 per cent of GDP.

Figure 7. Investment gaps and current account balance (% of GDP).



Source: Authors' calculations and World Bank World Development Indicators.

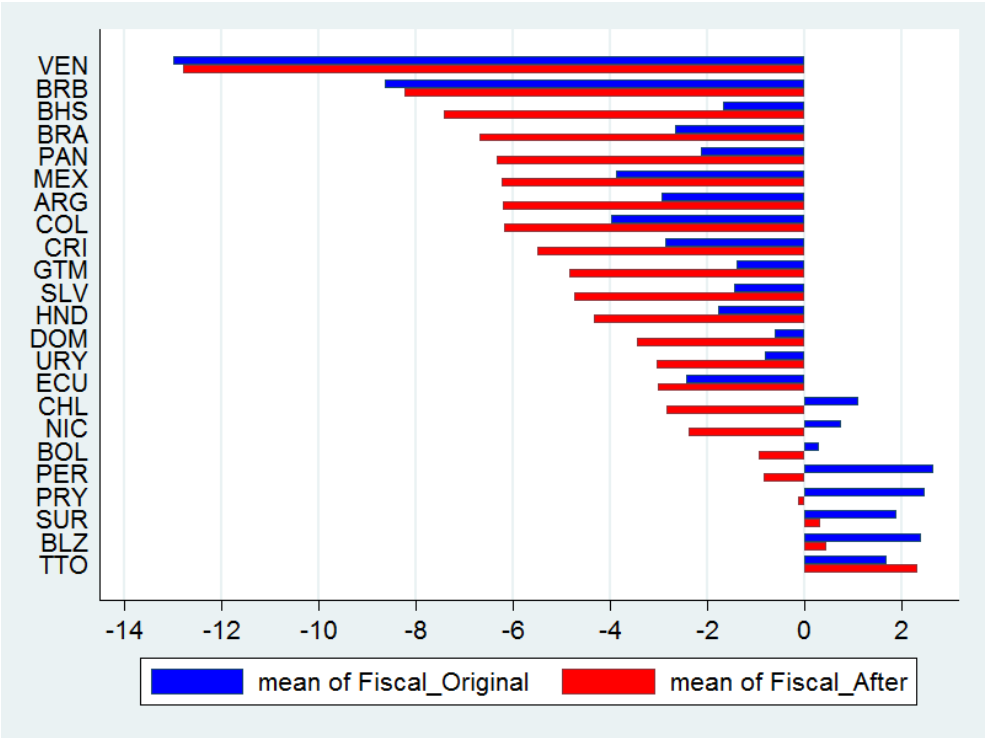
These are back-of-an-envelope estimates based on the assumption that other things remain equal and on long-run projections that are far from being problem free. However, they give an indication of the order of magnitude of the problem. It is also worth noting that these large current accounts would need to be sustained for an extended period (15 years in our estimations). Cavallo, Eichengreen and Panizza (2017) show that large and persistent current account deficits often lead to financial crises, high volatility and sub-par economic growth. Hence, a systematic scaling up of public investment will require an increase in the domestic savings rate (for a comprehensive discussion of savings rates in Latin America and the Caribbean see Cavallo and Serebrisky (2016)).

We can examine the fiscal implications of closing the investment gap by conducting a similar experiment. Specifically, we assume unchanged government revenues and

current expenditure and subtract from the observed fiscal balance the increase in public investment necessary to close the public investment gap.

Figure 8 shows the results of this exercise. The blue bars plot the average fiscal balance over 2010-14 and the red bars are equal to the blue bars minus the investment gap reported in Figure 6. Other things being equal, eight countries (including Brazil, Argentina, Mexico and Colombia) would need to have a fiscal deficit greater than 6 per cent of GDP and four other countries a fiscal deficit larger than 4 per cent of GDP to close their investment gap.

Figure 8. Investment gaps and fiscal balance (% of GDP).

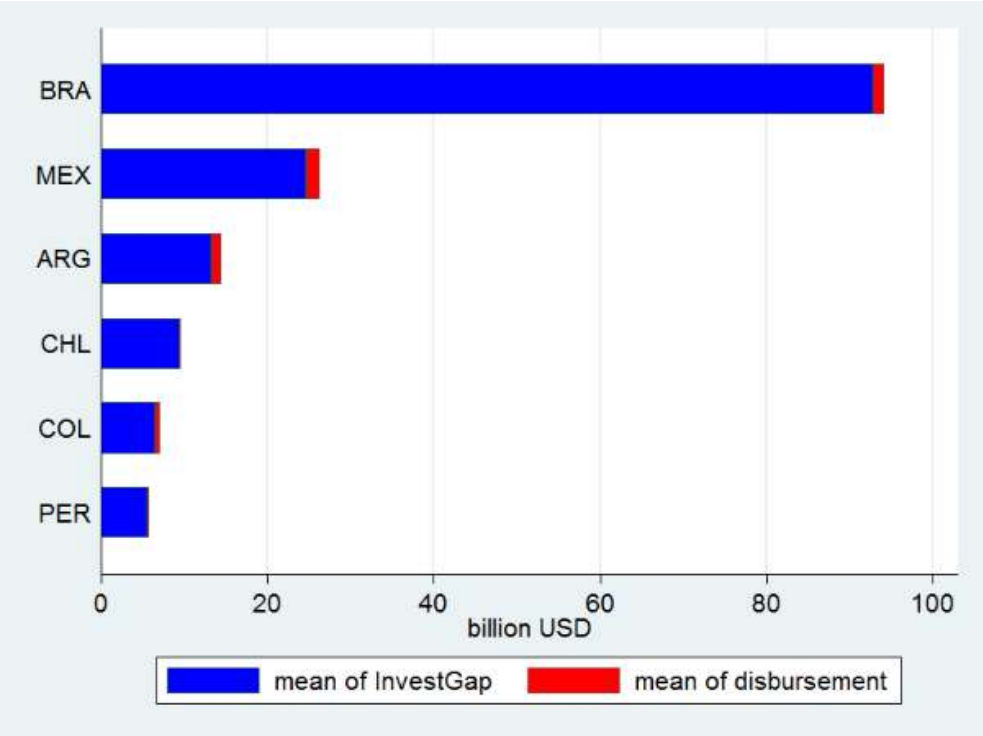


Source: Authors' calculations and World Bank World Development Indicators..

These back-of-an-envelope estimates fail to take a number of factors into account (for instance, the fact that public investment can have a positive effect on growth and fiscal revenues). However, they illustrate the serious fiscal implications linked to closing the investment gap. All large Latin American economies would need substantial fiscal deficits (ranging from 7.5 per cent in Brazil to 3 per cent in Chile) sustained for a period of 15 years to close the investment gap. Scaling up public investment will require fiscal reforms but also public–private partnerships, which would allow the private sector to finance some investment projects that traditionally have been financed with public funds. Multilateral development banks (MDBs) can help countries in the region to close these gaps through lending and policy advice. On the policy advice side, they can help countries to design fiscal reforms aimed at limiting the budgetary implications of scaling up public investment and creating an enabling environment for prompting greater private sector participation in infrastructure projects. MDBs can also help countries to develop policies that can promote domestic savings and therefore limit the current account implications of scaling up public investment (Cavallo and Serebrisky, 2016).

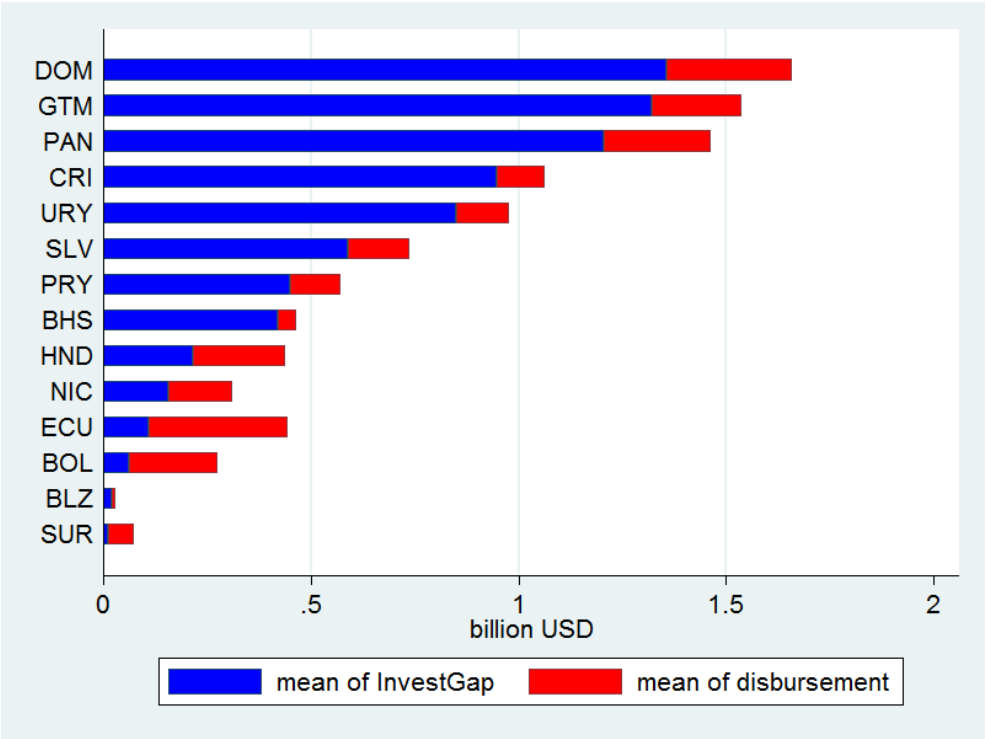
On the financing side, the question is one of the impact of an increase in MDB lending on closing these gaps. To examine this point, we consider the example of Inter-American Development Bank (IDB) lending. The horizontal bars in the Figures 9.1 and 9.2 plot the total public investment gap in 2015 for some IDB borrowing countries and the red bars show the share of the investment gap that could be covered if the IDB were to double its disbursements with respect to the 2010-14 average. Figure 9.1 shows that IDB gross disbursements are a small fraction of the total investment gaps of the six largest countries in the Region. However, for several small and medium-sized countries, plotted in Figure 9.2, a scaling up of IDB lending could have a significant effect on reducing the public investment gap. Figure 9.3 shows that for nine countries IDB disbursements represent more than 20 per cent of the public investment gap. A scaling up of IDB lending could have a substantial impact on public investment in these countries.

Figure 9.1. IDB disbursements and the investment gap (bln USD)



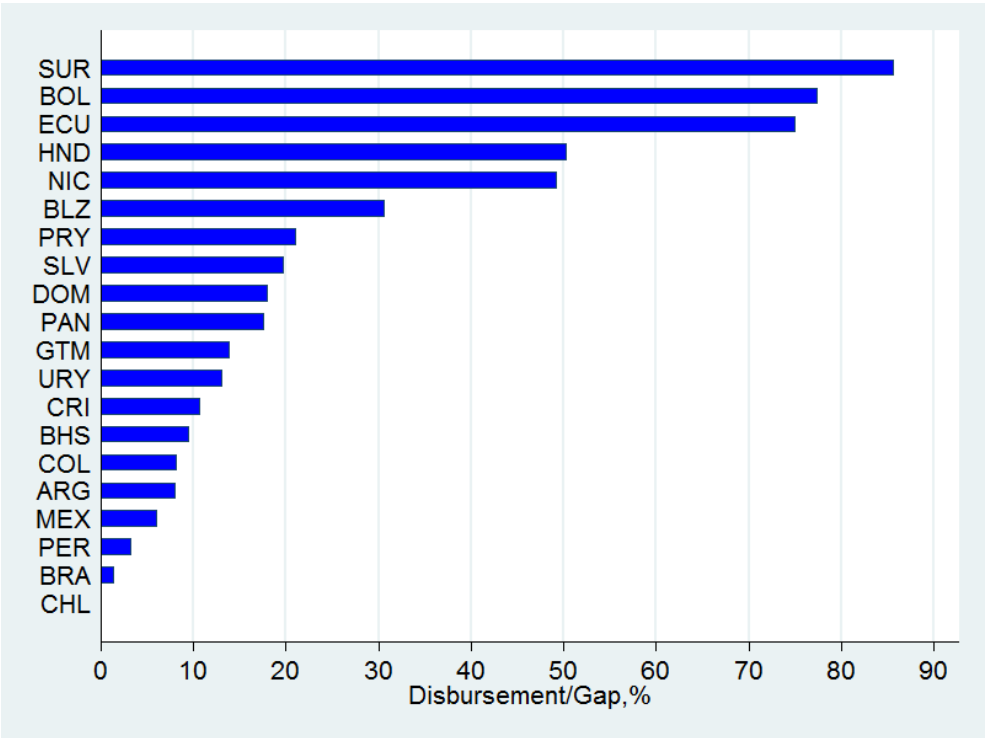
Source: Authors' calculations, World Bank World Development Indicators and IDB data.

Figure 9.2. IDB disbursements and the investment gap (bln USD)



Source: Authors' calculations, World Bank World Development Indicators and IDB data.

Figure 9.3. IDB disbursements and the investment gap (bln USD)



Source: Authors' calculations, World Bank World Development Indicators and IDB data.

There are two ways to interpret these findings. The first is that, as MDBs cannot have any important effect in large countries, they should concentrate their lending on small countries. The second possible interpretation is that there is a large latent demand for MDB lending. It is worth nothing that even in large countries, like Colombia and Argentina, a doubling of IDB lending could reduce the public investment gap by nearly 8 per cent. Moreover, multilateral lending could contribute to closing the investment gap thanks to its catalytic role for private sector financing.

5.1 Multilateral Lending is Safer from the Borrower's Point of View

While in a closed economy investment is limited by national savings, an open economy can increase investment by tapping foreign savings. In theory, a poor country with a low savings rate but good growth prospects can build up its capital stock by running a large and sustained current account deficit. Access to the international capital market should also allow countries to smooth public expenditure across good and bad times. In fact, there are good reasons why countries may want to increase public investment during demand-driven recessions. Such a policy would reduce the cost of building a country's capital stock (factors of production are cheaper during recessions) while facilitating the recovery by providing a stimulus to domestic demand.

However, developing and emerging market countries have precarious access to international finance and, as they tend to lose market access during recessions, they often implement procyclical fiscal policies (Gavin and Perotti, 1997). Public investment is often the adjustment variable and losing access to international financial flows can lead to budgetary cuts, which, besides deepening the recession in the short term, may also have long-term implications as these cuts tend to be concentrated on public investment (Easterly, Irwin and Servén, 2008) and infrastructure investment (Serebrisky et al., 2015).

Besides increasing the volatility of public investment, precarious access to international financial markets may also reduce a country's willingness to scale up investment by borrowing abroad during good times when financing is available. This is because, with volatile access to international finance, foreign borrowing is risky, as highlighted by the economic literature on original sin and sudden stops.

External debt is often denominated in foreign currency (Eichengreen, Hausmann and Panizza, 2007) and funding domestic investment projects that do not generate foreign earnings with foreign currency debt can lead to dangerous currency mismatches. Another risk, highlighted by the literature on sudden stops (Calvo, Izquierdo and Mejía, 2004; and Cavallo and Frankel, 2008), is that countries that rely heavily on foreign savings tend to face sudden capital flight. These sudden stops force the affected country to abruptly close its current account deficit. This outcome is usually achieved through a combination of real exchange rate depreciation and import contraction, both of which are typically accompanied by recessions, especially in the presence of foreign currency debt.[15]

While most multilateral lending is still denominated in foreign currency (and hence does not eliminate the risks linked to the presence of currency mismatches), lending by multilateral development banks is either acyclical or countercyclical (Galindo and Panizza, 2017). It is thus better suited for financing long-term investment projects as it is not subject to sudden stops. It is in this sense that lending by multilateral banks is a safer form of finance that can play an important role in scaling up investment in emerging and

developing countries. Cavallo, Eichengreen and Panizza (2017) find that large current account deficits financed with official flows are less likely to end with a financial crisis.

One puzzling element is that in good times, when liquidity is abundant, most Latin America countries prefer to borrow from financial markets instead of borrowing from the multilaterals. The standard explanation for this behaviour is that when the spread between the interest rate charged by official lenders and the rate charged by private lenders is low it is not worth paying the higher costs in terms of the compliance linked to official lending. This way of reasoning seems myopic because it does not take into account the costs linked to the volatility of market finance.[16] In future research, it would be interesting to compare the total costs (interest rate + volatility) of market financing with the total cost (interest rate + compliance) of official financing.

6. Conclusions

This paper provides a simple and transparent methodology for estimating public investment gaps in developing countries together with a detailed analysis of these gaps in LAC countries. We also develop a simple methodology for incorporating SDG targets into our investment gap estimates (poverty, infant mortality and lower secondary school completion).

We find that in 2015 the total public investment gap of LAC countries was close to USD 170 billion (3.1 per cent of the region's GDP) and that the gap is expected to reach USD 501 billion (4.4 per cent of the region's GDP) by 2030. This increase is somehow surprising as the region's GDP per capita is expected to increase during this period, which should in principle lead to a decline in public investment needed. However, the increase in GDP per capita will be accompanied by a structural transformation of the region's economies away from agriculture and manufacturing and towards the service sector. This second effect dominates and leads to a larger public investment gap by 2030. If we were to add to the projected 2030 gap the necessary public investment needed to reach the three SDGs examined, the public investment gap would reach USD 1,406 billion (12.4 per cent of the region's GDP) by 2030.

Most of the region's largest economies have gaps well above 2 per cent of GDP and Brazil had a gap of 4 per cent of GDP in 2015. Like all forecasting exercises, our estimates have a substantial margin of error and should be complemented with expert assessments of gaps in specific areas.

Future research should focus on estimating confidence intervals for these predictions and on building bounds that take into account possible endogeneity problems with the methodology described in this article. It would also be interesting to put the investment gaps on the left-hand side of a regression analysis and study whether country characteristics are correlated with these gaps. Potential control variables include private savings, the level of development, government balance, current account balance, fiscal and monetary policy procyclicality, and the composition of public debt. It would also be interesting to study the relationship between investment gaps and the cyclicality of public investment spending. Finally, future research could expand our methodology to alternative SDG targets.

Annex

Data Appendix

Investment and capital stock data come from the IMF Investment and Capital Stock Dataset 2017. This data set contains comprehensive and comparable data across countries on public, private and total investment, as well as capital stocks for all IMF member countries. These flows and stocks include public–private partnership (PPPs) projects.

Our key focus is on public investment and the IMF data set has comparable data across 170 countries (see Pritchett (2000) for reasons why capital and investment flow data may not be comparable across countries). Investment and capital stock data are computed using PPP exchange rates to make them comparable across countries. This explains why the investment numbers in the new IMF data set are a bit larger than what one may be used to observing for low-income countries.

Data on infrastructure investment are drawn from the Global Infrastructure Outlook (GIO). The GIO contains infrastructure data for around 50 countries from 2007 until 2015.

The infrastructure investment efficiency data are from the World Economic Forum and it includes 170 countries from 2006 to 2014.

GDP, GDP per capita, population, the share of agriculture value-added in GDP, and the share of manufacturing value-added in GDP come from the World Bank's World Development Indicators 2017.

GDP forecast data until 2022 are taken from the IMF's World Economic Outlook (WEO) which is available for 170 countries. For GDP forecasts after 2002, we use the OECD data set, which contains the GDP forecast for its member countries (including China and Russia) until 2060.

Data on poverty, child mortality under five, and lower secondary education completion corresponding to SDG targets comes from World Development Indicators.

Appendix : Endogeneity Bias

Our methodology assumes that β_2 in Equation (1) measures the causal effect of GDP per capita on investment. This is equivalent to assuming that GDP per capita is fully exogenous and hence uncorrelated with the residuals of Equation (1). However, this assumption is unlikely to hold as investment may have a positive effect on GDP per capita (in the standard neoclassical growth model an increase in investment leads to a higher steady state income). Consider, for instance, a model in which public investment (I) is regressed on GDP per capita (Y):

$$I = \alpha + \beta Y + \varepsilon \quad (2)$$

where α and β are parameters to be estimated and ε is a shock to public investment. In the set-up of Equation (2), a negative value of β indicates that richer countries need less public investment. This is what we find when we estimate Equation (1). Now, let us also

assume that public investment has an effect on GDP per capita and that this relationship can be described as

$$Y = m + kI + v \quad (3)$$

where m and k are parameters to be estimated and v is a shock to GDP per capita. The parameter k measures the effect of public investment on GDP per capita and is likely to be positive.

The OLS estimation of β from Equation (2) is

$$\beta = \frac{\beta\sigma_v^2 + k\sigma_\varepsilon^2}{k^2\sigma_\varepsilon^2 + \sigma_v^2} \quad (4)$$

and the bias of the OLS estimate is

$$E(\beta) - \beta = \frac{k(1-\beta k)}{\sigma_v^2/\sigma_\varepsilon^2 + k^2} \quad (5)$$

Under the assumptions that (which is satisfied if β and k have opposite signs) and $k > 0$, the OLS estimate of β is positively biased. While our estimation strategy partly controls for this endogeneity problem by using lagged values as instruments, any violation of the exclusion restrictions (and the Sargan test is a necessary but not sufficient condition for the validity of these restrictions) is likely to lead to a positive bias in the estimation of β. Hence, the true value of β_2 is likely to be smaller than -0.46. In future research, it would be interesting to build bounds for the value of β_2 and use these bounds to build a distribution of the investment gap.

Appendix Tables

Appendix Table 1. Public investment demand including SDG infant mortality target

Region	Estimated public investment demand (% GDP)	Business-as-usual investment (% GDP)	Business-as-usual investment gap (% GDP)
EAP	6.1	13.2	-7.1
ECA	7.9	2.9	5.0

LAC	9.9	3.6	6.3
MNA	10.5	6.4	4.1
SAS	15.3	5.4	9.9
SSA	21.5	4.4	17.1

Source: Authors' calculations.

Appendix Table 2. Public investment demand including SDG lower secondary education completion target

Region	Estimated public investment demand (% GDP)	Business-as-usual investment (% GDP)	Business-as-usual investment gap (% GDP)
EAP	6.2	13.2	-7.0
ECA	7.9	2.9	5.0
LAC:	8.6	3.6	5.0
MNA	8.7	6.4	2.3
SAS	8.1	5.4	2.7
SSA	9.3	4.4	4.9

Source: Authors' calculations.

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NOTES

1. Data include the share of public investment invested through public–private partnerships.
2. Public investment has both direct and indirect effects on economic growth. The indirect effects are linked to the complementarities between public and private investment (Dreger and Reimers, 2016). There are, however, also authors that have found that public investment crowds out private investment (Afonso and St. Aubyn, 2016).
3. LAC countries include Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay, and Venezuela. For data sources, see the Data Appendix.
4. Purchasing power parity.
5. The average public investment-to-GDP ratio for developing countries tends to be larger than the average for developed countries, whereas in terms of total investment-to-GDP ratio the averages for developed and developing countries are similar.
6. Ruiz-Nuñez and Wei (2015) estimate models for telephones subscribers per 1,000 persons, kilometres of paved roads per square kilometre of land area, kilometres of unpaved roads per square kilometre of land area, kilometres of rail per 1,000 persons, KW of installed electricity generation capacity per capita, percentage of households with access to electricity, percentage of households with access to water and sanitation, percentage of households with access to sanitation and percentage of households with access to waste water treatment.
7. The year fixed effects control for common shocks. The results are qualitatively identical and quantitatively similar if we exclude year fixed effects. We can introduce other control variables into Equation (1). One potential candidate is the World Economic Forum's (WEF) quality of infrastructure variable, which is likely to affect demand for public investment. The problem with this variable is that it is only available from 2006, so once we take 5-year averages we would be left with two observations per country, which would not allow us to use our preferred estimation strategy.
8. When we run the same specification on a sample of developed countries (31 countries and 115 observations) the Sargan and the Arellano and Bond autocorrelation tests suggest that the instruments are not valid. It is also unclear whether with such a small cross-section we satisfy the conditions necessary for asymptotics to be valid. In our baseline sample composed of developing and emerging market countries, we also run a specification where we include the share of private investment in GDP as a regressor. The results are qualitatively identical, and the share of private investment to GDP has a positive and statistically significant coefficient suggesting that private and public investment complement each other.

9. As the demand equation is estimated in first differences, the fixed effects cannot be recovered directly from the estimated equation but need to be obtained by applying the point estimates to a level equation.
10. It is also worth noting that the quality of recent data in Venezuela is poor and this may lead to imprecise estimates of the gap.
11. With more data, the same approach could be applied to a larger number of indicators.
12. By 2030, end preventable deaths of newborns and children under five years of age, with all countries aiming to reduce under-five mortality to at least as low as 25 per 1,000 live births.
13. By 2030, ensure that all girls and boys complete free, equitable and quality secondary education leading to relevant and effective learning outcomes
14. GDP per capita is also negatively correlated with the poverty ratio, whereas the agriculture and manufacturing value-added shares in GDP do not seem to have a statistically significant impact on poverty rates.
15. Because of these risks, which were at the centre of the financial crises of the 1990s, many East Asian countries decided to put in place policies aimed at reducing their net exposure to external debt. These policies consisted of either borrowing less or self-insuring by accumulating large foreign reserves, (Hausmann and Panizza, 2011). This was, however, an easy choice for East Asian countries characterised by high saving rates and no need to tap foreign markets to finance their sky-high investment rates. Things are more difficult for Latin American countries characterised by low saving rates.
16. While it is true that when countries lose access to market finance they can still get funding from the multilaterals, the process is usually slow and emergency finance often comes at a premium (in terms of both interest rates and conditionality) over regular lending facilities. Moreover, if multilaterals do not have enough demand in good times, their steady state balance sheet will remain small and hard to scale at times of crisis.

ABSTRACTS

We estimate public investment gaps in a sample of developing countries using a public investment demand function. We then use gross domestic product (GDP) per capita projections, forecasts of structural transformation, and three Sustainable Development Goals (SDGs) targets (poverty, infant mortality and lower secondary school completion) to predict public investment needs in 2030 in Latin American and Caribbean countries. Our estimates suggest that in 2015 their total public investment gap was close to USD 170 billion (3.1 per cent of the region's GDP) and expected to surpass USD 1.4 trillion (12.4 per cent of the region's GDP) by 2030 if the SDGs were to be reached.

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