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Doing More with Less: How Can Brazil Foster Development While Pursuing Fiscal Consolidation?

by Valentina Flamini and Mauricio Soto

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Doing More with Less: How Can Brazil Foster Development while Pursuing Fiscal Consolidation?

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Abstract

Following a benchmarking exercise, we estimate the spending required to reach satisfactory progress in the Sustainable Development Goals in the health, education, and infrastructure sectors in Brazil. We find that there is room for savings in education (up to 1.5 percentage point of GDP) and health (up to 2.5 percentage points of GDP) without compromising the quality of services but additional investments for over 3 percent of GDP per year are needed to close large infrastructure gaps in roads, water, and electricity by 2030. Brazil can do more with less, but increasing efficiency of public spending will require substantial reforms.

JEL Classification Numbers: Q01, H11, H20, H87, O23, I15, I25, L92, L94, L95, F35.

Keywords: SDGs, development, fiscal policy, public spending, Brazil

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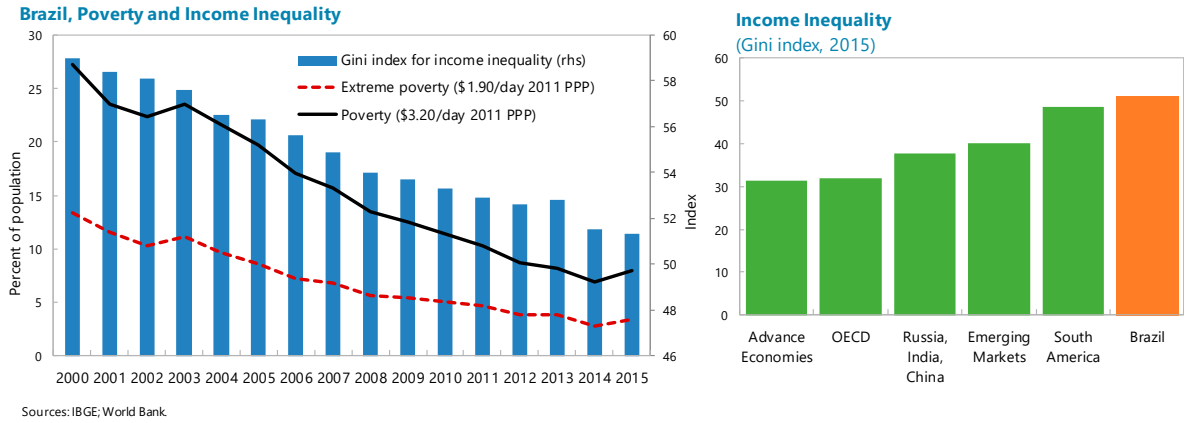
I. INTRODUCTION

Brazil has achieved remarkable social and economic progress over the past two decades, but poverty and income inequality remain high by regional standards. Since 2000, about 20 and 10 percent of the population have lifted themselves out of poverty and extreme poverty respectively; life expectancy at birth increased by more than 5 years; and the Gini coefficient for income inequality fell by almost 8 percentage points (Figure 1). Such progress was the effect of fast growth stoked by the commodity supercycle, helped by policies implemented by the government, including increases in social spending and the minimum wage (Góes and Karpowicz, 2017). Despite such remarkable progress, Brazil is still one of the most unequal countries in Latin America and the world (Figure 1).

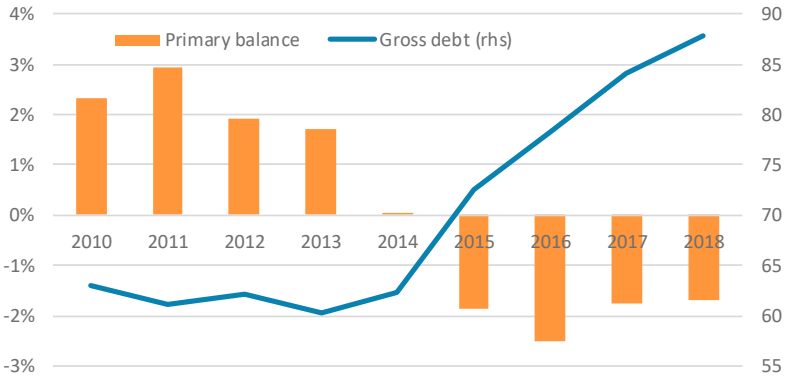
Figure 1. Poverty and Income Inequality



Sources: IBGE; World Bank.

Brazil's fiscal situation has deteriorated substantially since 2014, leaving limited space for development spending. The 2015−16 recession widened fiscal deficits and swelled debt levels: the primary balance turned from average surpluses of 2.6 percent of GDP in 2007−13 into average deficits of 2 percent of GDP in 2015−18. The gross debt of the NFPS (Nonfinancial Public Sector) increased from 60 percent of GDP in 2013 to 88 percent of GDP in 2018, exposing the country to debt sustainability risks (Figure 2). The constitutional spending cap introduced in November 2016 entails a decline of about 0.5 percentage points of GDP annually in federal government expenditure in 2019−24, drastically reducing fiscal space for discretionary spending. Thus far, a lot of the adjustment has fallen on government capital spending, which remains low at about 1 percent of GDP. However, looking forward other sectors critical for development—including education and health—would need to contribute to the adjustment even with significant reforms to the social security system and wage bill.

Figure 2. Primary Balance and Gross Debt
(Percent of GDP)



Sources: Brazil Ministry of Economy; and Central Bank.

The Sustainable Development Goals (SDGs) agenda provides a shared blueprint for development objectives. The agenda was launched at the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012 and adopted in January 2016 by all United Nation member states. The SDGs establish measurable and multilaterally agreed development priorities that will guide national policies and international cooperation until 2030. They include 17 goals and 169 targets, building on the success of the Millennium Development Goals while embracing new areas of development such as climate change and sustainable consumption, among other priorities.

Brazil has integrated the SDGs into the government's national development plans and policies. Brazil has been an active member in the policy forum leading to the SDGs adoption. In 2016 the government created the National Commission for the SDG, as the main institutional inter-agency coordination mechanism for the implementation of the 2030 Agenda in Brazil. The Commission is an advisory body composed by representatives from the federal and subnational governments, and civil society responsible for internalizing and integrating the SDGs within the national agenda. As part of the adoption process, the SDG targets and indicators have been mapped into the attributes of the of the 2016−19 Multi-Year Plan (PPA), the main medium-term planning instrument for government policies, and in the National Strategy for Economic and Social Development 2020−31. As of 2016, 86 and 78 percent of the targets and indicators of the SDGs respectively were consistent with the attributes of the PPA.

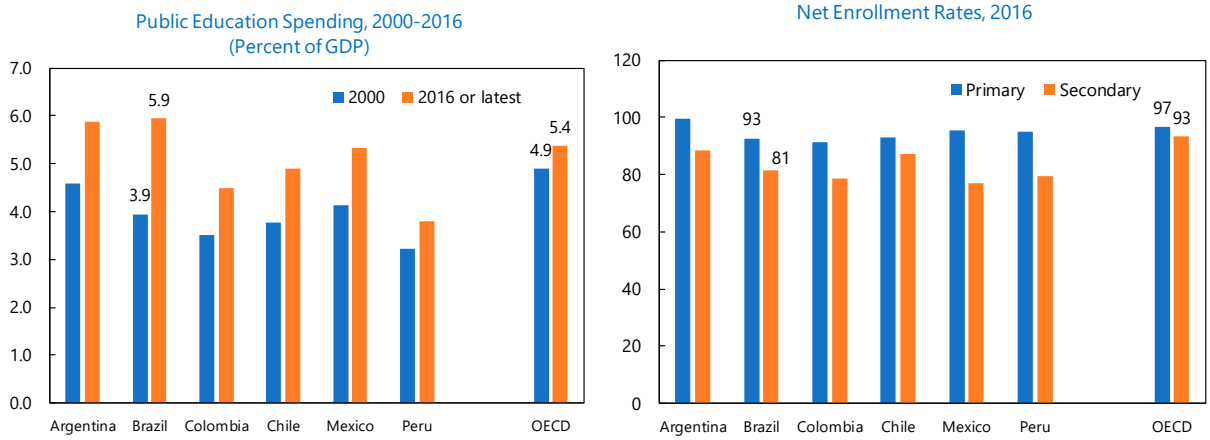
Given its current fiscal consolidation needs, Brazil will need to *do more with less* to fulfill its own and the SDG agenda. In this paper we estimate the spending required to (efficiently) foster Brazil's human, social, and physical capital which is at the core of sustainable and inclusive growth. We focus outcomes in the health, education, and infrastructure sectors, for which public intervention is essential, and anchor our estimates to the SDGs agenda by measuring the cost of attaining satisfactory progress towards the goals related to health (SDG3), education (SDG4) and infrastructure (SDG 6, 7, 9, 11) following the methodology developed by Gaspar and others (2019).

II. Where Does Brazil Stand?

A. Education

Government expenditure in education has been increasing rapidly, but enrollment is lagging. Public spending in education increased from about 4 to 6 percent of GDP in 2000−16, a spending level above the average for the OECD economies (Figure 3). Today, Brazil is among the countries with the highest level of expenditure in the region. Nonetheless, education outcome indicators remain disappointing, including enrollment rates for primary and secondary education which are well below OECD levels (even though above regional average). Today, fewer than 63 percent of individuals complete secondary education, compared to 71 percent in peer Latin American economies and 88 percent in the OECD.

Figure 3. Public Education Expenditure and Enrollment

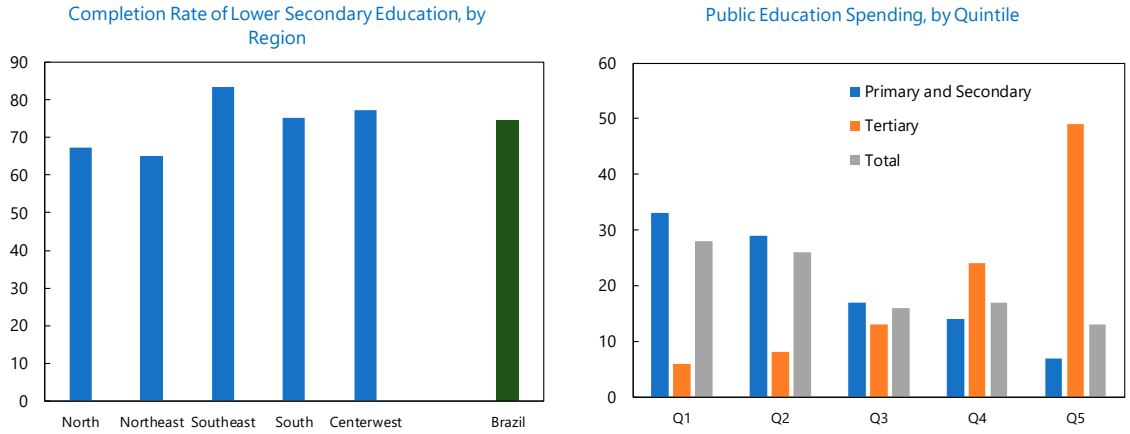


Source: UNESCO.

Achievements vary across regions. The gap between the percent of individuals who complete lower secondary is nearly 20 percentage points between the Southeast (where 84 percent complete lower secondary) and the Northeast (where only 65 percent complete lower secondary) (Figure 4). Furthermore, total education spending is only mildly progressive—about 54 percent of total spending goes to households in the bottom 40 percent of the income distribution. This reflects a combination of progressive spending in primary and secondary education, but regressive spending in tertiary education (World Bank, 2017; Higgins and Pereira, 2014).

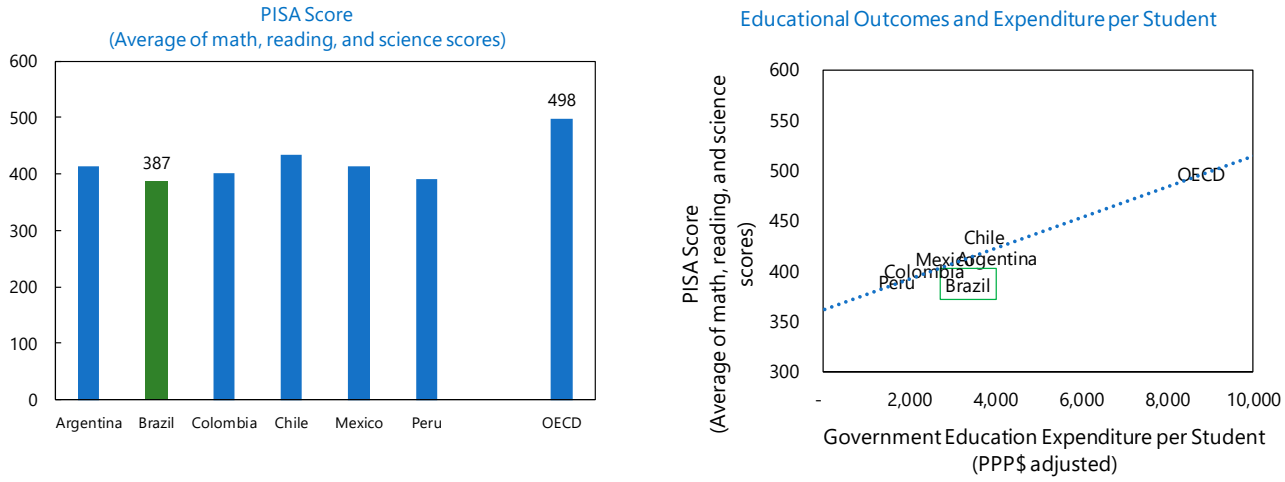
The quality of educational outcomes is disappointing. Average PISA (Program for International Student Assessment) scores are lower than peers and substantially below OECD economies (Figure 5). Performance in PISA are lower than implied by the level of expenditure per student, and countries that spend much less per student achieve similar or higher outcomes. In fact, the World Bank estimates that PISA results are only about 20 percent lower than given the cumulative expenditure per student over 2004–12 (World Bank, 2017).

Figure 4. Disparities in Public Educations Outcomes and Expenditure



Sources: ENDES (2018) and Word Bank (2017).

Figure 5. Education Outcomes

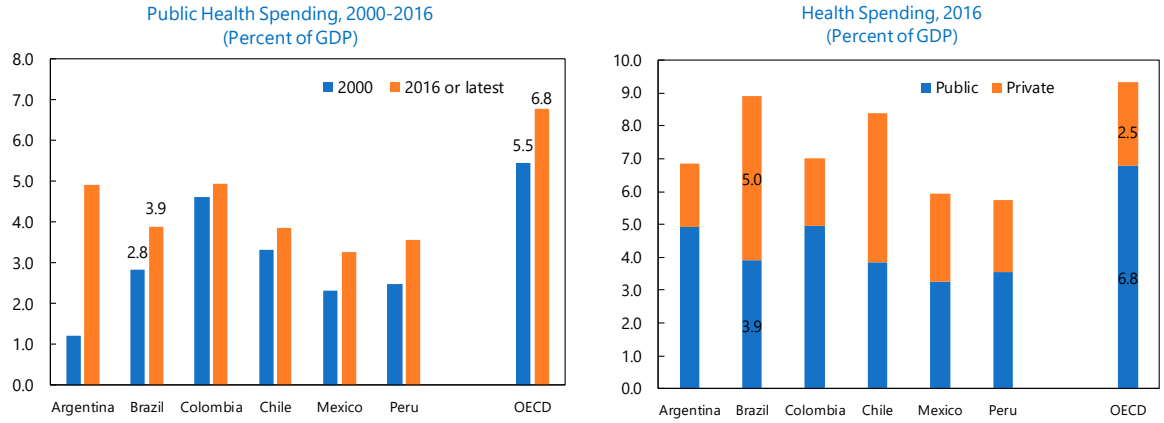


Sources: OECD, UNESCO, and IMF staff calculations.

B. Health

Government expenditure in health has increased to levels observed in peer countries. Public health spending increased from 2.8 percent of GDP in 2000 to 3.9 in 2016, just below the average for peers (4 percent of GDP) (Figure 6). This increase in public spending largely reflects the expansion of the Unified National Health Care System (SUS) through the Family Health Program (PSF), including a 75 percent increase in the community health workers and a 400 percent increase in the family health teams over 2000–10 (Paim and others 2011). However, at 9 percent of GDP, total health spending is substantially higher than regional peers and nearly at the level of the OECD economies.

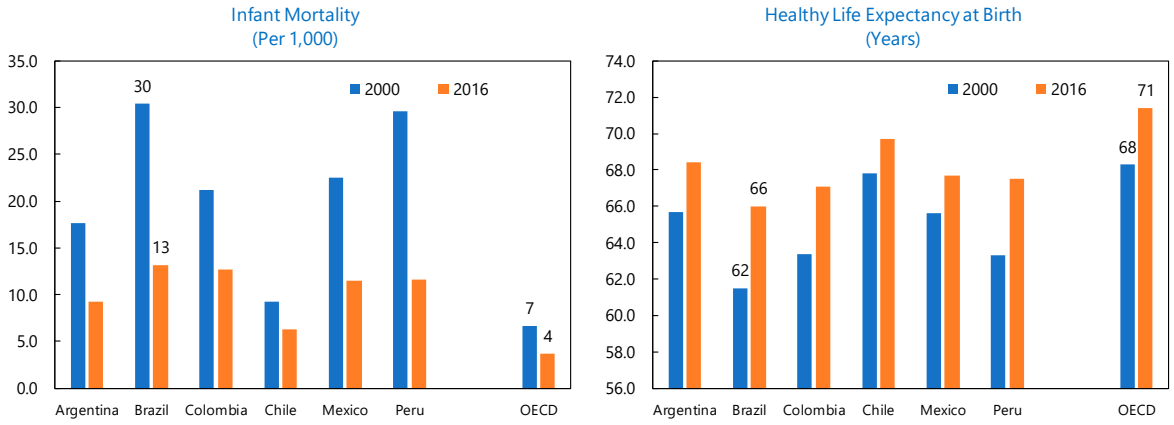
Figure 6. Health Expenditure



Source: WHO.

Health outcomes have improved substantially, but still lag peers. The expansion of the SUS improved access to health services, including primary care, and today prenatal and vaccination have nearly universal coverage (Paim and others 2011). This has contributed to an improvement in the indicators—since 2000, infant mortality has declined by 60 percent and life expectancy has increased by four years (Figure 7). Notwithstanding this progress, both indicators lag regional peers and are substantially worse than in the OECD. Furthermore, substantial disparities remain. Infant mortality in the North is about 60 percent higher than in the South (ENDES 2018).

Figure 7. Health Expenditure

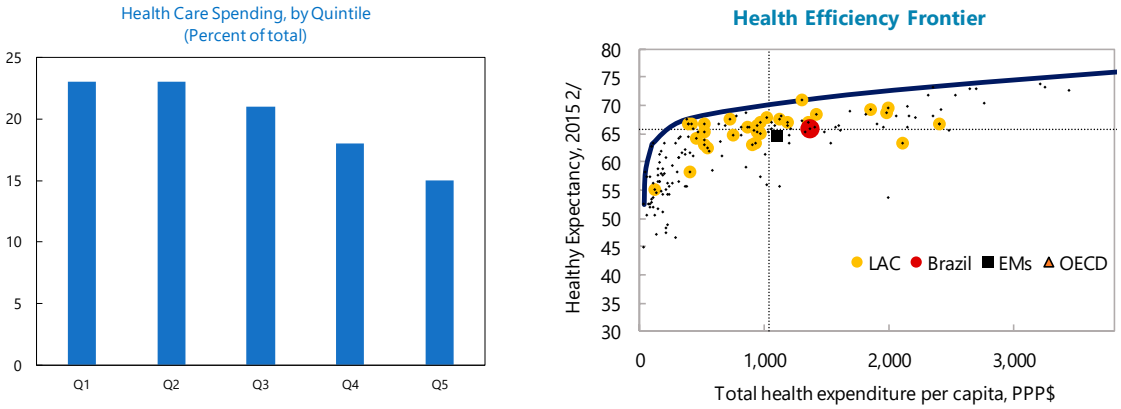


Source: WHO.
Note: Healthy Life Expectancy (HALE) at birth applies disability weights to health states to compute the equivalent number of years of good health that a newborn can expect. For comparison, HALE at age 60 in Brazil was 17 years in 2016: https://apps.who.int/gho/data/view.main.HALEXv, and (unweighted) life expectancy at birth was 76 years in 2016 and 2017.

Health spending is mildly progressive but with substantial inefficiencies. About 46 percent of health expenditure is concentrated in the population in the bottom 40 percent of the income distribution (Figure 8). However, important socioeconomic inequalities in access

and quality of care remain (Victoria and others, 2011). Supplemental private health coverage is under 20 percent for households whose head has an income under 1 minimum wage compared with over 70 percent for households whose head as an income above 3 minimum wages (Paim and others, 2011). In addition to the differences in standards of care, this implies that the tax expenditures for private health insurance premiums (about 0.3 percent of GDP) are regressive (World Bank, 2017). Spending also seems inefficient. Peer countries achieve similar or better health outcomes with less resources. This is consistent with the World Bank (2017) finding that the same outcomes could be achieved with 23 less resources in primary health and 34 percent less resources in secondary and tertiary care, with most inefficiencies in the smaller hospitals and municipalities.

Figure 8. Health Expenditure Distribution and Efficiency

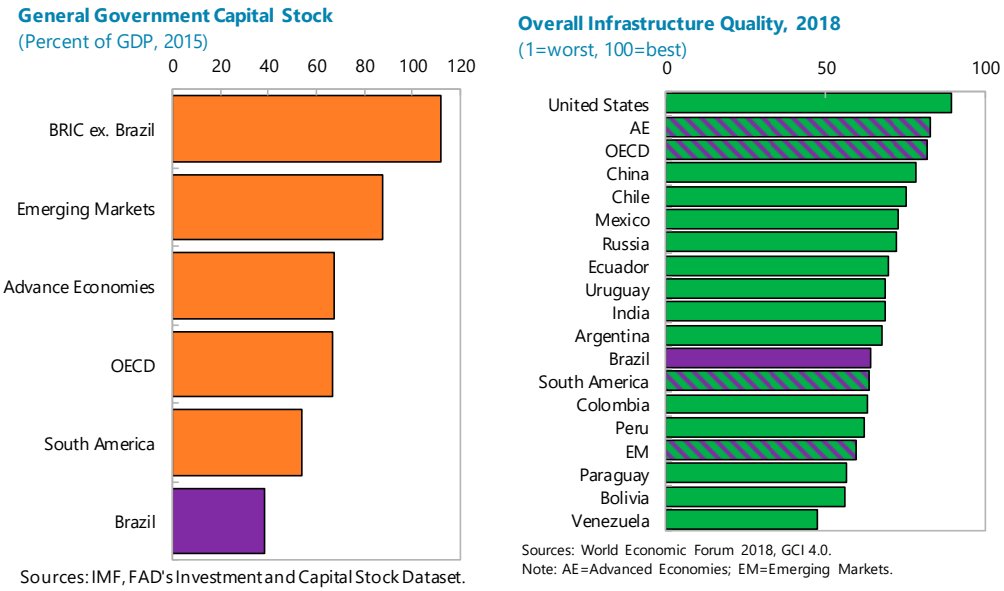


Source: World Bank (2018) and IMF Expenditure Assessment Tool.

C. Infrastructure

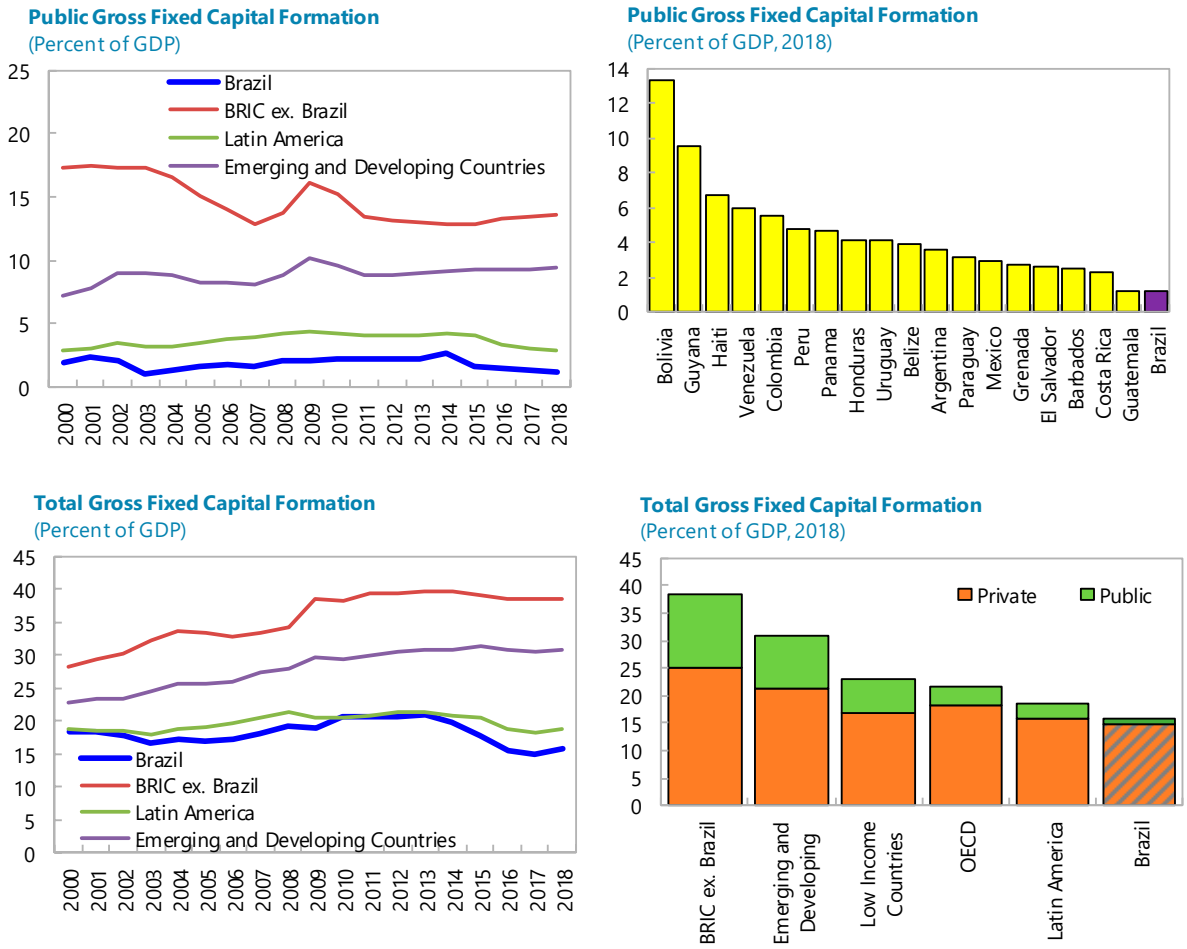
Brazil infrastructure stock and its adequacy rank low compared to peer and regional countries. Brazil's public capital stock as a share of GDP was less than half the level in other BRICs, emerging economies, and Latin American countries in 2015 (Figure 9) having declined by close to a quarter during the 2000s. Qualitative indicators of infrastructure adequacy are also inferior to those in peer countries: Brazil ranked 81 out of 140 countries surveyed by the World Economic Forum in 2018 on overall infrastructure adequacy.

Figure 9. Capital Stock and Quality of Infrastructure



The capital stock erosion is a result of years of low public investment and maintenance. General government capital spending in Brazil averaged less than 2 percent of GDP over the last 20 years, compared to 5.3 and 6 percent in Latin America and other emerging economies (Figure 10). The share of investment in infrastructure is also lower than in other emerging economies: in 2015, only 22 percent of capital spending funded by the federal government was directed on economic infrastructure, compared to 45 percent in other emerging economies. While public investment has been chronically low, private investment was at par with peer countries until 2014 but plunged during the 2015−16 recession and is now about 2 percentages of GDP lower than Latin America and other emerging economies (Figure 9). As a result, Brazil's total investment in 2017 was lower than all other regional aggregates, including low income countries within Latin America (Figure 4).

Figure 10. Public and Total Gross Fixed Capital Formation

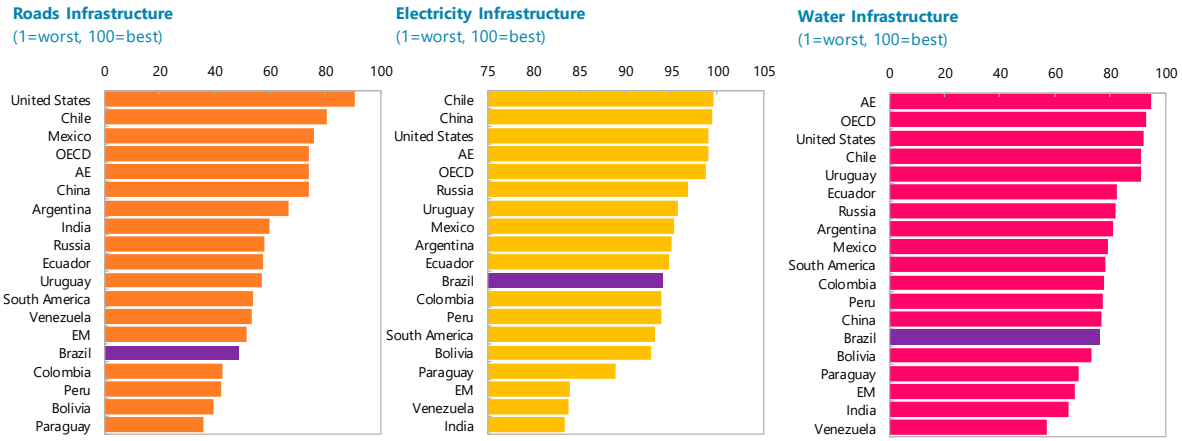


Brazil's infrastructure quality is poor but access is good. In the road sector, Brazil was ranked 74/140 by the WEF on road *connectivity* and 112/140 on *quality* of roads: a result of the lowest share of paved roads in the world both in absolute terms and relative to GDP per capita (according to WDI, only 13 percent of the total road network was paved in 2010 compared with 53 percent in India and 61 percent in China). Similarly, electrification is almost universal (99.6 percent of the population), but electric power transmission and distribution losses amounted to about 15 percent of output in 2018. In the water sector, while 94 percent of the population had access to safe drinking water in 2014 (WHO/UNICEF JPM 2015), the share of population unserved by improved sanitation facilities is still high, and disruption in service and deficiencies in water systems remain challenging for those who have access, especially in rural areas.

The infrastructure gap is large in the road transportation sector. In 2018, the World Economic Forum ranked Brazil 93/140 on roads infrastructure, below other BRIC countries and the average for both emerging economies and South America (Figure 11). Poor road infrastructure increases transportation and transaction costs, hinders the movement of goods and people, and negatively affects access to power and water, hampering potential growth.

Inferior roads infrastructure quality is particularly detrimental in a large country as Brazil, where the primary method of cargo transportation is in trucks via roads—in Brazil, 60 percent of agricultural commodities are transported by highways, yet its infrastructure is inferior relative to its export competitors (Credit Suisse, 2013; Garcia-Escribano and Karpowicz, 2017). This became especially apparent during the 11-day truckers' strike in May 2018 over fuel prices, which caused a nationwide shortage of food, medicine, oil, and other goods throughout the country resulting in GDP losses and a spike in inflation.

Figure 11. Adequacy of Roads, Electricity, and Water Infrastructure
(2018)



Sources: World Economic Forum 2018, GCI4.0

Brazil's high electrification rate reflects ample generation capacity, but the country's large size poses challenges to power transmission and distribution. Brazil generates the third highest amount of electricity in the Americas, behind only to the U.S. and Canada. Generation capacity is dominated by hydroelectricity (Brazil is the second largest producer of hydroelectric power in the world, behind China), which accounted for more than 70 percent of total installed capacity in 2016 (U.S. Energy Information Administration), with the reminder provided by fossil fuels sources (mostly natural gas and coal), biomass, and a small amount of wind and nuclear. The government plays a substantial role in the Brazilian electricity sector—Eletrobras (of which the federal government is the majority shareholder) owns about one-third of total installed capacity, and transmission lines are also largely state-owned. Most of Brazil's generation capacity is located in the Amazon Basin, far from urban demand centers, which requires significant investment in transmission and distribution systems: the Madeira transmission line, which links hydropower plants in the Amazon Basin to major load centers in the southeast, is the longest high-voltage, direct-current line in the world.

Although access to safe drinking water is widespread, the water sanitation gap remains large. The water, sanitation and hygiene sector in Brazil is guided by the National Sanitation Plan designed in 2014, which aims to reach universal access to safely managed water and the attainment of at least 92 percent access to safely managed sanitation by 2033. These goals are in agreement with the SDGs and would result in substantial reduction in regional and local inequalities. Despite the government's ambition, however, about 20 percent of the population

lacked access to improved sanitation facilities in 2015 (30 percent in rural areas), with the Southeast and Northeast regions suffering the largest access deficits. Tensions between the federal, state and municipal governments about their respective roles in the sector contribute to creating bottlenecks, as by constitution the legal mandate for the regulation and provision of water and sanitation services rests with the municipalities but state companies are largely in charge of water and sewer services. Some Brazilian states have also established regulatory agencies for public services that cover water supply and sanitation, whose role is limited given that the regulation of service provision is a responsibility of municipalities. At the same time, a federal law enacted in 2007 sets the main roles, policies and guidelines for the sector.

III. How Much will it Cost to Improve Outcomes?

We estimate the level of spending required to improve outcomes and reach satisfactory progress in the SDGs. Given Brazil's need to consolidate its fiscal accounts to preserve debt sustainability and comply with its fiscal framework, it is crucial to assess the level of spending necessary to improve education, health and infrastructure outcomes. In view of the international commitment to the SDGs as mutually recognized objectives and their adoption within Brazil's national framework, we anchor our estimates to the SDGs targets.

A. Costing Methodology

Spending estimates are derived using an input-output approach which assumes that development outcomes are a function of a mix of inputs. Following the methodology developed by Gaspar and others (2019) we benchmark main input costs to what is observed in countries with Brazil's similar levels of GDP per capita that reach high development outcomes. The methodology follows three steps: (i) identifying the main costs parameters, including inputs and their associated unit costs; (ii) benchmarking the costing parameters by examining their levels in countries with comparable GDP per capita attaining high social outcomes today; and (iii) estimating the spending levels associated with these benchmarks, given Brazil's GDP per capital and population growth projections until 2030.

Estimates of additional spending are reported as of 2030, in percentage points of GDP. For education and health, results are reported as the difference between the share of 2030 GDP in spending consistent with high performance and the current level of spending as a share of 2030 GDP.[2] For physical capital, the spending to close the infrastructure gap between 2019 and 2030 is annualized and expressed in percent of 2030 GDP. After 2030, annual education and health spending would be recurrent, while infrastructure spending would decrease to about 60 percent to cover depreciation of the capital stock built through 2030. Since high performing countries with similar levels of Brazil's GDP per capita are used as benchmarks, our costing estimates assume high spending efficiency and can be interpreted as a lower spending floor needed to achieve the benchmarked progress in SDGs target.

[2] GDP is projected using IMF's WEO projections to 2024. Between 2024 and 2030, the projection assumes that GDP increases at the growth rate assumed for 2024 in WEO.

Education. Total spending for education can be expressed as a function of the number of teachers, teachers' salaries (*AWAGE*), share of non-compensatory current expenses (y) and capital spending (z), where the number of teachers can be derived as the product of the teacher-per-student ratio (*TSR*), enrollment rate (*ER*), and school-age population (*SAP*):

$$Total\ education\ spending = (AWAGE * TSR * ER * SAP)/(1 - y - z)$$

The methodology sets *TSR, AWAGE, y,* and z at the median values observed today in countries with similar per-capita income[3] as Brazil and high education outcomes[4]. Education spending in 2030 is then estimated using the corresponding benchmarked key inputs and unit costs and Brazil's projections for economic growth and school-age demographics, assuming full enrollment for at least 2 years of preprimary and tertiary education, and 12 years of primary and secondary education.[5]

Health. Likewise, total spending in health is calculated as a function of doctors' salaries (*DAWAGE*), number of doctors and other medical personnel, the ratio of non-doctor to doctor wages (α), the share of non-compensatory current expenses (y) and capital spending (z)[6], where the number pf doctors and other medical personnel is derived using doctor density (*DPR*), total population (pop), and ratio of doctors to all other health staff (ρ):

$$Total\ health\ spending = (DPR * pop * \left(1 + \frac{\alpha}{\rho}\right) * DAWAGE)/(1 - y - z)$$

Benchmarks for *DAWAGE, DPR,* and ρ are derived as the median values observed today in countries with similar per-capita income as Brazil and high healthcare outcomes.[7] Health spending for Brazil in 2030 are estimated based on the benchmarked parameters using Brazil's projections for growth and demographics.

Roads. We use the results from the regressions in Gaspar and others (2019) to estimate the road network needs. Road density is regressed on variables capturing the size and structure of the economy, including GDP per capita, population density, agriculture and manufacturing sector shares in the economy, urbanization rate, and the World Bank's Rural Access Index

[3] GDP per capita between US$6,000 and US$15,000 in 2016 is used to map the middle-income country group and associated benchmarks.

[4] High-performing countries are those with an SDG4 education index above 82, to allow for a representative sample size of high performing middle-income countries.

[5] The assumed enrollment rates are consistent with target rates of 50 percent for preprimary and tertiary education, and 100 percent for primary and secondary education.

[6] The ratio of non-doctor to doctor wage is assumed to be 0.5; shares of capital and other current spending to total spending are imputed using the World Bank income group averages.

[7] High-performing countries are those with an SDG3 health index above 78 in the middle-income country group.

(RAI), for a cross section of low-income countries and emerging economies. The RAI measures the number of rural people who live within two kilometers of an all-season road as a proportion of the total rural population. An "all-season road" is a road that is motorable all year round by the prevailing means of rural transport. Since the latter qualification implies mostly paved roads, the IRA is used as a proxy for adequate access to the transport system. The regression results are used to estimate the additional kilometers of roads needed to ensure road access for all, proxied by raising the RAI to at least 90 percent, while accounting for projected changes in population and GDP per capita through 2030. The total cost of the additional road network is estimated by multiplying the estimated additional kilometers by the unit cost of constructing one kilometer, which is set at a minimum of US$500,000, following Imi and others (2016). To account for depreciation, the total cost of the additional kilometers is increased by 5 percent.

Electricity. As in Gaspar and others (2019), we estimate the additional electricity network needed to provide access to 100 percent of projected population in 2030, while accounting for an increase in per capita consumption in line with GDP per capita. The total cost of the additional electricity network is estimated using the unit cost per kilowatt of generation capacity set by the World Bank (2013) at US$2,250, including associated network costs (60 percent of the investment cost is assumed for generation, 30 percent for distribution, and 10 percent for transmission).

Water. Following Gaspar and others (2019), the cost of providing basic access to improved water and sanitation are derived using the WASH World Bank methodology described in Hutton and Varughese (2016). The model estimates the cost of meeting the water, sanitation, and hygiene (WASH)-related targets of SDG 6, using unit costs calibrated at the country level, including costs for capital investment, operations, and major capital maintenance to sustain the life span of the infrastructure created. Two targets are assessed: (1) achieving *universal* and equitable access to safe and affordable drinking water for all (target 6.1); and (2) achieving access to *adequate* and equitable sanitation and hygiene for all, including ending open defecation (target 6.2).

B. Spending Estimates

Education

There is substantial scope for containing expenditure spending in the medium term while achieving good outcomes. The main source of potential savings in education spending are associated with demographic developments, share of school age individuals in the population is projected to decline from 35 percent in 2016 to 25 percent in 2030. All other things equal, this would imply a potential reduction of 1.5−2 percentage points in education spending (Table 1). Furthermore, to improve outcomes, the benchmarking exercise suggests that Brazil should recalibrate the mix of salaries and personnel to emulate the levels observed in high performing countries, which tend to have lower teacher wages (in percent of GDP) but also smaller classes (lower student to teacher ratios). Enrollment rates should also be increased. Altogether, the estimates suggest that Brazil could achieve high performance in the education SDG with lower public and private spending, with savings estimated in about 1.1 and 0.3 percentage points of GDP respectively.

Table 1. Cost Estimates for Education

	GDP per capita $6,000-$15,000			Brazil	
	All	Low performance	High performance	2018	2030
Main factors					
Students per teacher ratio	14.3	18.3	11.3	18.3	11.3
Teacher wages (ratio to GDP per capita)	1.7	2.3	1.6	2.7	1.6
Other current and capital spending (% total spending)	46	43	47	43	47
Other					
Student age population (% total population)	36	40	23	35	25
Enrollment rate (preprimary to tertiary)	77	72	86	76	80
Private share (% of total spending)	13	21	10	13	10
Results					
Education spending (percent of GDP)	6.1	6.5	5.4	**6.9**	**5.5**
Public	5.3	5.1	4.9	6.0	4.9
Private	0.8	1.3	0.5	0.9	0.6
Spending per student (USD 2018)	2,020	1,873	3,381	2,291	2,795
SDG4 index	83	78	89	77	>89

Source: IMF staff estimates.

Health

The benchmarking exercise also suggest space to reduce health spending while improving health outcomes. While health compensation levels seem in line with good performing countries, Brazil could aim to increase the share of doctors in the population while containing the number of other health professionals (Table 2). Overall, by 2030, Brazil could save up to 2.5 percentage points of GDP in total health expenditure. This would imply public savings of up to 1 percentage points of GDP, assuming a constant share of private spending in total spending. However, government savings would be more modest if a rebalancing of spending toward public expenditure occurs as health services improve.

Table 2. Cost Estimates for Health

	GDP per capita $6,000-$15,000			Brazil	
	All	Low performance	High performance	2018	2030
Main factors					
Doctors per 1,000 population	2.1	2.0	2.7	1.9	2.7
Other medical personnel per 1,000 population	6.5	6.3	7.7	16.0	7.7
Doctor wages (% GDP per capita)	4.1	4.1	4.0	3.8	4.0
Other current and capital spending (% total spending)	60	61	60	59	59
Private share (% total spending)	40	48	32	57	32
Results					
Health spending (percent of GDP)	6.5	6.0	7.1	**8.9**	**6.4**
Public	3.9	3.1	4.9	3.9	4.4
Private	2.6	2.9	2.3	5.0	2.0
Per capita spending (USD 2018)	593	471	898	775	654
SDG3 index	80	78	86	67	>86

Source: IMF staff estimates.

Infrastructure

Roads

Ensuring road access for 90 percent of the Brazilian population would require an annual cost of about 3 percent of GDP. In Brazil 53 percent of the rural population has adequate access to the transport system, as measured by the RAI (Table 3). Increasing the RAI to 90 percent by 2030 (the minimum coverage of most advanced economies) would imply an increase in kilometers of road network by about 70 percent compared to its level today. Such estimate takes into account account projected increases in Brazil's population and GDP per capita until 2030, and is derived based on elasticities to GDP, population, and the RAI estimated in emerging and low-income economies. Applying the estimated minimum unit cost per kilometer, and an annual cost in maintenance of about 5 percent per year, yields an annual cost to ensure adequate road access for all of 3 percent of GDP. It should be noted that, by anchoring the additional growth network to population with access, rather than road density (expressed as the ratio of the length of the total road network to a country's land area), this estimate is consistent with the Brazil's geographical configuration. Namely, the Amazon rainforest, which extends over almost 60 percent of the country, does not require road connectivity as in urban or other rural areas, and alternative methodologies anchored to road density would have significantly biased cost estimates upwards.

Table 3. Cost Estimates for Roads

Country	**Brazil**	
	Today	2030
GDP	1,793,311,951,779	2,342,796,840,187
GDP Capita	8,424	10,246
% Growth		21.62%
Population	212,873,168	228,663,264
% Growth		7.42%
RAI	53%	90.00%
Km Roads	1,580,964	2,666,315
% Growth (EM/LIC)		68.65%
% Growth (All Countries)		96.22%
Area (Sq Km)	8,358,140	8,358,140
Density (Km per 1000 Sq Km)	0.19	0.32
Additional Km Needed	1,085,351	
Unit cost ($/Km)	487,168	
Total Cost	528,748,308,884	
% of 2030 GDP	22.57%	
Annual Cost	44,062,359,074	
% of 2030 GDP	1.88%	
Annual cost of maintenance (assumping 5% depreciation on new roads)		
% of 2030 GDP	1.13%	
Total annual cost including depreciation		
% of 2030 GDP	**3.01%**	
Memo items:		
	EM/LIC	
Roads to GDP Elasticity	0.13	
Roads to Population Elasticity	0.49	
Roads % increase per RAI idx poin	1.68	

Sources: IMF staff calculations.

Electricity

The estimated annual cost of reaching universal electricity consumption in line with GDP per capita increases is small, at about 0.1 percent of GDP. Since electrification in Brazil is almost universal, additional electrification costs will only need to cover the projected increase in per-capita use due to the growth in GDP per capita. Given the projected annualized population growth of 0.6 percent, and nominal GDP growth of about 30 percent between 2015 and 2030, GDP per capita is expected to grow by 22 percent over the same period. Using the unit cost of electricity generation and transmission of US$2,250 per kilowatt, the estimated additional annual costs to reach target consumption is equivalent to 0.1 percent of 2030 GDP (Table 4).

Table 4. Cost Estimates for Electricity

Country	**Brazil**
Electricity access at starting period	100%
Population at starting period	212,873,168
Forcasted Population 2030	228,663,264
Annualized Population Growth	0.6%
Number of years to 2030	13
Electricity consumption per user at starting period (kwh)	2,601
Unit cost incl. generation and transmission ($)	2,258
Nominal GDP at starting period ($)	1,793,311,951,779
GDP in 2030 at initial period price ($)	2,342,796,840,187
(A)	
Annual cost to reach universal access while maintaining initial consumption	814,446,623
As percent of 2030 GDP	0.0%
(B)	
GDP Per capita Growth	22%
Expected consumption per user based on GDP Growth	3,130.02
Target consumption per user (link to growth, enter government target, or choose from distribution table below)	3130
Additional annual cost to reach target consumption	2,396,891,116
As percent of 2030 GDP	**0.1%**
(C)=(A)+(B)	
Annual cost to reach universal access and target consumption	3,211,337,738.53
As percent of 2030 GDP	**0.137%**

Sources: IMF staff calculations.

Future costs may change depending on the electricity generation mix. Brazil plans to increase the share of non-hydro renewables in its generation mix and in December 2015 announced the Distributed Generation Development Program for Energy to expand consumer investment in renewable resources, particularly solar photovoltaic. This increased emphasis on distributed generation will also help reduce the need for additional transmission infrastructure in the future, but the initial capital and financing charges of solar power is high. Moreover, non-dispatchable technologies such as hydroelectric and photovoltaic

expose the system to power shortages, during which a dispatchable technology must be available to supply the demand. Among dispatchable technologies nuclear power has the lowest electricity production costs per kilowatt hour, once the capital and interest charges of new plants have been paid off. While the construction of the Agra 3 nuclear plant was suspended in 2015, the government plans to sell the plant and construction of new plants could start after 2020. Increased reliance on established nuclear power generation capacity could reduce Brazil's network prices in the long term.

Water Providing universal access to safely managed water, sanitation, and hygiene services will cost 0.3 percent of GDP per year. In line with Brazil's widespread access to safe drinking water and geographical distribution of its population, most of the financing needs arise from extending sanitation services in urban areas, also reflecting higher unit costs of sanitation compared to water services. Accordingly, the annual cost of reaching universal basic water and sanitation coverage would be about 0.05 percent of GDP, of which 0.1 and 0.4 percent of GDP directed to water and sanitation services respectively in urban areas. The cost of providing basic hygiene is virtually zero, largely reflecting comparatively low per capita costs. Extending safely managed water and sanitation services will be costlier, reflecting both higher unit costs and a larger share of unserved population. As a result, universal access to safe sanitation and water in urban areas would cost about 0.2 and 0.04 percent of GDP per year respectively, while extending safe water and sanitation services to the unserved in rural areas would imply a total annual cost 0.02 percent of GDP. The overall estimated annual cost of universal access to safe water and sanitation is 0.3 percent of GDP (Table 5). The estimated target population to be served is based on coverage of services in 2015 and population growth, taking into account projected internal migration from rural to urban areas based on recent trends.

Tariff policies will need to ensure effective and sustainable universal coverage while maintaining service delivery affordable by the poor. Effective service delivery will require a governance and accountability framework that ensure that the committed financial resources reach the local level and respond efficiently to the needs of their communities. Tariff policies will need to safeguard the long-term financial viability of water utilities, while ensuring that water services remain affordable for the poor. Sustainability and equitability considerations are particularly relevant when it comes to water management as water resources are essential not only for economic growth but also and primarily for human development and environmental sustainability. The government recognizes the social function of water in the National Development Strategy 2020–31, which includes guidelines to expand secure water supply infrastructure while promoting the conservation, recovery and rational use of water resources.

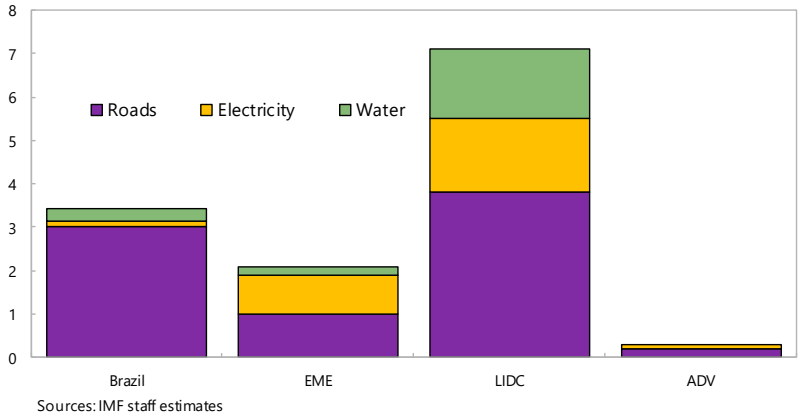
Table 5. Cost Estimates for Water

Country	Brazil											
	Ending open defecation	Basic						Safely Managed				Total SDG6
		Water		Sanitation		Hygiene		Water		Sanitation		
		Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	
Total target population (million)	5.9	1.9	27.9	10.7	46.7	0.5	36.9	10.0	36.6	15.4	142.5	157.9
Population unserved in 2015 (million)	8.5	5.7	5.0	14.6	23.8	4.4	14.0	13.9	13.6	19.3	119.5	138.8
Population growth 2015-2030 (million)	(3.9)	(3.9)	23.0	(3.9)	23.0	(3.9)	23.0	(3.9)	23.0	(3.9)	23.0	19.1
Cost (per capita, $)	39	40	179	75	312	7	5	381	381	132	398	600
Total cost ($ million)	227	75	4,994	800	14,565	4	184	3,802	13,927	2,042	56,705	94,677
Annual cost ($ million)	15.1	5.0	332.9	53.3	971.0	0.2	12.3	253.5	928.5	136.2	3,780.3	6,312
Total cost (% of 2030 GDP)	0.10%	0.03%	2.18%	0.35%	6.37%	0.00%	0.08%	1.66%	6.09%	0.89%	24.80%	4.04%
Annual cost (% of 2030 GDP)	0.00%	0.00%	0.01%	0.00%	0.04%	0.00%	0.00%	0.01%	0.04%	0.01%	0.16%	**0.27%**

Sources: IMF staff calculations based on Hutton and Varughese (2016). Note: Safely managed water supply means an on-plot water supply for every household; and safely managed sanitation includes a toilet with safe management of fecal waste. Basic water supply includes an improved community water source within a 30-minute round-trip; basic sanitation includes an improved toilet; and basic hygiene includes a hand-washing station with soap and water for every household. Ending open defecation implies simple, traditional, low-cost latrines. Total cost is estimated on a 15-year horizon and the annual cost derived accordingly.

Overall, closing the infrastructure gap will require annual spending of 3.4 percent of GDP between 2019 and 2030. This estimate is higher than the average for other emerging economies, which would have to spend 2.1 percent of GDP, mainly because of higher spending on roads (3 percent of GDP in Brazil versus 1 percent of GDP in other emerging economies). On the other hand, Brazil's spending needs on electricity and water are marginally lower than in other emerging peer countries. The total spending in infrastructure compares to 7.1 percent of GDP in low income and developing countries, and 0.3 percent of GDP in advanced economies (Figure 12).

Figure 12. Infrastructure SDG Cost Estimates
(Percent of GDP)

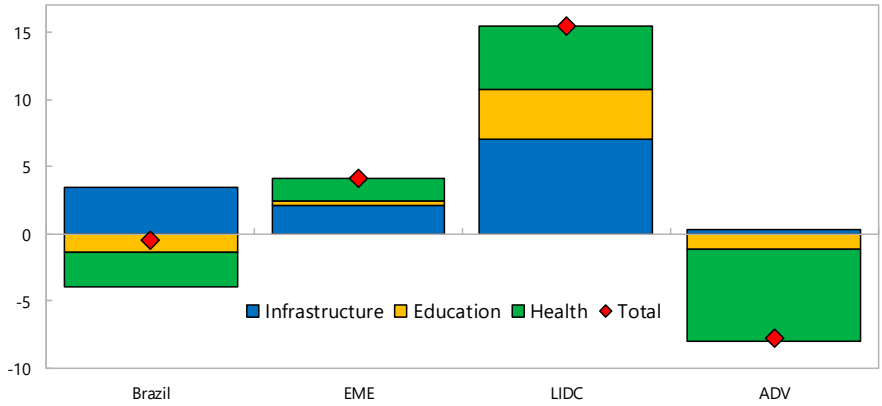


Sources: IMF staff estimates

The total cost of delivering education, health, roads, power, and sanitation to a growing Brazilian population, is lower than in other emerging economies. In principle, if reallocation of public spending were possible, savings from higher efficiency in the health and education sectors could unlock financing for infrastructure investment. As the fiscal savings from these sectors would more than offset the annual spending needs in

infrastructure (namely road), the overall cost of reaching the SDGs by 2030 would amount to a negative 0.5 percent pf GDP annually, compared to 4 percent of GDP in other emerging economies, and 15 percent of GDP in low income and developing countries (Figure 13). However, rigidities in the Brazil's budget induced by the pervasive earmarking of revenues would drastically reduce the scope for reallocation of funds across sectors. Moreover, the constitutional expenditure ceiling will imply a compression of primary spending by 4 percent of GDP by 2030, eroding the fiscal space created by efficiency gains in the health and education sectors.

Figure 13. Total SDG Cost Estimates
(Percent of GDP)



Sources: IMF staff estimates

IV. Conclusions and Policy Implications

How can Brazil scale up infrastructure investment while complying with its fiscal consolidation needs? Our estimates suggest room for public savings of about 3 percent of GDP per year in the health and education sectors (once the share of private savings in the health sector is accounted for), and substantial spending needs of 3½ percent of GDP to close Brazil's infrastructure gap, in particular related to roads. The estimated savings in health and educations are consistent with the limit imposed by the constitutional spending ceiling (*teto*) and would respect the respective constitutional floors. Achieving such savings would require reforms to improve the efficiency of government spending while addressing existing inequities. Furthermore, meeting the additional spending needs in the infrastructure sector will be challenging given the compression in primary spending required by the *teto*. We see the following options to accommodate higher infrastructure spending while complying with the constitutional expenditure ceiling.

The government could implement deeper cuts in non-investment spending beyond what is implied by the *teto.* To create fiscal space for the needed infrastructure spending, non-investment public expenditures would need to be retrenched in the near to medium term below the level imposed by the spending ceiling. However, this would require unpopular and politically costly spending cuts, in particular to the wage bill—in addition to passing the social security reform currently being discussed by Congress—and addressing budget rigidities to allow for more discretionary reductions in spending.

Alternatively, essential infrastructure spending could be prioritized before 2027 in a way that just complies with the *teto* while less critical investment will need to be postponed. This approach will require improvements in the strategic prioritization of public investment, and project appraisal and selection, which are currently weak due to a lack of central guidance on priorities and poor coordination across levels of government (PIMA, 2018). Delaying the non-essential infrastructure spending would imply a slower closure of the infrastructure gap and a more gradual reduction of debt after 2027 and could be supported by measures to increase tax revenues.

Boosting revenues would require strong administrative and policy reforms. Revenue measures should focus on improving tax compliance and reducing distortionary tax exemptions, which are estimated to cost the government 4 percent of GDP per year. Tax policy reforms aimed at streamlining the tax system have the potential to increase revenues by enhancing tax compliance and improving the business environment (see below). Overperforming fiscal targets through increases in revenues could finance additional investment spending after 2027 without worsening Brazil's debt sustainability, although it would fail to accommodate the additional spending for as long as the *teto* applies.

In any case, private sector resources are necessary. Attracting private finance and supporting private sector development requires improving the business environment, in particular simplifying the tax system, opening up the economy to foreign trade, and easing the procedures to start a business. In this respect, recently introduced provisional measures aimed at reducing red tape and supporting the opening of small businesses are an encouraging step in the right direction, and so are the government's plan to lower import fees on selected goods, current efforts to negotiate an EU-Mercorsur trade agreement, and the authorities' intention to reform the tax system once the social security reform is passed by Congress.

Concession agreements should be considered until the PPP framework is strengthened. Given Brazil's high public debt and low PPP institutional strength (IMF, 2018), the strategic framework for PPP, including the assessment of potential fiscal risks, should be improved before expanding the use of PPP, or outright private provision of infrastructure through concessions should be favored. In this respect, the government launched a concession program which is likely to pick up speed in 2020. Moreover, the National Development Strategy 2020−31 includes guidelines to improve the planning and management of public infrastructure, with the definition of medium- and long-term priority projects, streamline the relevant legislation with a view to provide greater legal certainty for domestic and foreign private investors, and review concession models to reduce the need for commitment of fiscal resources. A Lower House-Senate joint committee recently approved a provisional measure which will allow the privatization of water and sewage systems, along with the relevant state-owned enterprises, and has the potential to attract private investment to the sector.

A viable strategy would be a combination of the all above. This would imply some deeper cuts in non-investment expenditure that generates savings for priority infrastructure spending while mobilizing private capital until 2027. More substantial investment in road

infrastructure would be postponed until after 2027 with the support of policy and administrative revenue-enhancing measures to avoid a deterioration in fiscal sustainability. In the meantime, implementing the structural agenda will be crucial to boost growth and preserve efficient service delivery in the health and education sectors. Enhancing the efficiency of public spending will require strong and effective public institutions, addressing corruption, and upgrading transparency and accountability. It's a tight policy agenda, but it will bear substantial economic and social dividend down the road.

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