FREDERICK S. PARDEE CENTER FOR INTERNATIONAL FUTURES

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SUSTAINABLE DEVELOPMENT GOALS REPORT: BRAZIL 2030

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Executive Summary

A decade of inclusive growth in Brazil between 2003 and 2013 raised millions from poverty and reduced inequality, earning its leaders praise for its social progress and leading some to ask whether Brazil is a "role model" for other developing countries (Barrientos & Amann, 2014). Since 2014 however, Brazil's economy has been mired in a deep recession and its political system paralyzed by a wide-ranging corruption scandal that has claimed the political lives of former Presidents. The combined economic and political situation in Brazil has revealed a number of structural challenges facing the country, including: an aging population, low and declining growth in economic productivity, rising unemployment, dilapidated infrastructure, and a political situation which has shaken confidence in Brazil's public institutions. The policy choices made today to address its many challenges will determine Brazil's ability to accelerate its development and meet the targets established by the United Nations (UN) Sustainable Development Goals (SDGs). This report explores Brazil's development trajectory to 2030 across key sectors of human development and Brazil's prospects for achieving select SDG targets. This report also includes four alternative scenarios designed to help readers to explore policy tradeoffs and prospects for achieving these targets.

The 17 SDG's, with a horizon out to 2030, represent the latest iteration of development targets, goals, and aspirations set forth by the global community to promote sustainable development and economic growth. This report uses the International Futures (IFs) Current Path scenario to examine development trends in Brazil out to 2030. IFs is an integrated assessment platform that relies on over 4,000 historical data series to produce forecasts for 186 countries out to the year 2100. IFs is developed and maintained by the Frederick S. Pardee Center for International Futures at the Josef Korbel School of International Studies at the University of Denver. Unless otherwise noted, all data and forecasts come from IFs version 7.31.

In addition to exploring Brazil's Current Path trajectory, this report contains four alternative scenarios designed to elaborate potential futures for Brazil and its ability to meet SDG targets. The four scenarios are: 1) Human Capabilities, 2) Improved Governance, 3) Trade and Investment, 4) Integrated Push. The first simulates interventions and spending to improve education, reduce non-communicable disease deaths, and expand access to basic infrastructure. The second models improvements in government effectiveness, a reduction in corruption, and greater economic freedom and inclusiveness. The third simulates a policy package more in line with neoclassical economic thinking: trade liberalization, foreign direct investment (FDI) promotion, coupled with high levels of domestic private investment to boost competition and innovation. The fourth combines elements of each scenario into an integrated push for Brazil's development and reveals the relative impact of an integrated scenario over any sector-specific focuses.

Exploring Brazil's development trajectory requires an understanding of Brazil's development history. A middle-income economy, Brazil is the largest country by population and land area in Latin America. It also has the largest economy in the region and is a member of multiple regional and global institutions. Brazil has made important developmental progress over the last two decades. Since 1990, life expectancy has increased from 65 years to 75 in 2015, while infant mortality (in the first year of life) fell from 49 per thousand to around 14 per thousand over the same period. Undernutrition (as a percent of children under five) was cut in half from 5 percent to around 2.2 percent in 2015. Access to electricity reached nearly 100 percent of the population in 2012, while combined access rates to clean water and sanitation exceed 90 percent of the population by 2015. Brazil's GDP per capita (purchasing power parity or PPP) increased from around $10,200 in 1990 to over $15,200 in 2013 (all values in 2011$). Brazil's current economic recession has reversed some of these gains. By 2015, Brazil's GDP per capita had fallen to $14,530.

There are 94 forecasted variables in the IFs model that align with SDG indicators. This report focuses primarily on a subset of 44 indicators.[1] Of those 44 with hard targets that align with forecast variables in IFs, Brazil has already or is forecast to meet 19 indicators (43 percent) along the Current Path. For instance, the undernourished population is forecast to fall to 1.3 percent, under the target of 1.5 percent by 2030 (SDG 2). The under 5 mortality rate is forecast to reach 9.6 per thousand by 2030, well below a target of 25 per thousand (SDG 3). Net primary enrollment and completion rates have already exceeded targets set by SDG 4. Primary education enrollment and completion rates, as well as targets related to gender parity in education are forecast to be met. Access rates for clean water (SDG 6) and electricity (SDG 7) are forecast to be met.

Brazil, however, is not forecast to meet a number of SDG targets by 2030. For instance, by 2030 an estimated 7.6 percent of the population might well still be living in poverty on less than $3.10 per day (SDG 1). In the health sector, the death rate from premature non-communicable diseases (NCDs) will increase gradually and will not meet NCD health indicator targets (SDG 3). Primary education is on target, but lower secondary graduation rates, while forecast to rise from around 87 percent to 90 percent, will not reach universal targets under SDG 4. Similarly, upper secondary graduation rates will grow from 67 percent in 2015 to an estimated 75 percent in 2030, but remain below universal SDG target. The percentage of the population with access to improved sanitation services is forecast to rise from 83 percent in 2015 to 86 percent by 2030, below the target of 98 percent (SDG 6).

The scenarios help to frame some of the policy options for meeting SDG targets, each has its benefits and costs. For instance, in 2030, the human capabilities scenario results in the highest HDI score, longest life expectancy, and greatest average years of education. There is also the most significant reduction

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[1] The 44 indicators were chosen based on: availability of explicit, numeric targets for each indicator, and the relevance (and data availability) for Brazil.

poverty, with an estimated 4.6 million fewer people in poverty compared to the Current Path. At the same time, the emphasis on human development in this scenario means that in 2030 the elderly population is larger; there are an estimated 436,000 more people aged 65 or older compared to the Current Path, with implications for retirement needs social spending.

Improving Governance has the largest impact on GDP, reaching $3.58 trillion in 2030 compared with $3.24 trillion in the Current Path. GDP per capita in this scenario is 3.5 percent larger in 2030 than in the Human Capabilities scenario. Improving Governance produces larger economic benefits than Human Capabilities. This is due to the governance issues facing Brazil today. Reducing corruption and promoting economic freedom and inclusivity would likely bring more immediate economic benefits. Interventions to expand infrastructure require large up-front investment and construction, increasing education stock takes years to enroll and move students through the school system.

Trade and Investment achieves similar economic benefits in terms of GDP and GDP per capita as the governance scenario. Notably however, poverty actually increases out to 2030 in this scenario as compared with the Current Path; 1.2 million more people live on less than $3.10 per day. This is a result of the scenario orientation. There is a focus on trade and investment, (through higher savings and investment), but there are no welfare interventions targeting distribution and poverty. As a result, the country gets richer, but not all segments of the population benefit equally, and poverty does increase. Beyond the SDG horizon of 2030, however, the economic integration and investment in this scenario do eventually lead to a reduction in poverty relative to the Current Path. In 2050, IFs estimates 15.2 million people live on less than $3.10 per day as compared with over 17 million in the Current Path (2050 data not shown). A more complete set of tradeoffs of each scenario on a number of indicators are shown in Table 1 below. Each data point reflects the value in 2030.

Table 1 also reflects the importance of integrated interventions across multiple issue areas. For example, the Integrated Push scenario has the most significant impacts across the majority of outcome indicators. It results in the largest GDP and GDP per capita, the highest score on the human development index (HDI), and greatest life expectancy. This occurs because of the complementary effects of interventions across issue areas, a conclusion that reinforces the value of integrated policy analysis.

To help unpack the context in which Brazil's progress towards the SDGs are unfolding, this report provides an overview of the trends likely to play a significant role on Brazil's development trajectory over the next 13 years along the Current Path. The Current Path is itself a dynamic series of forecasts that represent a continuation of Brazil's development trajectory absent major policy changes, unforeseen disasters, or drastic technological change. The report uses the Current Path as a starting point for exploring different development scenarios and their relative impacts across different areas of human development. Brazil is forecast to meet a number of important SDG targets, but this developmental progress will occur within an increasingly uncertain and difficult environment. Brazil faces multiple headwinds in the form of an aging demographic, structural economic challenges that contributed to the current recession and may continue to hamper growth, and political uncertainty. There is no "silver

bullet" for development, but an integrated analysis such as this illuminates the tradeoffs and synergies. The policy choices Brazil makes today will determine its ability to meet the targets defined under the SDGs.

Indicators	Current Path		Alternative Scenarios			
	2015	2030	Human Capabilities 2030	Governance 2030	Trade & Investment 2030	Integrated Push 2030
Household Consumption *Billion USD*	1,712	2,160	2,283	2,340	2,073	2,346
Adult Education *Average years (pop 15+)*	7.9	9.1	9.5	9.1	9.1	9.5
Gross Domestic Product (GDP)* *Billion USD*	2,656	3,241	3,438	3,579	3,579	4,208
GDP per Capita Purchasing Power Parity (PPP) *Thousand USD*	14.5	16.0	16.7	17.3	17.3	20.1
Government Revenue *Billion USD*	876	1,344	1,481	1,487	1,471	1,812
UN Human Development Indicator (HDI)** *Index*	0.76	0.80	0.82	0.80	0.80	0.83
Poverty *Million people* *Less than $3.10 per day*	18.0	17.2	12.6	15.3	18.4	11.6
Middle Class *Million People* *living on between $10 and $50 per day*	102.0	116.4	124.6	119.2	114.6	126.8
Life Expectancy *Years*	75.3	77.6	79.0	77.8	77.8	79.5
Carbon Emissions *Million Tons*	137.0	161.0	166.0	169.0	169.0	187.0

Table 1. Effects of different scenarios on selected indicators in 2030 for Brazil. Darker color represents a more "positive" outcome. Coloring compares each scenario outcome across each indicator. Source: IFs 7.31.
*GDP and GDP per capita figures represented in $2011 dollars. **HDI is a UN composite index measuring achievement across life expectancy, average years of education, and GNI per capita.

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The Frederick S. Pardee Center for International Futures

The Frederick S. Pardee Center for International Futures is based at the Josef Korbel School of International Studies at the University of Denver. The Pardee Center specializes in helping governments, international organizations, and private sector organizations frame uncertainty and think strategically about the future. The Pardee Center focuses on exploring past development trends, understanding the complex inter-relationships that drive development outcomes, and shaping policies that communicate and achieve a clear development strategy.

International Futures (IFs) is a free and open-source quantitative tool for thinking about long-term futures. The platform helps users to understand dynamics within and across global systems, and to think systematically about potential trends, development goals and targets. While no software can reliably predict the future, IFs forecasts — which are calculated using data and a mix of quantitative modelling approaches — offer a broad and transparent way to think about the tradeoffs in policymaking.

There are three main avenues for analysis in IFs: historical data analysis (cross-sectional and longitudinal) of more than 4,000 series, Current Path analysis (how dynamic global systems seem to be developing), and alternative scenario development (exploring if-then statements about the future). To do this, IFs integrates relationships across 186 countries and 12 core systems, including: agriculture, demographics, economics, education, energy, environment, finance, governance, health, infrastructure, international politics, and technology. The sub-models for each system are dynamically connected, so IFs can simulate how changes in one system may lead to changes across all others. As a result, IFs endogenizes more variables and relationships from a wider range of key development systems than any other model in the world.

IFs is developed by The Frederick S. Pardee Center for International Futures, based at the Josef Korbel School of International Studies at the University of Denver in Colorado, USA. It was originally created by Professor Barry B. Hughes. Learn more about IFs or download the tool for free at pardee.du.edu.

Pardee Center and UNDP SDG Collaboration

This report is part of a broader, long-term collaboration between the Pardee Center and UNDP to assess SDG attainment and prospects across a variety of countries using IFs. These reports will feed into the country-level MAPS analysis conducted by the UN. The Pardee Center has also worked with UNDP Moldova. As part of this collaboration, the Pardee Center has developed a new SDG dashboard in IFs that shows Current Path forecasts for SDG indicators for 186 countries and the prospects for meeting those targets at the country level. While not every SDG indicator is forecast in IFs, Pardee has also pulled in over 200 data series that align directly with every SDG indicator across the 17 major SDG goals. This allows users to see a current (2015) value for every SDG indicator in all 186 countries. For more information on the SDG dashboard and instructions on its use see our wiki here.
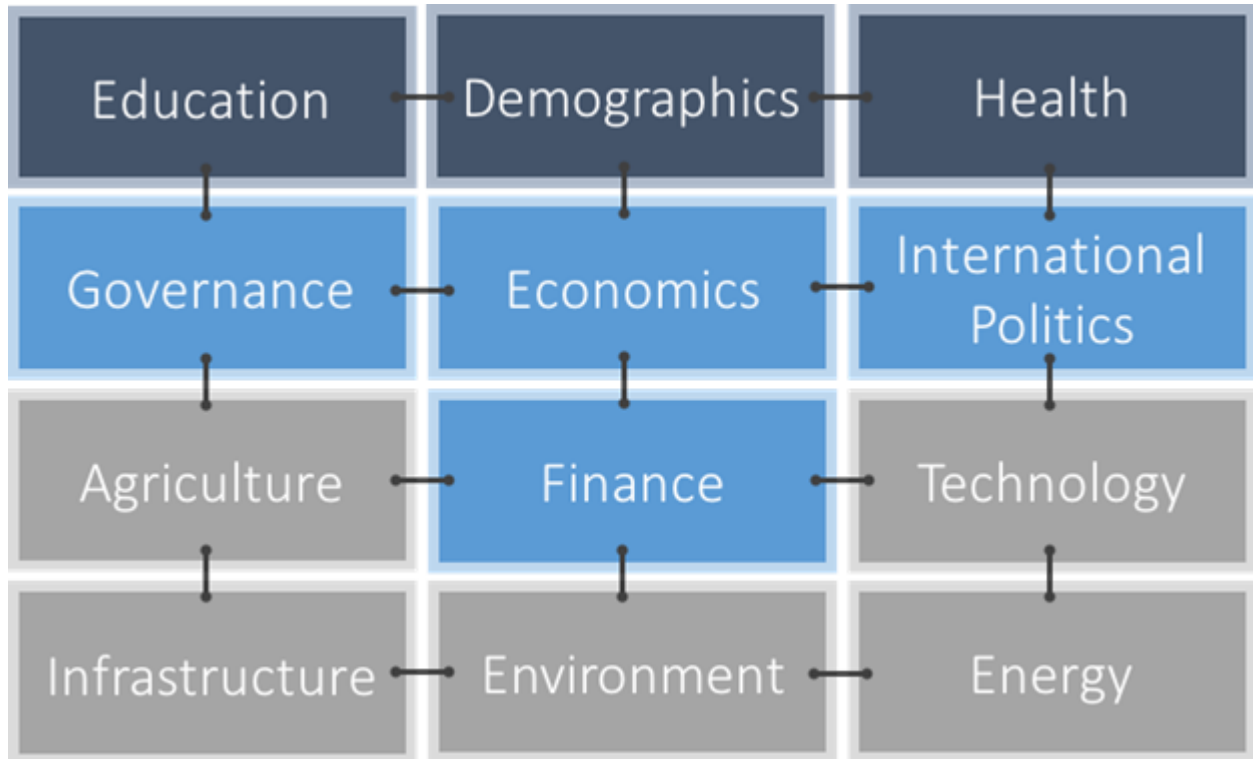
Figure 1. Stylistic representation of models in IFs. Source: Authors.

The Current Path Scenario

The IFs Current Path is a collection of interacting forecasts that, while dynamic, represent a continuation of current policy choices and environmental conditions. Although the Current Path generally demonstrates continuity with historical patterns, it provides a structure that generates a wide range of non-linear forecasts rather than just a simple linear extrapolation of historical trends. The Current Path assumes no major paradigm shifts, seismic policy changes or impactful low-probability events. Given that the Current Path is built from initial conditions of historical variables and is analyzed in comparison to other forecasts of particular issue areas, it can be a valuable starting point to carry out scenario analysis and construct alternative future scenarios.

Introduction

Brazil is the largest country by population and land area in Latin America and the 5th largest by population and land area in the world. In 2015 its Gross Domestic Product (GDP) was an estimated $2.66 trillion, (2011$ at Market Exchange Rates) making it the largest economy in Latin America and the 7th largest globally. As the home of the Amazon rainforest, Brazil also has an important role to play in preserving the "Lungs of the Planet." (BBC, 2014). In addition to its vast population and economy, Brazil is also active internationally and has 125 embassies around the world.[2] In 2015 Brazil was the 4th largest global recipient of Foreign Direct Investment (FDI) (UNCTD, 2016). The country is a member of the BRICS countries, an organization of major emerging economies that includes China, Russia, India, and South Africa. These countries make up around 40 percent of the world's population and over 20 percent of global GDP. Brazil is also a founding member of Mercosur, a Latin American trade bloc comprising Argentina, Paraguay, Uruguay and Venezuela. Given its size and international activity, Brazil holds important international and regional stature.

Brazil recent history has been characterized by inclusive economic growth, pro-poor social spending, and poverty reduction. Between 2000 and 2013 economic growth averaged around 3 percent per annum, favorable socioeconomic policies lifted close 14.4 million people out of extreme poverty (defined as living on less than $1.90 per day), and the Gini index, a measure of inequality,[3] fell by a value of 0.06 on the index, from 0.59 to 0.53. Much of Brazil's recent progress has been the result of expanding labor markets, declining wage inequality and pro-poor policies like the much heralded Bolsa Familia, a conditional cash transfer program that now reaches around 14 million families across the country (Shei, Costa, Reis, & Ko, 2014).

Box 1: Brazil's Current Path in IFs

The Current Path provides a necessary starting point for any alternative scenario analysis. The alternative scenarios discussed later in the report are all compared relative to the Current Path. Description and analysis of Brazil's Current Path forecasts are provided in more detail throughout the trends section of the report. To help readers contextualize Brazil's development trajectory, this box pulls together various threads of the Current Path forecast to summarize Brazil's development narrative to 2030.

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[2] Taken from Pardee Center Diplometrics dataset available here

[3] Gini Index measures inequality on a scale of 0 to 1. 0 represents perfect equality, 1 represents perfect inequality.

Brazil is an upper-middle income country with the largest economy in Latin America. Economic growth over the last decade averaged around 3 percent per annum and was helped by an expanding labor market and redistributive social policies that benefitted Brazil's poorest. The recession, which began in 2014, has highlighted the need for reform. Brazil is on an unsustainable fiscal trajectory and already dedicates a significant portion of the government budget to social spending. Across the horizon, a rapidly aging population mean that a greater demand for government resources will come from the elderly. In light of budget constraints, (the current government is moving to enshrine austerity policies in the constitution), funds for social transfer programs and Brazil's reduction in inequality may be affected. Structural deficiencies in Brazil's economic model (low productivity, low levels of trade openness, low investment) mean that Brazil's economy is forecast grow slowly (around 2 percent per annum) across the horizon. As a result, Brazil's per capita economic output grows modestly, and is not forecast to converge towards per capita levels of some of the world's economic leaders, such as the United States. Continued expansion of access to basic services like water and sanitation, information and communication technology (ICT), transportation, and education occurs in the Current Path, though universal access is not forecast by 2030. Modest economic growth coupled with continuing expansion of services means poverty is forecast to continue declining, but elimination targets are not forecast to be met by 2030.

Overall, Brazil is forecast to meet an estimated 43 percent of SDG indicators forecast in IFs along the Current Path. The IFs Current Path suggests that Brazil's ability to meet the SDGs will happen in an increasingly complicated external environment, shaped by an aging demographic and structural economic challenges. The government's ability to respond to these challenges will be shaped in large part by its capacity to overcome the current political crisis. In the following sections we unpack Brazil's development trajectory greater detail.

This inclusive development translated into positive achievements with respect to the Millennium Development Goals (MDGs), a set of eight global goals in operation from 2000 to 2015 that called for: 1) reducing poverty and hunger, 2) universal primary education, 3) promoting gender equality, 4) reducing child mortality, 5) improving maternal health, 6) combatting HIV/AIDS, 7) environmental sustainability, and 8) global partnerships for development.

Brazil was largely successful in meeting the targets established by the MDGs, with some exceptions (United Nations Department of Economic and Social Affairs, 2015). Poverty and hunger rates fell by more than half from 16.2 percent in 1990 to 3.8 in 2012, and 14.8 percent to less than 5 percent in 2015 respectively. Primary enrollment rates were close to 95 percent by 2015. Under mortality rate fell by more than two thirds. Gender parity in education remained near equal, while improvements were seen in female employment (as a share of wage employment). Reductions were made in infectious disease, including reducing the death rate (per 100,000) from tuberculosis by close to 60 percent. Progress towards the MDGs was not without its challenges. Brazil failed to meet targets under Goal 5 to reduce

the maternal mortality ratio by three quarters. Goal 7, with a focus on environmental sustainability, was not met. Deforestation has continued and has even accelerated in recent years (Fearnside, 2017).

Brazil today stands at a cross-roads. Since 2014 the country has been in a recession and GDP has contracted by around 3.7 percent in both 2015 and 2016. The International Monetary Fund (IMF) forecasts Brazil's GDP to grow an anemic 0.07 percent in 2017 (IMF, 2017). The current recession has been compounded by a series of political crises that began in 2014 and ultimately claimed the career of then President Dilma Rousseff in 2016 (Watts, 2016). Former President Luiz Inácio Lula da Silva, who served from 2003 to 2011 was also recently convicted in first instance of corruption and money laundering, sentenced to ten years in prison, pending final appeal (Phillips, 2017). The deep political and economic issues currently affecting the country have forced a re-evaluation of Brazil's development model. The Government's own Voluntary Review on the Sustainable Development Goals acknowledges that Brazil is unlikely to resume economic growth without serious structural reform (UN, 2017).

Building on the human development progress made under the MDGs, in September 2015 the global community launched the UN Sustainable Development Goals (SDGs), a set of global development objectives with a horizon to 2030. These targets represent a global initiative to enhance sustainable development. The goal of this report is to place these targets within Brazil's own national development context and to provide policymakers a sense of Brazil's prospects for achieving these global targets by 2030.

The report is organized around four major areas: i) trends across key issue areas out to 2030, ii) a scorecard describing Brazil's progress with respect to the SDGs in 2015 and Current Path scores of select indicators in 2030, iii) descriptions of scenario interventions and summary output, and iv) discussion of the results and conclusions. The trends explored in the first section are emphasized because they are foundational elements of Brazil's development and emphasize both recent successes and major challenges facing the country. These trends also feed directly into the scenarios constructed for this report. For context, Brazil's trends are frequently compared with regional scores using the UN South America regional group,[4] as well as the BRICS countries.

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[4] Regional grouping that includes: Argentina, Bolivia, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela

Brazil Current Path Trends

Demographics

Brazil's demographic trends have implications for a variety of sectors of human development out to 2030. The idea that "demographics is destiny" (Greenhill, 2011) appropriately captures the cross-cutting effects of demographics on many sectors of human development. In the case of Brazil, its demographic shifts are already in motion and cannot be easily halted by policy. Instead the focus must be on preparing for the economic and spending implications of these transitions.

Brazil is the largest country in Latin America by population size and land area, with an estimated 205.9 million people in 2015 across an area of 8.4 million square kilometers. This is almost four times larger than the next largest country by land area in Latin America (Argentina), and close to 80 percent larger than the next largest by population (Mexico). Brazil's population has nearly tripled since 1960, from 72.9 million in 1960 to 205.9 million in 2015 (data from the World Population Prospects, 2017 revision). Along the Current Path, Brazil's population is forecast to reach 226.3 million by 2030. Despite this growth, population growth rates have been gradually slowing in Brazil across much of the time period described above, and are forecast to continue slowing across the horizon. Between 1960 and 1980, Brazil's population grew at an average of 2.6 percent per annum. From 2000 to 2015, population growth averaged only 1.14 percent, and from 2016 to 2030 population is forecast to grow at approximately 0.6 percent per annum.

Box 2: Forecasting Demographics in IFs

Condensed from (Hughes, 2014: 3-4)

The population model of IFs uses the cohort component analysis approach of many population models, including the studies done by the United Nations. The approach relies upon age, fertility, and mortality distributions for each country/region with 22 cohorts: one for infants, 20 of five-year size, and one for all individuals of age 100 or older.

The dominant population formulation is a simple addition of births at the bottom of the cohort distribution, subtraction of deaths from each population cohort, and advance of people to the next cohort over time.
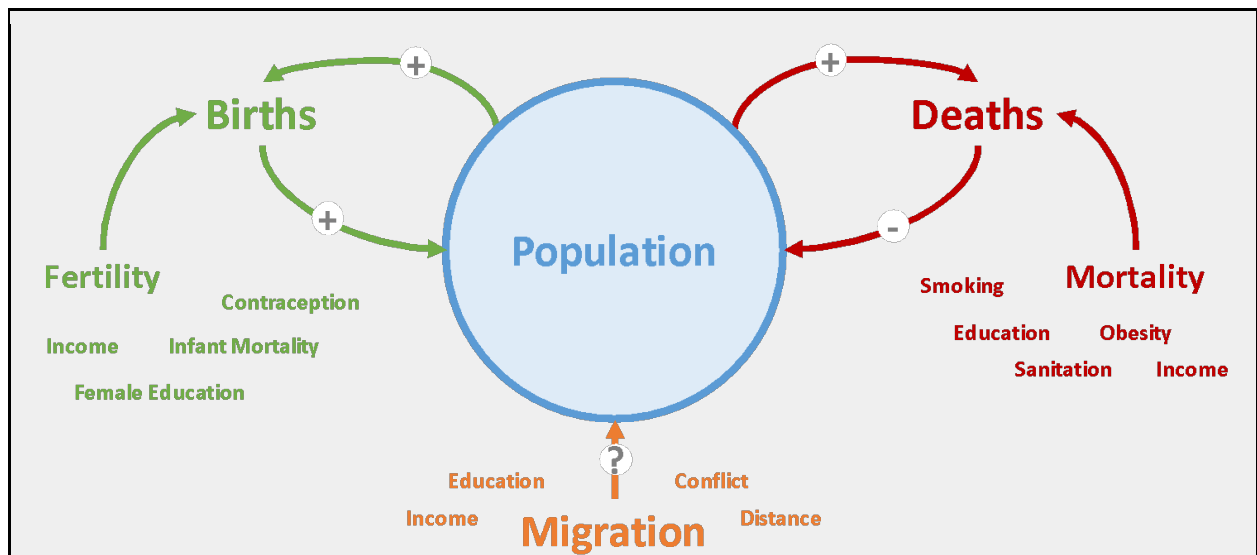

Figure 2. Representation of population stocks and flows in IFs demographics model. Figure created by Bohl (2016) for client presentation in relation to Demographic Risk Report.[5]

Births are modeled as a function of the total fertility rate (TFR), which in the longer term responds especially to education level of the adult population. In many places there is also a secular trend reduction in fertility. Deaths are primarily a function of life expectancy, itself computed within the IFs health model where, like fertility, it responds in the long run to adult education and also to GDP per capita and technology change. There is also a secular trend reduction in mortality in most countries. Population data is initialized from UN Department of Economic and Social Affairs (UNDESA) World Population Prospects estimates.

IFs demographic forecasts take into account migration patterns using net migration data from UNDESA. Given its size, migration has not historically played a significant role in Brazil's demographic composition, its movement accounting for less than 1 percent of the total population. In the IFs Current Path these trends are forecast to continue out to 2030, with Brazil forecast to see gradual outward migration of approximately 0.02 percent of the population.

The larger demographic model in combination with the health model provides representation of and control over migration; the fertility impact of infant mortality and contraception use rates; and the mortality impact of many factors including undernutrition, smoking rates, and indoor air pollution from open burning of solid fuels.

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[5] David K. Bohl, Barry B. Hughes, and Shelby Johnson. 2016. "Understanding and Forecasting Demographic Risks and Benefits." Project Report to Zurich Insurance Group and the Atlantic Council. Pardee Center for International Futures, University of Denver, Denver, CO.

Falling fertility rates have been a primary driver of Brazil's slowing population growth. In 1960 Brazil fertility rate was around 6 children per woman, falling to around 1.7 children per woman in 2015, below the natural replacement rate (2.1). This is below both the global fertility rate in 2015 (2.5) and the average fertility rate across South American countries (excluding Brazil) (2.2) (using data from World Population Prospects 2012 revision). Across the forecast horizon, Brazil's fertility rate is expected to remain between 1.7 and 1.8 children per woman.

Along the Current Path we can see the effects of Brazil's demographic trends on the population composition. Figure 3 below shows the population pyramid (millions) for Brazil in 2015 and 2030.[6] Brazil is currently experiencing a "demographic dividend," that is the working-age population (15-64) is more than twice the size of the dependent population (under 15, over 65). A demographic dividend is an important element of economic growth (more on that below.) As a result of Brazil's falling fertility rates, Brazil's demographic dividend has been growing steadily since the 1970s and a smaller proportion of the population is below the age of 15 today (22 percent) than were in 1970 (42 percent), based on data from the World Population Prospects (2017).
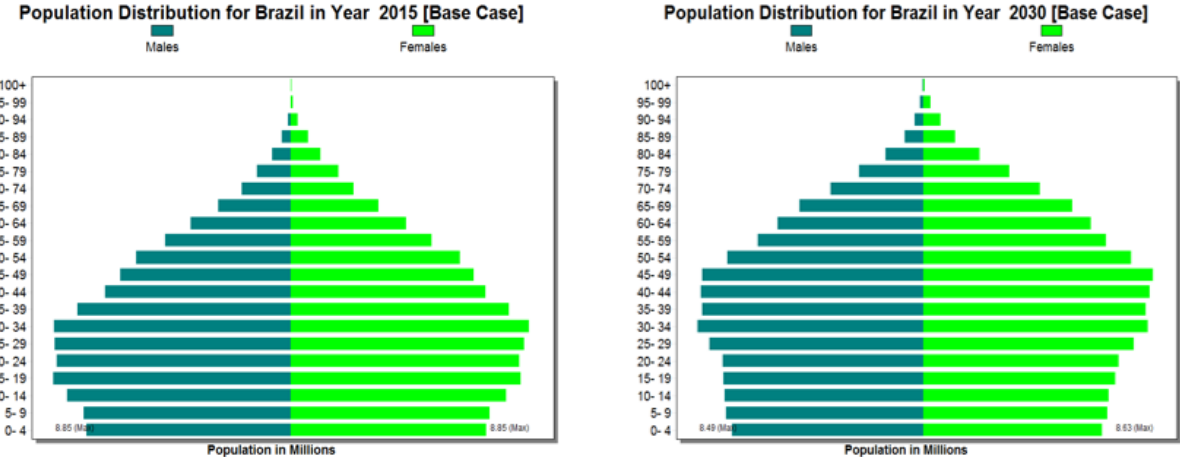
Figure 3. Population Pyramids for Brazil along the Current Path in 2015 (left) and 2030 (right). Source: IFs v7.31.

Yet these trends are not forecast to continue along the Current Path. Falling fertility rates result in a smaller percent of the population under 15, and a larger relative workforce. Over time the workforce begins to age, helped by increased life expectancy, which means that the proportion of the elderly

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[6]IFs population pyramids show population distribution in 5-year age-and-sex cohorts. Younger populations have a greater percentage of the population concentrated the bottom of the pyramid. As population ages, the middle and top of the pyramid begin to fill out.

population (those 65+) will grow. For Brazil, the percent of the population aged 65+ is forecast to increase from around 7.9 percent in 2015 to 13.5 percent in 2030, an increase of more than 14 million people. By 2050, 22 percent of the population is forecast to be over 65. The elderly dependency ratio, the ratio of 65+ to working age, is forecast to grow from 0.11 in 2015 to 0.2 by 2030, by 2050 it could be 0.36. In 2015, Brazil's elderly dependence ratio was the fourth highest in South America, along the Current Path it is forecast to be the second highest on the continent by 2050, behind only Chile. These trends will impact Brazil's labor force. In 2015 Brazil's labor force was estimated at around 107 million people. Along the Current Path Brazil's labor force will grow to an estimated 117.9 million in 2030, before beginning to shrink back down to 113 million in 2050. Table 2 below depicts Brazil in comparison to regional averages across a number of demographic indicators.

Indicators	Brazil Current Path		South America Current Path	
	2015	2030	2015	2030
Life Expectancy	75.2	77.6	75.1	77.3
Percent of Population aged 15-64	69.5	67.6	65.8	66
Percent of Population aged 65+	7.9	13.5	8	11.9
Median Age	31.3	37.4	29.1	33.8
Demographic Dividend	2.3	2.1	1.9	1.94
Elderly Dependency Ratio (pop 65+/16-65)	0.11	0.2	0.12	0.18

Table 2. Select Demographic Indicators for Brazil and UN South America regional group (excluding Brazil) in 2015 and 2030. Source: IFs v7.31.

A country's demographic composition is closely tied to its prospects for economic growth. A large demographic dividend is a favorable period of economic growth because of the potential for increasing savings and consumption, labor force expansion, and investment in economic growth (OECD, ECLAC, & CAF, 2016; Wong & Carvalho, 2006). Brazil is at an "advanced" stage of the demographic transition (ECLAC, 2008), and did not fully capitalize on its favorable demographic position until the first decade of the 2000s, with policies that boosted labor market expansion, job creation, and poverty reduction. A 2016 World Bank country diagnostic report noted that between 2002 and 2010 close to two-thirds of Brazil's GDP increase came from increases in the quantity and quality of labor inputs, resulting in part from Brazil's progression through the demographic transition (World Bank, 2016).

Nevertheless, Brazil's aging population over the next several decades has implications for Brazil's future growth model. The country will not be able to rely on an expanding labor force, growth will have to come from other areas. Additionally, a rapidly aging population will demand an increasingly large portion of the government budget is directed towards pensions and welfare expenditure, with fewer active workers capable of sustaining retirees. According to Goes et al (2016) at the IMF, in 2015 half of Brazil's public expenditure went to health and pensions (16 percent of GDP). The same paper forecasts

health and pension spending will reach 21 percent of GDP in 2025 and 40 percent of GDP by 2050. Brazil's budgets will be increasingly squeezed by pension demands across the forecast horizon, and spending requirements could really accelerate after 2030.

These represent significant expenditure commitments for a country that already spends heavily on social programs. According to the OECD (2017), Brazil had the highest level of social spending of governments in Latin America (31.3 percent of total expenditure) in 2014, and posted the second highest government deficit (6 percent of GDP). The government of Brazil has even recently acknowledged in its 2017 Voluntary Review for the SDGs that public finances in Brazil were on an unsustainable trajectory. Over the forecast horizon the government may want to prepare itself for a greater demand for its fiscal resources coming from retirees and seniors.

Governance

Economic challenges brought on by declining commodity prices, structural inefficiencies, and public spending deficits have been compounded by a series of political crises related to a series of wide-ranging corruption investigations. Fallout from the investigation continued to grow and the ruling coalition, led by the Workers Party, became entangled in the investigation. Over 90 people have been convicted through Operation Lava Jato (Car Wash), including former President Luiz Inácio Lula da Silva, who was sentenced in July 2017 to 10 years in prison, pending an appeal (Phillips, 2017).

Box 3. Forecasting Governance in IFs

Taken from (Hughes et al., 2014:4;)

Governance plays a foundational role in any country's development trajectory. The ability of the government to secure and administer the territory it governs through effective delivery of basic human services across the population is an essential determinant of growth and development. With respect to IFs, governance represents the "way society manages itself," and the dynamic interactions between civil society, the population, and government institutions.

Governance in IFs is conceptualized and forecast along three major transitions broadly in line with tenets of modernization theory, namely: a security transition, a capacity transition, and an inclusion transition.

The security transition begins with the movement from anarchy to sovereignty as states consolidate territory, establish a monopoly on the legitimate use of force, and achieve international recognition by other states. The security transition is focused on maintaining stability and reducing internal conflict within a bounded territorial area as states begin to develop administrative capacity.

The capacity transition follows the development and professionalization of the state bureaucracy and the ability of the state to administer to the territory it controls. Developing governance capacity requires things like an effective public administration, a system of taxation and revenue generation, a legitimate system of laws and rules applied equally and a professional military and police force. These elements help the state deliver public services.

The final transition is towards one of inclusion. The process of moving toward inclusive governance includes free movement of information, association, pluralistic decision-making, and a cooperative political culture.

The diagram below details the conceptualization of the governance model and how it interacts with other modules in IFs.
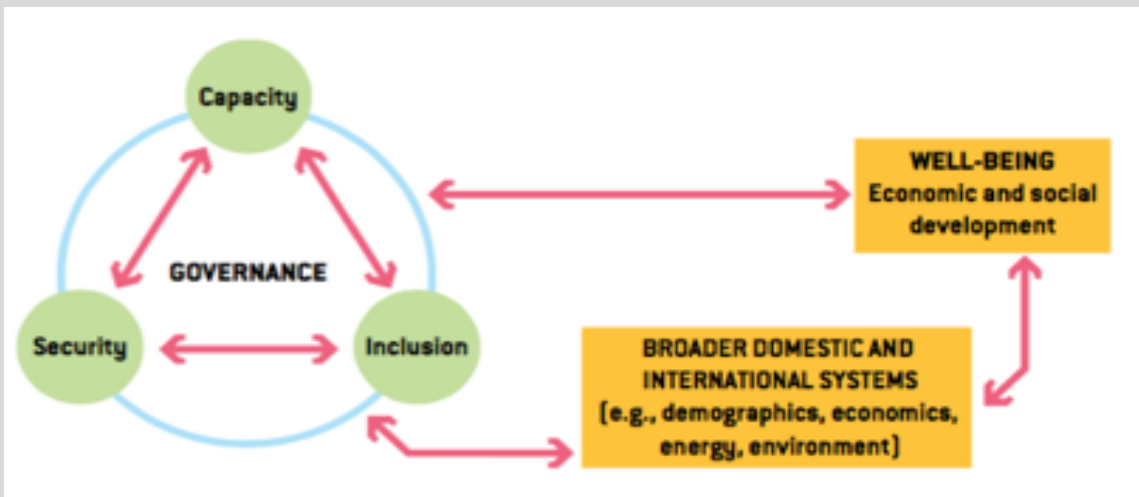
Figure 4. Stylistic representation of governance model in IFs. Source: Hughes et al, 2014.

IFs measures governance along each transition as an index score from 0 to 1 for each country in the model. The security score is initialized using data on state failure, adverse regime change and internal conflict (politicide, genocide, ethnic, or civil war) from the Political Instability Task Force project. Rather than forecasting discrete conflict events, IFs forecasts both the probability of intrastate conflict and vulnerability to intrastate for any country-year pair. Probability of conflict is a function of past conflict, neighborhood effects, economic growth rates (inverse), trade openness (inverse), youth bulge, infant mortality, and regime type. Vulnerability to conflict is a function of a variety of inputs including: energy trade dependence, economic growth rates (inverse), urbanization rate, infant mortality, undernutrition, corruption, and government effectiveness. A full list of drivers can be found in supporting documentation referenced at the end of this report.

The capacity index is forecasted as a function of government revenue and corruption, conceptualized as the Government's ability collect revenue and the efficacy of its administration. Government revenue

(percent of GDP) comes from World Bank and OECD data, while corruption data are taken from Transparency International's Corruption Perceptions Index.

The inclusion index is conceived as a broad set of variables social and political variables including, (but not limited to) regime type (democracy vs. autocracy) and gender empowerment. Regime type data is initialized from the Polity Project's 11-point democracy scale data, while Gender Empowerment is initialized from UN Gender Empowerment Measure.

In 2016, Brazil's President Dilma Rousseff of the Workers Party was accused of moving funds between government budgets in Brazil. She was eventually impeached in August 2016 after a senate vote. Furthermore, her replacement, President Michel Temer, is himself facing a raft of corruption charges and survived a vote to suspend his presidency in August 2017 (Lopes, 2017). Such is Brazil's size and influence in the region that these series of scandals have spread across its borders. In February, Peru issued an arrest warrant for its former President Alejandro Toledo, who is wanted for taking bribes in return for awarding Odebrecht, one of Brazil's largest construction firms implicated in the scandal, with infrastructure contracts in Peru (Tegel, 2017).

These scandals revealing the deep levels of corruption in Brazilian politics have eroded public confidence in Brazil's institutions. A July 2017 Pew survey found that 82 percent of Brazilians polled felt the economy's situation was "bad," up from around 40 percent in 2013. Corruption too remains at the forefront of the public consciousness, with 95 percent of respondents saying corrupt politicians remain a "problem" in Brazil. Other external assessments concur. According to the Worldwide Governance Indicators project from the World Bank, Brazil fell from the 60th percentile down to the 30th percentile in its "control of corruption" between 2011 and 2015.

IFs measures and forecasts governance transparency (defined as the absence of corruption) and is initialized from Transparency International's Corruption Perceptions Index (transparency and corruption are drivers of governance capacity, see box 3).[7] In 2015 Brazil was ranked 74th (out of 186 countries in

[7] IFs uses the Corruption Perceptions Index (CPI) from Transparency International (TI) to initialize and forecast quantitative measures of governance corruption. Founded in 1993, TI is an international NGO that works to identify and reduce corruption, promote transparency, across society and government. IFs uses the CPI because it contains information on perceived corruption from over 180 countries derived from multiple sources and institutions. In 2012, TI simplified the CPI computation to allow for analysis across time. An alternative measure of corruption (control of corruption) is produced by the World Bank's Worldwide Governance Indicators (WGI) project, but is not forecast in IFs. According to the World Bank

IFs) with respect to its level of transparency, behind Macedonia and just ahead of Tunisia. Regionally, Brazil ranks behind Chile and Uruguay. Over the horizon, IFs forecasts gradual improvements in governance transparency; although the improvements happen slower than many other countries such that by 2030 Brazil ranks 80th in its level of governance transparency, behind Peru and roughly the level of transparency of Malaysia today.

IFs also measures and forecasts government effectiveness, intended to capture the ability of the government to effectively administer services (see Box 2), again initialized from the Worldwide Governance Indicators project. Government effectiveness measures captures the quality of public services, the civil service, the policy formulation process, and the government's commitment to these policies (World Bank, 2016). In 2015 Brazil ranked 93rd globally and 4th in the region behind Chile, Uruguay, and Colombia. Again, Brazil is forecast to see gradual improvement along the Current Path, but more slowly than many other countries. By 2030, Brazil is forecast to be ranked 96th globally and 5th in the region.

These trends suggest that Brazil could see improvement in governance over the forecast horizon, but at a slower pace than many other countries. Governance will continue to play a foundational role in Brazil's development trajectory and ability to define and achieve its targets under the SDGs. Yet the fact remains that Brazil is enveloped in a political crisis that is seemingly difficult to shake. With general elections scheduled for 2018, some are worried that political discontent in Brazil could the field for more populist, authoritarian forces looking to profit on the disarray (Waldron, 2017). Continued fallout from the political crisis will distract attention from addressing other development issues in Brazil.

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measure, in 2015 Brazil ranked 120 out of 209 countries (1 being the least corrupt). For comparison, TI places Brazil as the 74th least corrupt.

Economy

Brazil's current political situation is also being compounded by a prolonged economic recession that began towards the end of 2014 and has persisted into 2017. This economic downturn marked a sharp reverse from a previous decade of sustained inclusive growth that raised over 20 million people out of poverty. Growth was powered by labor market expansion and social spending on programs like Bolsa Familia, which gave cash to Brazil's poorest families in return for ensuring their children attended school, got immunized, and had access to regular medical checkups (Tepperman, 2015). The program has had positive impacts on school enrollment, particularly among females, and has contributed to falling inequality, reduced malnutrition, and improved child healthcare (de Brauw et al, 2015; Shei et al., 2014; Soares, et al, 2010). At a cost of around half a percent of GDP, Bolsa Familia now reaches an estimated 14 million households across Brazil.

From 2000 to 2013, Brazil's GDP grew at an average of 3.6 percent per annum, and GDP expanded from around $1.7 trillion to $2.6 trillion (2011$ and at Market Exchange Rates from IMF World Economic Outlook). GDP per capita over the same time grew from just over $11,000 in 2000 to $15,290 (PPP) by 2013.

The recession and ensuing economic slowdown has reversed some of those gains. In 2014, Brazil's economy grew less than 1 percent and entered a deep recession in 2015 and 2016, contracting by 3.8 percent and 3.7 percent respectively. IMF forecasts anemic growth of less than a percent in 2017. Unemployment has also grown from 6.9 percent in 2014 to an estimated 12 percent by 2016 (Reuters 2017). The IMF 5-year GDP growth forecasts for Brazil are conservative, estimating under 2 percent out to 2022, compared with over 5 percent growth forecasts for BRICS countries and estimates of around 3 percent globally (estimated in IFs using IMF data). IFs forecasts these growth rates to continue, averaging around 1.8 percent between 2022 and 2030.

Moreover, while inequality fell during Brazil's decade of growth (Brazil's Gini index fell more than 0.06 on the index from 2003 to 2013), it remains a significant problem. With a domestic Gini index score of 51.3 in 2015, Brazil is the 14th most unequal country (out of the 186 countries in IFs). Using measures of income distribution beyond the Gini Index, recent studies have shown that the top 10 percent of Brazil have seen their share of income distribution rise more rapidly than the bottom 50 percent over the last 15 years (Morgan, 2017). A 2017 report estimates that six men in Brazil have the same combined wealth as the bottom 50 percent of the population (Oxfam, 2017). Slow economic growth and high levels of inequality mean Brazil is unlikely to meet poverty targets within the timeline of the SDGs. Along the Current Path, poverty in Brazil is forecast to decrease gradually, but will not reach zero by 2030. By 2030, 8.8 million people (4 percent of the population) could still be living on less than $1.90 per day.

Poverty Rates	Percent of Population			Headcount (Millions)		
	2003	2015	2030	2003	2015	2030
Less than $1.90 per day	12.7	4.5	3.9	23.2	9.3	8.8
Less than $3.10 per day	25.2	8.8	7.6	45.9	18	17.2

Table 3. *Poverty Rates ($2011)* in Brazil as a percent of the population and headcount (millions) in 2003, 2015, and 2030. Data from World Development Indicators (World Bank) and forecast from IFs v7.31.

In addition to income inequality, Brazil also has the lowest Gender Empowerment Measure (GEM) score in the region in 2015 (behind other South American countries).[8] Brazil's 2015 GEM score was estimated at 0.50, up from 0.36 in 1995. The highest GEM scores were in Argentina (0.69), Peru (0.64), and Ecuador (0.62). By 2030 Brazil's GEM score is forecast to increase to 0.55, but it is still forecast to be the lowest score in the region.

The recession in Brazil has also revealed structural deficiencies facing Brazil's economy. Rectifying these underlying deficiencies will be important for restoring sustainable, long-term growth in Brazil. A recent 2016 diagnostic report completed by the World Bank is instructive in this regard. The report highlights two main challenges facing the Brazilian economy: i) low productivity growth, and ii) unsustainable public sector spending commitments (World Bank, 2016).[9]

Brazil may have the 7th largest economy globally, but its 2015 GDP per capita (PPP) places it 77 (out of 186 countries in IFs). GDP per capita (economic output per person) can provide a rough indication of economic sophistication and productivity. The graph below shows Brazil's GDP per capita (as a share of

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[8] IFs measures and forecasts the GEM. GEM is a UN index designed to measure gender equality. It is based on estimates of women's relative income, participation in high-paying positions of economic power, and access to professional and parliamentary positions. Although this index has been replaced by the Gender Inequality Index (GII) and the forecasts should be treated with caution, it provides a rough benchmark of gender equality.

[9] There are other issues macro-level issues around public spending challenges in Brazil including: rates of bank concentration and competition, historically high interest rates, and a high exchange rate which have implications for Brazil's ability to pay down its public debt. These areas are not included explicitly in the economic analysis due primarily to modeling limitations. They also do not affect the main conclusions of this section.

U.S. GDP per capita) between 1960 and 2030.[10] BRICS countries are provided for context. Economic convergence theory expects poorer countries with low per capita GDP to grow faster than high per capita countries and converge towards (or catch up with) high per capita levels. Instead, Brazil's GDP per capita has declined gradually as a share of the U.S. from the mid-1970s to 2015. Along the forecast horizon Brazil's GDP per capita is forecast to remain at around 25 percent of the U.S. level. By contrast, China's GDP per capita has grown rapidly from less than 1 percent of the U.S. level in 1990 and is forecast to grow to 38 percent by 2030. India is also experiencing a similar trajectory to China.

Convergence with U.S. GDP per Capita
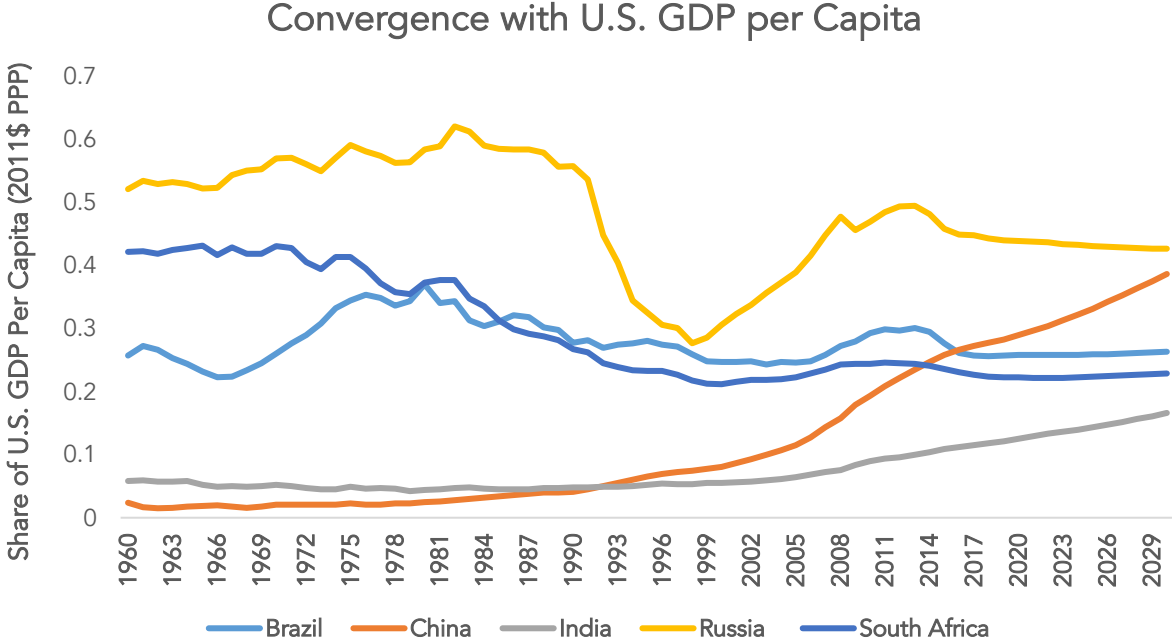
Figure 5. Convergence with US GDP per capita (2011$ at PPP) for BRICS countries 1960-2030. Data from World Development Indicators. Forecast from IFs v7.31.

Brazil's low productivity growth is the result of a number of interconnected issues including: high costs of finance and doing business, dilapidated physical structure, a closed trading system which limits competition and mutes incentives for innovation and technological adoption (World Bank, 2016). As a result, between 2002 and 2014 multifactor productivity (see Box 4 for description) accounted for only about 10 percent of Brazil's economic growth, while productivity improvements accounted for more than half of GDP growth in other emerging economies like China, India, and Russia (Elstrodt et al., 2014).

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[10] Figure 5 measures convergence with levels of U.S. GDP per capita ($52,000 in 2015). Data are calculated by dividing BRICS country GDP per capita with U.S. GDP per capita for each year of the horizon. A score of 1 on the vertical axis would indicate BRICS GDP per capita equal to that of the U.S.

Box 4. Forecasting Economics in IFs

Taken from Hughes, 2015:

GDP is determined as a forecast of supply-side inputs of labor, capital stock, and multifactor productivity (MFP). This approach is sometimes called a Solowian Cobb-Douglas production function. Capital stock is a function of investment and depreciation rates. Labor supply is a function of population dynamics from the demographic model and endogenous labor force participation rates, which are influenced by female participation.

Secondly, IFs contains a six-sector equilibrium-seeking representation of supply, domestic demand, and trade. Furthermore, the goods and services market representation is embedded in a larger social accounting matrix that incorporates behavior of households, firms, and government and their associated financial flows. The six sectors represented in IFs are: agriculture, raw materials, energy, manufactures, services, and ICT. Data for each of these sectors is aggregated from the Global Trade and Analysis Project based at Purdue University in the United States.

MFP (sometimes called Total Factor Productivity or TFP) is calculated and forecast endogenously within IFs. MFP reflects the efficiency with which inputs of labor and capital are used in production and output process. Improvements in MFP come from a variety of factors, most notably technology. The building blocks of MFP are decomposed into four categories: human capital, physical capital, social capital, and knowledge capital. Gains in MFP due to human capital are based on education and health (i.e. years of education, life expectancy). Gains in physical capital depend on natural environmental systems and physical infrastructure (i.e. energy, roads). Social capital is driven by institutional and social factors (i.e. governance, economic freedom), and knowledge capital is driven by knowledge diffusion factors (i.e. trade, research and development).

Brazil's domestic private entrepreneurial climate suffers from burdensome regulations. According to the World Bank's Ease of Doing Business index, Brazil ranks 116 out of 189 countries with only India ranking lower (World Bank, 2016). Additionally, surveys completed in São Paulo and Brasília, two of Brazil's largest cities, estimated on average it took over 83 days to start a business, which is twice as high as in South Africa (46), and almost three times as high as China (31) and India (29). High levels of regulation could be a factor pushing many entrepreneurs towards the informal sector. In 2015, IFs estimates that 42 percent of Brazil's labor force (as a share of total non-agricultural labor) is in the informal sector. Only India has a higher percentage of informal labor among BRICS countries. Along the Current Path, by 2030 an estimated 28 percent of Brazil's labor will still be operating informally, higher than other BRICS countries except India. Notably, Brazil's informal levels are below regional averages in 2015 (54 percent) and forecast to remain so along the horizon.

Despite its vast size and scale, Brazil's economy also remains remarkably closed to trade. In 2015 total trade amounted to 25.6 percent of Brazil's GDP, placing it 185 out of 186 countries in IFs and below more traditionally closed countries like Myanmar and Cuba (estimated in IFs using IMF data). Along the Current Path, trade is only expected to grow incrementally by 2030, reaching 28.8 percent of GDP. In 2015 exports amounted to 11.7 percent of GDP and imports close to 13.9 percent of GDP. These are the lowest figures in South America, a region that already has low trade penetration relative to other parts of the world. External analysis has confirmed that Brazil's low trade openness is in some ways uniquely "Brazilian," and cannot be accounted for easily as function of the size of the economy, the domestic population, or the size of the country (Canuto, 2015).

Brazil has historically looked inward to profit from its large domestic market and erected both non-tariff and tariff barriers to protect domestic industries. These barriers have helped select Brazilian companies prosper, but at the same time they reduce incentives for these companies to invest, boost productivity, and compete in the global economy. Brazil's export basket has in recent years become increasingly dependent on commodities. According to analysis by McKinsey Global Institute, between 2005 and 2012, Brazil's commodity exports increased from $11 billion to $64 billion (Elstrodt et al., 2014). In 2016, Brazil's top exports were soy beans and related products, iron ore, petroleum products, and poultry meat (Observatory of Economic Complexity, 2017) . The commodity boom over the last decade caused the Brazilian Real to appreciate, lowering the competitiveness of exports in other sectors. For instance, the World Bank estimates Brazilian exports of high-tech manufactured goods (as percentage of total manufacturing exports) fell from 18 percent in 2000 to around 12 percent in 2015. Similarly, manufacturing exports (as percent of total merchandise exported) has fallen from 58 percent in 2000 to around 38 percent in 2015.

Brazil's growth over the past several decades is a testament to successful distribution and labor policies that have stimulated GDP growth, reduced inequality (by some measures), and lifted millions out of poverty. The current recession has reversed some of those gains, and opened up questions about Brazil's economic health and its growth model. Along the forecast horizon, Brazil's GDP is expected to grow, reaching over $3.24 trillion in 2030. It will remain the largest economy in South America by some stretch, more than double the size of the next largest economy in the region. GDP per capita growth is forecast to remain more modest, reaching $16,030 by 2030, behind that of Chile, Uruguay, Argentina, and Colombia.

GDP per Capita (2011$, PPP)			
	2003	2015	2030	% change 2015-2030
Brazil	11,470	14,530	16,030	10.6
Chile	15,760	22,200	26,900	21.2
Uruguay	11,500	19,950	25,500	27.8
Argentina	13,360	19,100	22,600	18.3
Colombia	8,625	12,990	16,650	28.1

Table 4 GDP per capita (2011$, PPP) in 2003, 2015, and 2030 for Brazil and select South American Countries. Data from World Development Indicators. Forecast from IFs v7.31

Infrastructure

Brazil has made progress in expanding basic infrastructure over the past few decades, but there is a growing consensus that infrastructure needs to improve rapidly in order to both keep pace with and help push Brazil's development forward. Brazil spends less on infrastructure (as a percent of GDP) than many of its peer and competitor countries. The national budget from 2011-2014 set aside spending equivalent to roughly 1 percent of GDP and more recent estimates put infrastructure spending at around 2.5 percent of GDP in 2016 (Goy, 2016). The World Bank recommends spending levels around 6 percent for developing countries to catch up with advanced economies (Amann, Baer, Trebat, & Lora, 2016). Brazil's spending pales in comparison to other BRICS countries. Between 2008 and 2013 China spent an estimated 8.8 percent of its GDP on infrastructure, India around 5.2 percent, Russia 4.5 percent, and South Africa 4.7 percent (Woetzel et al, 2016).

Box 5. Forecasting Infrastructure in IFs

Condensed from (Rothman et al, 2014:4)

Infrastructure, defined as "the system of public works of a country, state, or region and the resources (such as the personnel, buildings, or equipment) required to complete an activity" (Rothman et al, 2014:3), is an important backbone of any developed economy. IFs measures and forecasts the stock of infrastructure (e.g. the physical amount) and population access rates to that infrastructure. IFs infrastructure model is disaggregated into two groups of forecasts: "core infrastructure" and "other infrastructure." Core infrastructure is modeled explicitly and grouped around four main areas: water and sanitation (WASH), information and communication technologies (ICT), roads, and electricity. "Other infrastructure" captures infrastructure types not modeled explicitly in IFs: railroads, ports, airports, and other types of infrastructure that could emerge in the future. Decisions around what constitutes core infrastructure reflect data availability and previous analyses of what can be feasibly modeled.

Infrastructure forecasting in IFs progresses in the following sequence for each forecast year: i) estimate expected levels of infrastructure, ii) translate expected levels into financial requirements, iii) balance financial requirements with available resources, iv) forecast actual levels of attainable infrastructure, v) estimate the social, economic, and environmental impact of actual infrastructure development. Figure 7 lays out these steps:
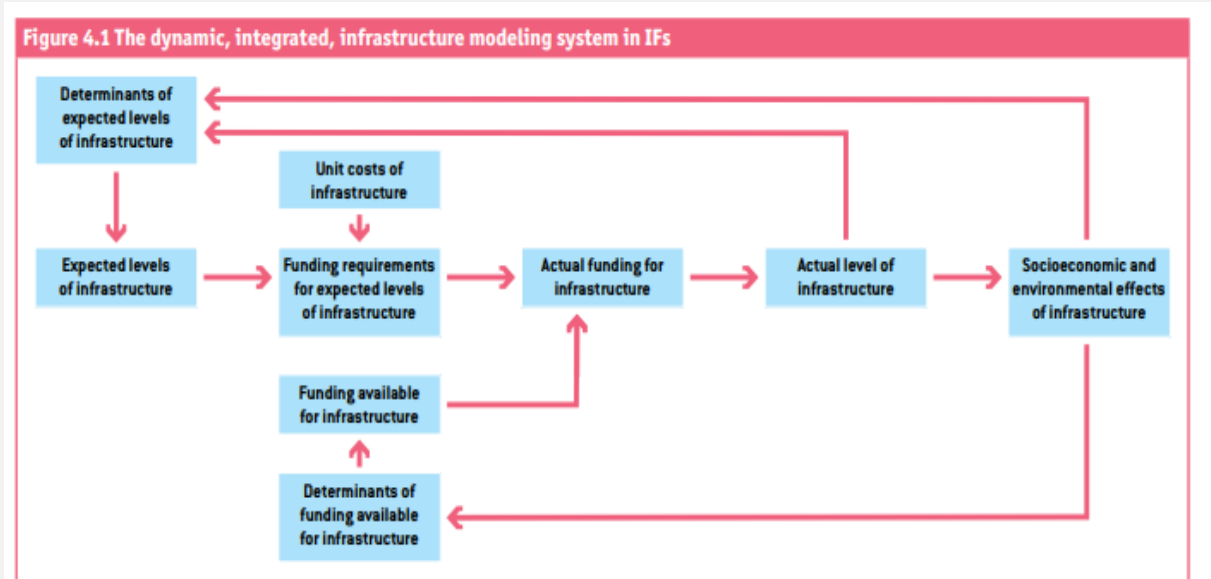

Figure 4.1 The dynamic, integrated, infrastructure modeling system in IFs

Figure 6. Stylistic representation of infrastructure spending and forecasting in IFs. Source: Rothman et al, 2014

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Expected levels of infrastructure for each component type are forecasted using a series of accounting and econometric equations driven by model inputs like GDP, population, land area, educational attainment, income, poverty levels and governance. Expected infrastructure is translated into financial requirements for funding based on costs for both new infrastructure and maintenance of existing. Financial requirements are then translated into financing resources available in conjunction with the IFs government finance model. Government finance balances government domestic revenue and foreign aid across costs on transfers (pensions and social welfare) and direct government spending. IFs models spending across broad categories of defense, education, health, research and development, basic infrastructure, and other infrastructure (airports, ports, railroads), and other (residual category). The financing requirements are then balanced against expected levels of infrastructure to determine the actual infrastructure development in that year.

The benefits of infrastructure on economic growth are well established in the literature (Amann et al, 2014; Amann et al., 2016; Andres et al., 2017; Calderon & Serven, 2010). Brazil's underinvestment translates into impediments to economic growth. Transportation costs in Brazil are notoriously high, logistics spending represents around 15 percent of Brazil's GDP, in other advanced economies this spending is closer to 10 percent (Ocampo & Ros, 2011). A 2013 report by Credit Suisse estimated that Brazil's infrastructure inefficiencies cost between 10 and 15 percent of GDP every year (Savaris, Vinagre, & Magalhaes, 2013).

The solutions to Brazil's infrastructure challenges may not be as simple as "spend more" to reduce the investment gap. A recent report on infrastructure in Latin America makes the case that more spending will be challenging for many Latin American countries already squeezed by tightening budgets (Andres et al., 2017). Brazil's current President Michel Temer is proposing to freeze federal spending through a constitutional amendment (Assis, 2016). In light of fiscal constraints, the report makes the case that narrowing the infrastructure gap requires spending efficiently on well-defined infrastructure priorities. Brazil, whose infrastructure suffers from weak capacity and lax enforcement in addition to underinvestment means projects are sometimes included in the federal budget without proper appraisal and many, like the North East Transnordestina railway, remain unfinished (Andres et al., 2017; Goy, 2016). With this context in mind, we now shift to an overview of Brazil's infrastructure along the forecast horizon across each of the four areas measured in IFs, water and sanitation, ICT, roads, and electricity.

Water, Sanitation & Hygiene

In 1990, an estimated 77 percent of Brazil's population had access to piped water and 66 percent had access to improved sanitation. By 2015, those numbers had increased to 93.7 percent and 82.8 percent respectively. Continuing improvements are expected, by 2030 an estimated 95 percent of Brazilians will

have access to piped water and 85 percent will have improved sanitation. Along the Current Path Brazil is forecast to meet SDG targets with respect to clean water access, but sanitation access is not forecast to be met. Notably however, in 2015 improved sanitation access rates in Brazil were higher than other BRICS economies including: China (76 percent), Russia (72 percent), South Africa (66 percent) and India (40 percent).

Box 6. Water and Sanitation in IFs

IFs water access forecasts are initialized using data from the Joint Monitoring Program (JMP) on water and sanitation, published by UNICEF and the WHO. IFs water is classified according to the following 1) piped water, 2) other improved services (e.g. boreholes, tubewells, protected wells and springs, packaged water) 3) unimproved services (e.g. surface water, unprotected wells and spring). IFs sanitation forecasts are similarly initialized using data from the Joint Monitoring Program (JMP). IFs sanitation is classified according to the following: 1) improved services (those that separate human waste from human contact such as a flush toilet), 2) shared services (services shared between two or more households), and 3) other unimproved services (pit latrines, hanging latrines, bucket latrines, and open defecation).

Additionally, in 2015 an estimated 53.4 percent of the population had access to wastewater collection systems, and 26 percent were connected to wastewater treatment systems. Access is forecast to grow across the horizon, but Brazil is not forecast to meet the SDG target of 98 percent access to wastewater collection and treatment.

IFs measures and forecasts access rates to clean water and sanitation, but Brazil's water infrastructure also suffers from grid inefficiencies. Brazil is a water abundant country; according to the World Bank, Brazil is home to close to one-fifth of the world's water reserves (World Bank, 2016). Some Brazilian cities, however, have faced water shortages in recent years, the product of several interrelated factors including climate change, drought, and water-intensive agriculture and energy sectors (World Bank, 2016; Stauffer, 2016; Victor et al, 2015. Additionally, Brazil's water supply suffers from deficiencies in the grid. The National Information System on Sanitation (SNIS) estimates that close to 40 percent of treated water is wasted through leaks, illegal connections and grid system irregularities in 100 cities with a population greater than 250,000. Expanding access to clean water also requires improving Brazil's grid system to ensure clean water reaches the population efficiently.

	JMP Classification	1990	2000	2015	2030
	Unimproved	11.5	6.5	1.88	0.6
Water	Other Improved	10.7	7.3	4.4	4.6
	Piped	77.8	86.1	93.7	94.8
	Other Unimproved	32.4	24.2	15.9	12.6
Sanitation	Shared	1.03	1.2	1.27	2.05
	Improved	66	74.7	82.8	85.4
Wastewater Collection and Treatment	Wastewater Collection System	-	-	53.4	63.9
	Wastewater Treatment system	-	-	26	43.6

Table 5. Water and sanitation access rates for Brazil in 1990, 2000, 2015, and 2030. Data from JMP. Forecast from IFs v7.31

Information and Communication Technologies (ICT)

Brazil's ICT access rates are ahead of regional averages and on par with averages across the OECD, particularly with respect to mobile technology. Table 6 shows access and subscription rates across the four types of ICT modeled in IFs. Subscription rates across South America (excluding Brazil), BRICS (excluding Brazil) and the OECD are provided for comparison.[11]

	Fixed Telephone Lines			Fixed Broadband			Mobile Phone			Mobile Broadband		
	2000	2015	2030	2000	2015	2030	2000	2015	2030	2000	2015	2030
Brazil	17.7	21.5	9.8	0.057	12.1	28.9	13.3	126.6	152.6	-	79.4	152.6
South America	14.4	17.3	8.7	0.02	10.5	32.5	12.2	115.6	145.6	-	38.2	126.8
BRICS	8.5	10.2	6.4	0.002	11.4	37.5	3.9	92.1	144.1	-	24.3	109.8
OECD	50.8	38.5	13.9	1.5	29.1	43.1	45.4	114.9	146.6	-	87.3	145.5

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[11] Subscription saturation points for different ICT technologies differ across countries. Data from the International Telecommunications Union show penetration rates for mobile phones that exceed 100 subscriptions per 100 persons (e.g., approaching 200 in Hong Kong). At the same time, some countries (e.g., Denmark) seem to be reaching a saturation level for fixed broadband well below 100 subscriptions per 100 persons. With this uncertainty in mind, IFs saturates at 50 per 100 for fixed broadband and 150 per 100 for mobile technology. These data come from the International Telecommunications Union (ITU) and were updated in August 2017.

Table 6. ICT Access Rates (per 100 people) for Brazil, South America, BRICS, and OECD in 2000, 2015, and 2030. South America and BRICS group exclude Brazil. Data from International Telecommunications Union (ITU). Forecasts from IFs v7.31.

Within South America, Brazil had the 5th highest mobile phone subscription rate in 2015, behind Argentina (150.3), Uruguay (148.3), Suriname (134.9) and Chile (129.5). By 2030 Brazil will have the 6th highest mobile phone subscription rates behind those listed above with the addition of Peru. Brazil does have the highest subscription rates for mobile broadband in 2015, roughly 15 percent higher than the next highest country Chile (53.8).

Box 7. ICT in IFs

ICT is measured and modeled in IFs using subscription rates (per 100 people). IFs models four types of ICT: fixed telephone lines, fixed broadband, mobile telephone, and mobile broadband. Growth in ICT hardware is driven primarily as a function of GDP, population, regulatory quality, and urbanization rates, and data used to initialize ICT access comes from the International Telecommunications Union.

Road Network

Roads connect producers to markets, students with schools, people with hospitals and healthcare, and employees with jobs. They are essential to development progress and it is well-established that roads contribute positively to productivity (C. Berg, 2015; C. N. Berg, Deichmann, Liu, & Selod, 2015; Fraumeni, 2009). In 2015 Brazil had over 1.58 million kilometers of road, the fourth largest road network in absolute terms globally. This is a potentially misleading statistic however as Brazil is the 5th largest country in the world by total land area. A more helpful picture of Brazil's road network is found in comparisons of relative road network density. IFs measures road density per hectare and per capita. Table 7 shows how Brazil compares with some of its peers. Argentina is included as a regional neighbor, China, Russia, and India are included as comparison countries with similarly large land areas. Indonesia and Nigeria are included for comparison as countries with less land area than Brazil but similarly large populations. Road density across the Organization for Economic Cooperation and Development (OECD) is included as a benchmark for high-income countries.

	Paved Roads per Capita (Thousand kilometers (KM) per person)			Paved Roads per Hectare (Kilometers (KM) per Thousand hectares)		
	2000	2015	2030	2000	2015	2030
Brazil	590.4	1,040	1,316	0.12	0.26	0.36
Argentina	1,686	1,814	2,268	0.23	0.29	0.4
China	-	2,149	3,501	-	3.19	5.36
India	1,484	2,244	2,888	5.26	9.88	14.66
Russia	-	6,920	8,451	-	0.61	0.72
Indonesia	954.4	1,287	1,687	1.11	1.83	2.75
Nigeria	-	159.9	207.5	-	0.32	0.59
OECD	7,941	8,870	9,151	2.67	3.29	3.59

Table 7. Road density per hectare and per person in Brazil, selected countries, and the OECD in 2000, 2015, and 2030. The OECD is an inter-governmental organization comprising 35 of the wealthiest countries in the world. Data from World Development Indicators. Forecasts from IFs v7.31.

This provides a more nuanced picture of road density. In 2015 Brazil had fewer paved roads per capita than all comparison countries except Nigeria. Road density per hectare was lower than even Nigeria in 2015. The IFs Current Path forecasts Brazil's total road network to grow from 1.58 million kilometers in 2015 to over 1.63 kilometers by 2030. Despite the forecasted growth, Brazil is not forecast to improve its relative position much by 2030, overtaking only Indonesia in terms of paved roads per capita. With respect to paved roads per hectare, Brazil is forecast to overtake Argentina along the horizon. Rural areas are almost certainly underserved. The rural access index (RAI) which measures the percentage of the population living within 2 kilometers of an all-weather road estimates that Brazil has had some of the lowest rural access rates of the countries reported here. In 2001 an estimated 53 percent of the population had access to an all-weather road, compared with 77 percent in Argentina, 97 percent in China, and 61 percent in India, and 47 percent in Nigeria.[12]

The amount of paved road, a rough indication of the overall quality of road infrastructure, suggests Brazil has work to do. In 2015 an estimated 13.6 percent of Brazil's total road infrastructure was paved, behind every other comparison country. Russia had the overall highest paved rate (80 percent). Along the Current Path, Brazil is forecast to see paved road growth, but it will remain at the bottom of comparison countries.

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[12] The data comes from the World Bank's Rural Access Index, a project that has been discontinued. These estimates should be treated with caution, however they are useful for providing a rough benchmark for rural road access.

	Paved Roads (Percent of total road network)		
	1995	2015	2030
Brazil	8.9	13.6	18.2
Argentina	29.1	32.2	35.9
China	-	63.7	83.6
India	55.4	53.8	63.6
Russia	-	80.1	80.2
Indonesia	52.4	57	61.8
Nigeria	-	15	19.4
OECD	60.3	69.7	71.5

Table 8. Paved roads (percent of total road network) in Brazil, select comparison countries, and the OECD in 1995, 2015, and 2030. The OECD is an inter-governmental organization comprising 35 of the wealthiest countries in the world. Data from World Development Indicators. Forecasts from IFs v7.31.

Electricity

Access to electricity for the urban population in Brazil has been around 100 percent since 1990 according to the World Bank's World Development Indicators. Rural electricity access, estimated to be around 63 percent in 1990, reached 97 percent in 2012 and is forecast to remain at around 100 percent of the population out to 2030.

In addition to near 100 percent electricity access rates, Brazil has some of the highest electricity generation capacity in South America. Data on electricity generation capacity are from the U.S. Energy Information Agency (2016). In 2015, Brazil produced an estimated 126 gigawatts of electricity, ahead of Argentina (36.1), Venezuela (27.1) and Chile (19.2), the next highest producers in the region. In fact Brazil's overall generation capacity was the 10th highest among the countries in IFs in 2015. By 2030 its generation capacity is forecast to reach 148.7 gigawatts. On a per capita generation basis, however, Brazil performs less well. Its per capita generation (measured in kilowatts per capita) was 0.61 in 2015, 7th highest in the region. Paraguay (1.3) and Chile (1.1) had the highest per capita generation regionally. By 2030 per capita generation is forecast to reach 0.66, but its regional ranking will not change.

Brazil also has some of the highest transmission and distribution loss rates in the region. Based on data from the World Development Indicators, in 2015, Brazil lost an estimated 15.8 percent of its total output to transmission and distribution, down from a peak of 17.7 percent in 2000. This is the second highest loss rate in the region behind only Venezuela (36.1 percent). Gradual improvement is forecast; by 2030 loss rates could decline to 12.2 percent.

Health

Brazil has made important strides extending health services over the past few decades. But, the shifting burden of disease from communicable disease to non-communicable disease is and will continue to present challenges for the Brazilian health system now and across the horizon. Brazil offers free public healthcare to every citizen and in 1988 it became a constitutional right. An impressive feat for such a large country, Brazil's free public healthcare is not without its challenges. Resources are often stretched thin and patients often face extensive delays in seeing doctors or obtaining health information and results (Khazan, 2014). In a 2013 poll conducted by Datafolha, a Brazilian polling agency, 48 percent of Brazilian respondents said healthcare was Brazil's biggest problem (Folha de S. Paulo, 2013).

These challenges should not obscure the accomplishments Brazil has achieved in healthcare. Life expectancy and infant mortality, two important indicators of health system performance, have improved rapidly over the past 25 years. Since 1990 Brazil has reduced infant mortality rates (deaths within first year of life) by 70 percent (from 49.2 per thousand births to 14.5 per thousand), bringing them lower than both the South American average (16.5 per thousand) and the BRICS average (23.6 per thousand) in 2015. Life expectancy has increased by nearly 10 years, from 65.4 in 1990 to 75 years (71.5 for males, 78.9 for females) in 2015. This is commensurate with the average across South American countries (75.1 years) and higher than the average for the BRICS (72.1 years). Across the forecast horizon, infant mortality is forecast to continue declining to 9.8 per thousand by 2030 and life expectancy is forecast to reach 77.6 years by 2030.
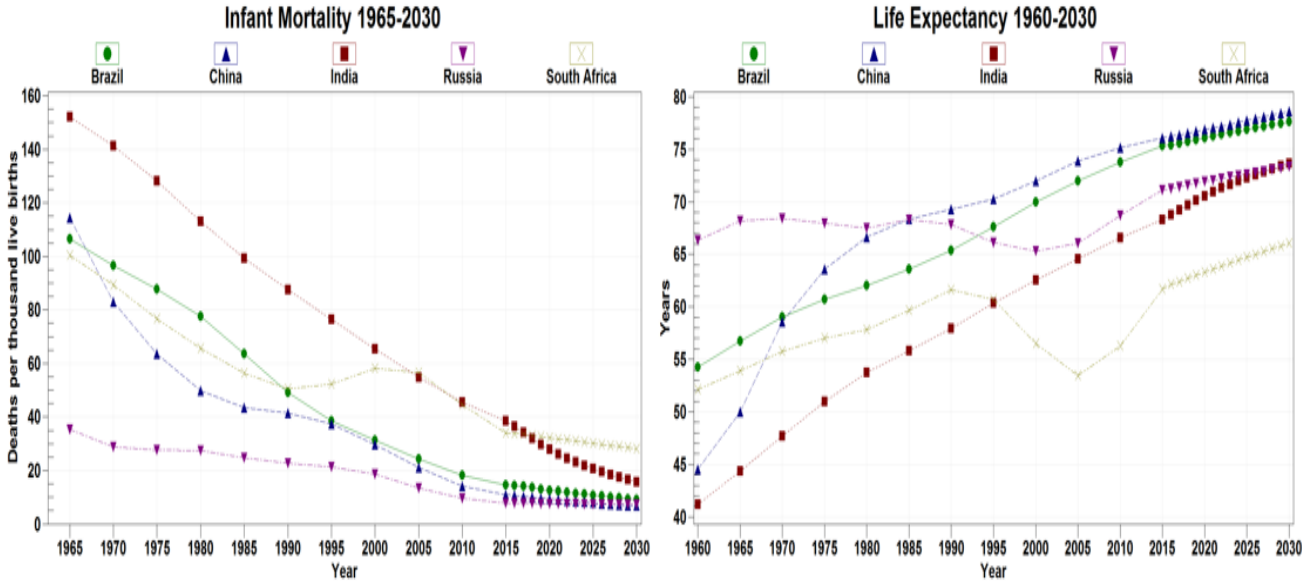
Figure 7. Infant Mortality (per thousand live births and during first year of life) and Life Expectancy for Brazil and BRICS countries 1960-2030. Data from World Population Prospects, 2017 revision. Forecasts from IFs v7.31.

Brazil was also able to achieve many of the health-related Millennium Development Goals. The number of undernourished people (according to State of Food insecurity index from FAO) fell from 18.4 million in 1990 to 2.7 million in 2015 (MDG Goal 1: reduce hunger by half). According to the WHO, tuberculosis incidence rates fell from 51 per 100,000 in 2000 to 41 per 100,000 in 2015 and the number of deaths from tuberculosis (excluding HIV) also declined from 8,300 [confidence interval 6,400-10,000], to 5,500 [confidence interval 4,900-5,900]. (MDG Goal 6: halt and reverse spread of tuberculosis). The HIV prevalence rate is estimated at less than 1 percent of the population in 2015.

Box 8. Life Expectancy by Brazilian State

Figure 7 shows life expectancy estimates for males and females in 2030 across the 27 states (including the federal district) of Brazil from IFs subnational model.[13] In 2017 Santa Catarina had the highest life expectancy in the country (82.2 years for females and 75.3 years for males). Together, Santa Catarina's life expectancy (78.8) is roughly 3 years above the national average. The lowest life expectancy is found in Maranhão State, with an average of 70.7 years (66.8 for males, 74.5 for females).

Along the Current Path, in 2030 Santa Catarina maintains the highest life expectancy in Brazil at 80.9 years (77.2 for males, 84.5 for females). The states with the next highest life expectancy in 2030 are Federal District (Distrito Federal) at 80.2 years (76.5 for males, 83.9 for females), and São Paulo at 80 years (76.7 for males, 83.4 for females). The States with the lowest life expectancy in 2030 are: Maranhão at 72.8 years (68.6 for males, 77 for females), Piauí at 73.3 years (68.7 for males, 77.8 for females), and Alagoas at 73.7 years (68.6 for males, 78.8 for females).

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[13] The Pardee Center is enhancing the capability for subnational forecasting in IFs, which is currently limited. Because the SDGs are national targets, this report has focused on national-level forecasts and outcomes.
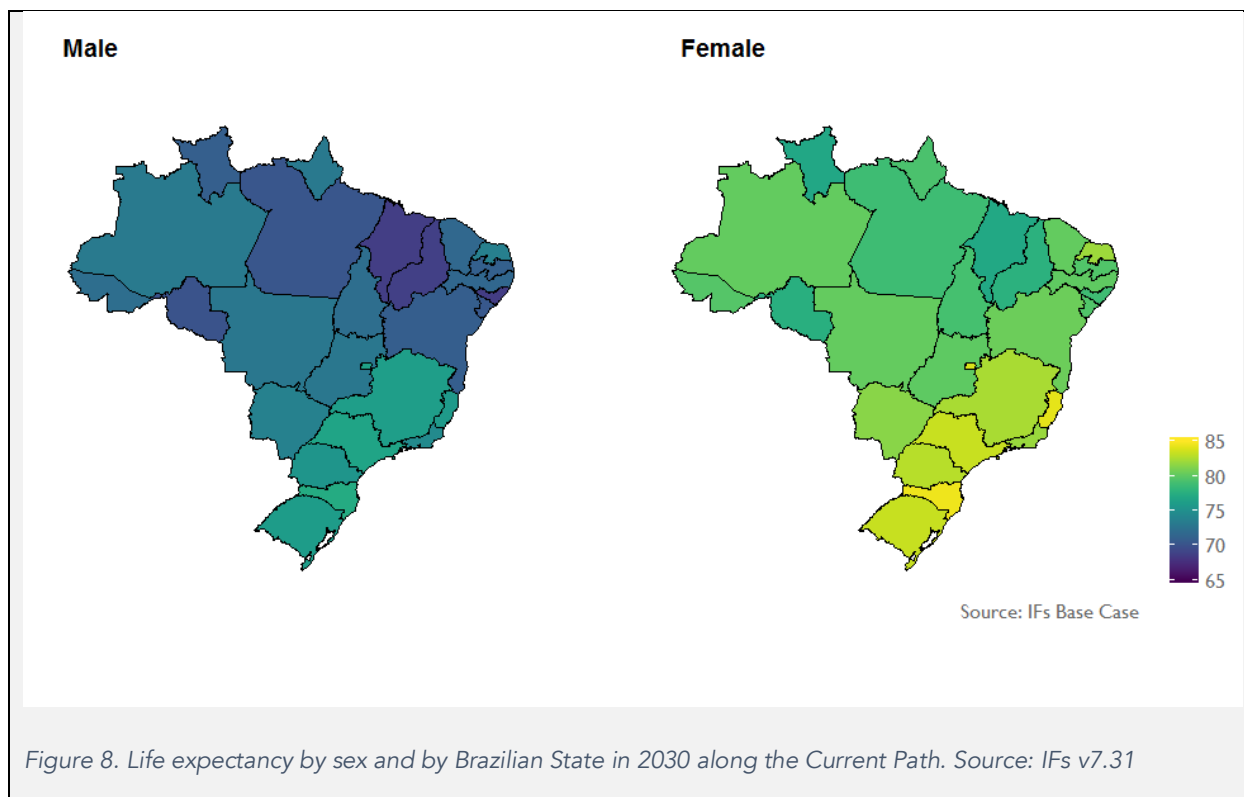
Reductions in the communicable disease burden mean that people are able to live longer, healthier lives. As populations live longer, an increasing proportion of the disease burden comes from non-communicable diseases. Brazil's reductions in communicable diseases, alongside economic growth and an ageing, means that Brazil's overall burden of disease is and will be increasingly characterized by non-communicable diseases. This means that Brazilian health systems will need to adapt to treat a greater burden of NCDs. These are not passed through infectious agents but are caused by a combination of lifestyle, genetic, and environmental issues (Murray et al, 2015) that may include urbanization, aging, lack of physical exercise, smoking, and unhealthy diets. Rising non-communicable disease burdens require investments in "horizontal" health systems capable of delivering health services to poor segments of the population and addressing prevailing health concerns, rather than "vertical" systems which provide substantial infrastructure for treatment of specific diseases (Elzinga, 2005; Narayan & Donnenfeld, 2016). Common examples of vertical strategies include malaria treatment programs in Africa or national "immunization days" common in many developing countries. While both systems have tradeoffs, horizontal health systems are more cost-effective over the long-term, can be sustained by the public sector and tend to be fully integrated with local health services (Myusa, 2005).

Box 9. Forecasting Health Outcomes in IFs

Condensed from (Hughes, Kuhn, Peterson, Rothman, & Solórzano, 2011)

IFs forecasts morbidity and mortality for 15 specific causes. These causes are grouped according to the WHO's International Classification for Disease (ICD) structure: communicable (infectious) diseases, non-communicable diseases, and accidents. Accidents is further broken down into traffic fatalities, unintentional injuries or death, and intentional injuries or death (murder, suicide, etc.). Data on mortality/morbidity for each of these causes is taken from the WHO Global Burden of Disease Project. The GBD project forecasts mortality and morbidity across hundreds of unique causes; for parsimony and forecasting purposes IFs consolidates data from the GBD into 15 specific causes: HIV/AIDS, diarrhea, respiratory infection, malaria, cancer, respiratory disease, diabetes, cardiovascular disease, digestive, mental health, other communicable disease, other non-communicable disease, traffic accidents, intentional injuries, and unintentional injuries.

Mortality and morbidity rates are forecast using a distal and proximate driver structure in the model. Distal drivers are those that change over a long period of time and are associated with the social determinants of health. They are systemic and draw from sectors outside the immediate purview of health. Examples of these drivers include levels of education, levels of income and technology. The Global Burden of Disease (GBD) identified income levels, education and technological progress as proxies that drive the incidence and prevalence of disease distally (C. J. Murray & Lopez, 1996). IFs uses these proxies as distal drivers to forecast health outcomes.

Proximate drivers affect the burden of disease more directly. IFs makes use of childhood undernutrition, the Body Mass Index (BMI), access to water and sanitation, and climate change as proximate drivers when forecasting disease mortality and health outcomes (Hughes et al., 2011). IFs also forecasts various demographic, economic and socio-political outcomes of reduction in disease mortality. Below is a simple diagrammatic description of the drivers of disease in IFs:
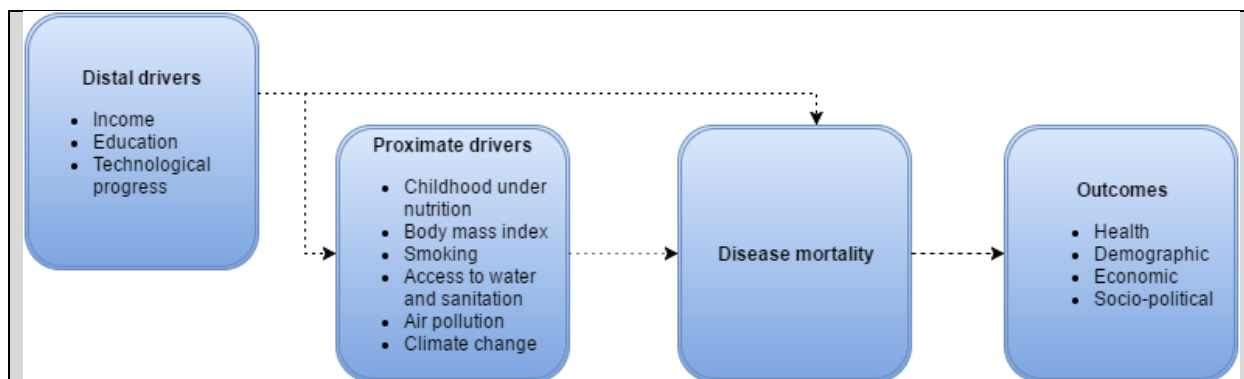
Figure 9. Representation of proximate and distal Drivers in IFs health model. Figure originally created by Hedden (2016) for Southern Africa Trends Report[14]

To provide a clearer picture of the forecasted disease burden in Brazil, Table 9 depicts the disability-adjusted life years (in millions) in 2015 and 2030 for each forecasted cause of death in IFs. Disability-adjusted life years, or DALYs, are calculated as the sum of years of life lost to premature death from disease or injury and years of life lost to disability or injury that renders a person unable to work in a fully productive capacity. DALYs represent a population-wide measure of a country's disease burden; a perfectly healthy population (with a life expectancy of 84 years based on longest life expectancies in the world) would have zero DALYs. Developed by the WHO Global Burden of Disease Project, they provide a quantifiable measurement of health (both mortality and morbidity) that can be compared across countries and time.

In 2015 DALYs from NCDs accounted for approximately 69 percent of the overall disease burden, while DALYs from communicable disease accounted for approximately 13 percent. Notably, DALYs from traffic accidents and other injuries accounted for 17 percent of the overall burden. Within the injuries category, DALYs from intentional injuries (interpersonal violence, homicide, suicide, and collective violence) accounted for over half of Brazil's DALYs from the injuries categories in 2015. This was the second highest estimated level of DALYs from intentional injuries in IFs globally in 2015, behind only India. Within the NCD category, the highest number of DALYs are attributable to cardiovascular disease,

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[14] Bohl, David K., Steve Hedden, Jonathan D. Moyer, Kanishka Narayan, Jessica Rettig. 2017. "Development Trends Report for Southern Africa." Invited Research Paper for USAID. Pardee Center for International Futures, University of Denver, Denver, CO.

accounting for 18 percent of the total NCD burden.[15] Across the forecast horizon the overall disease burden as measured by DALYs is forecast to increase, from 68.5 million DALYs in 2015 to an estimated 76.7 million in 2030. Most of that increase is being driven by a rising NCD burden which is forecast to account for around 75 percent of the total burden in 2030. Within the NCD category, DALYs from diabetes and respiratory diseases will see the most significant increases to 2030. Even in 2030 cardiovascular disease is still forecast to account of the largest percentage of the total NCD burden (19 percent).

ICD Category	Disease Subtype	Total DALYS (Millions of Years)	
		2015	2030
Communicable Disease	HIV/AIDS	0.807	0.577
	Diarrhea	0.267	0.168
	Malaria	0.004	0.002
	Respiratory Infections	2.39	2.04
	Other Communicable Diseases	5.49	3.54
	Total	8.96	6.33
Non-Communicable Disease	Cancer	5.8	7.28
	Cardiovascular disease	8.73	10.83
	Diabetes	2.22	3.27
	Digestive Diseases	2.94	3.67
	Respiratory Disease	4.35	6.42
	Mental Health	6.99	7.72
	Other Non-communicable Diseases	16.8	18.3
	Total	47.83	57.49
Injuries/ Traffic Accidents	Intentional Injuries	5.97	6.87
	Unintentional Injuries	2.83	3.1
	Traffic Accidents	2.87	2.95
	Total	11.67	12.92

Table 9. Total Disability-Adjusted Life Years (DALYs) for different disease subtypes forecast in IFs in Brazil in 2015 and 2030. Forecasts from IFs v7.31.

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[15] Does not include DALYs from "other non-communicable diseases." This disease category is taken from the World Health Organization Global Burden of Disease project and reflects a residual category of deaths from non-communicable disease that are not easily classified into any traditional communicable disease category. The same applies for "other communicable diseases."

Moreover, as seen in the Current Path scorecard (Table 11) below, the death rate (per thousand) of premature NCDs forecast in IFs is forecast to increase out to 2030, (from 2.35 per thousand to 2.59), suggesting that Brazil will not meet NCD reduction targets as set under the SDGs.

Education

The UN Universal Declaration of Human Rights asserts education as a basic human right; its benefits are well noted as beneficial for social development and change (UN, 1948). A starting point for understanding national education in Brazil is to look at the national education attainment, or the average years of formal education across the population aged 15 or older. Brazil's national average years of education has grown from 2.1 in 1960 to around 6.5 years in 2000, before reaching an estimated 7.9 years in 2015. That means the average Brazilian has attended secondary school. Along the Current Path, average education is expected to reach 9.1 years by 2030, or the regional average education of South American countries today. While higher than India (5.7), average education in Brazil lags behind other BRICS countries: China (8.6), South Africa (8.8), and Russia (11.6). Average educational attainment for OECD countries was 11.3 years in 2015.
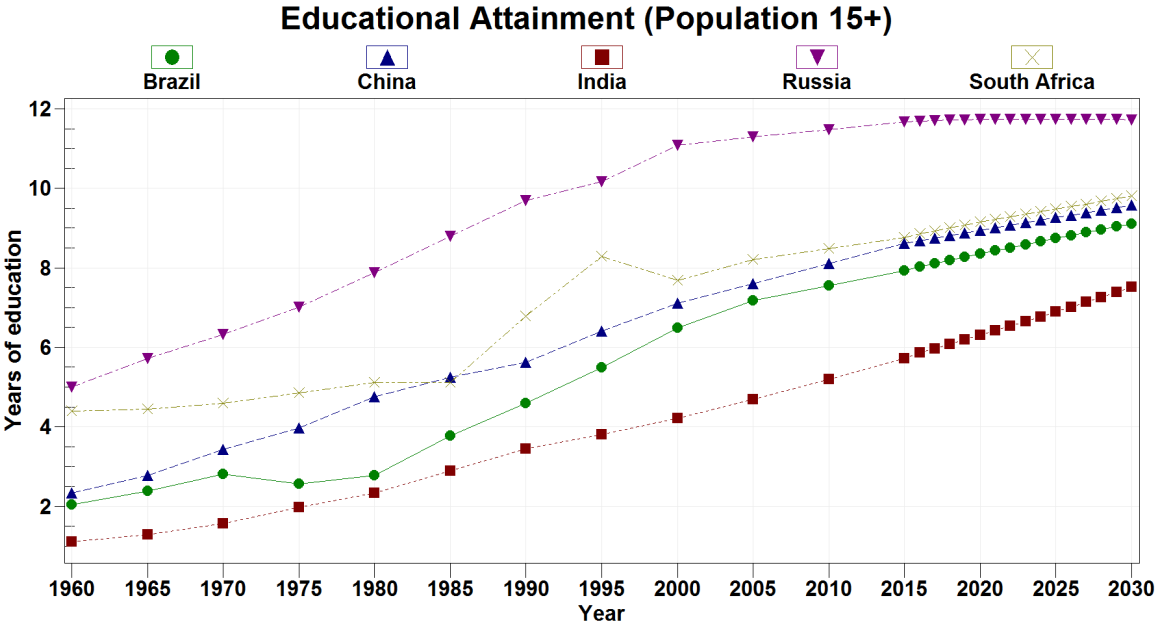
Figure 10. Average education attainment for population aged 15+. Data from Barro & Lee, 2014. Forecasts from IFs v7.31.

Box 10. Forecasting Education in IFs

Condensed from (Dickson, Hughes, & Irfan, 2010).

The IFs model has a well-developed education sub-module which simulates patterns of education participation and attainment for 186 countries to 2100. The education module is closely connected to the demographics module such that the rates of entrance, enrollment and graduation, forecast by the education module, can be multiplied with the number of children in the relevant age group to obtain student headcounts. Student counts are multiplied by per student costs — driven mostly by level of national income — to obtain total educational spending. This allows us to forecast intake rates, enrollment levels, and graduation rates for primary, secondary (lower and upper) and tertiary education by age and sex.

The number of entrants at the primary level is calculated from the intake demand, which is driven by household income and other non-income factors that are applied to the total number of children of that age group. A certain portion of primary level students a portion of those students survive to the final grade, a portion of those graduate, and a portion of those students "transition" from primary to lower secondary school. Separate transition rates exist for lower to upper secondary. Year-to-year progression through the schooling system primary school also accounts for both students who dropout and those who repeat grades. Education progression is also affected by dynamics in other areas of the model, including: demographic change, economic development, spending on public education (constrained by spending in other sectors) and supply and demand factors for education funds.

Education participation rates across time result in a measure of national educational attainment, or the average number of years a student remains in school. The IFs model calculates average years of education for different aggregations of the adult population, commonly defined as the percent of the population aged 15+. Educational attainment data is initialized using data on national educational attainment estimates from Barro and Lee (2015).

Brazil's education system suffers from a number of problems which inhibits human capital development and contribute to a skilled labor shortage, which has been identified in other studies as contributing to Brazil's productivity concerns (World Bank, 2016). The UN HDRO education index ranks Brazil 93 (out of 195 countries ranked) behind Chile (57), Argentina (43), Uruguay (69), South Africa (76), and Russia (44).[16]

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[16] The UN HDRO education index is computed from the mean years of schooling index and the expected years of schooling index. Education index scores are used as an input into the UN HDI index score. The education index is scored from 0 to 1, with a score of 1 indicating perfect attainment.

The 2015 Programme for International Student Assessment (PISA) ranked Brazil near the bottom of the 65 countries surveyed (Ramos, Schleicher, & Carvalhaes, 2015). Challenges in Brazil's education system stem from issues surrounding quality, access and cost, and teacher compensation and resources. (The Guardian, 2015; McLeod-Roberts, 2015). These problems persist despite the fact that Brazil spends a healthy 6 percent of GDP in 2015, up from around 3.5 percent in 2000 (de Morales, 2014). This is higher than Chile (4.8), Uruguay (4.3), and Argentina (5.5), and above every other BRICS country except South Africa.

Issues of quality are compounded by issues of education access. Education is a slow-moving system; it takes many years to enroll and move students through the school system in order to increase attainment. Increasing educational attainment across the population requires interventions to expand access and enable children to remain in school. In IFs, the education system is modeled as a pipeline, where students flow sequentially through each level of education from primary to tertiary. This pipeline is useful for identifying potential bottlenecks in the system.[17]

		Primary Enrollment	Primary Survival Rate	Lower Secondary Enrollment	Lower Secondary Graduation	Upper Secondary Enrollment	Upper Secondary Graduation	Tertiary Enrollment	Tertiary Graduation
2015	Brazil Male	113	86.2	108.4	79.4	85.8	57.5	41.9	19.7
	Brazil Female	109	84.8	109.2	94.3	101.5	77.6	56.7	34.6
	Brazil Total	111.1	85.5	108.8	86.7	93.5	67.3	49.2	27.1
2030	Brazil Male	105	91.4	98.6	83.2	83.6	67.9	44.4	23.2
	Brazil Female	105	92.8	103.2	96.4	95.9	81.2	62.1	38.5
	Brazil Total	105	92.1	100.8	89.6	89.6	74.4	53.1	30.8

Table 10. Education enrolment, survival, and graduation rates for primary, lower secondary, upper secondary, and tertiary education levels in Brazil in 2015 and 2030, rounded to nearest whole percent. Darker colors represent enrollment rates closer to 100 percent and thus a more "positive outcome." Source: Data from Barro-Lee and UNESCO UIS, forecast from IFS v7.31. Note: enrollment rates can exceed 100 percent because this is gross enrollment rate, which accounts for students of all ages entering a given level of education divided by number of age-appropriate children.

[17] Data for education are taken from UNESCO Institute for Statistics. According to UNESCO, official school ages by level of education in Brazil are as follows: primary (ages 6-10), secondary (ages 11-17), and tertiary (ages 18-22).

Notably, female enrollment exceeds males at almost every level. Brazil has been successful in expanding primary enrollment (gross), which was well over 100 percent in 2015. Further down the pipeline Brazil begins to experience some bottlenecks, particularly among males. Gross enrollment exceeds 100 percent but only 79 percent of males graduate from lower secondary, as compared with 84 percent of males across South America. Female lower secondary graduation rates in Brazil are on par with regional averages. An estimated 85 percent of age-appropriate males enroll in upper secondary education, but only 58 percent graduate. Female rates are higher than males, but a similar drop-off between enrollment and graduation at the upper secondary level is evident. In comparison, upper secondary average graduation rate across South America in 2015 was 65 percent for males and 77 percent for females. Lower and upper secondary male graduation rates are forecast to lag behind regional averages out to 2030 (88 percent for lower secondary and 73 percent for upper secondary).

The bottleneck tightens at the tertiary level, where less than half of males who enroll in tertiary education graduate. Around 60 percent of females who enrolled in tertiary education graduated in 2015. Brazil's tertiary graduation rate for both males and females exceeded regional averages (17.7) in 2015, and is in line with average graduation rates of other upper-middle income countries. By 2030 Brazil's tertiary graduation rate is forecast to be 30.8 percent, roughly 11 percentage points below the OECD average in 2015 (41.7 percent). Along the Current Path, Brazil is not forecast to reach SDG targets associated with lower secondary graduation, or upper secondary enrollment or graduation.

Brazil 2015 Scorecard and 2030 Current Path

Table 11 below lays out Brazil's 2015 scores along select SDG indicators and 2030 values along the Current Path. It is designed to provide an overview of Brazil's progress to date and establishes progress towards meeting the SDGs. Many of these Current Path indicators helped to inform the construction of the scenarios used in this report. Forecast values come from IFs. Indicators with most recent data or estimate only are not forecast in IFs or do not map to forecasted variables, but are provided to give a more complete picture of Brazil's status. Where available, the 2030 SDG target value is provided.

	SDG Goal and indicator(s) Description	Most Recent Data or IFs Estimate	Current Path 2030	SDG 2030 Target Value (UN)
Goal 1. End poverty in all its forms everywhere				
	Percentage of population below $3.10 (2011$ PPP) per day; Lognormal	8.8	7.6	3
	Percent of the population living on less than $1.90 (2011 USD) per day	4.5	3.9	3

Proportion of population living below the national poverty line; by sex and age; Total	7.4		

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Percentage of undernourished population	1.5	1.3	3
Proportion of the rural population that has experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	0.3		
Proportion of the urban population that has experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	0.3		
Proportion of the population that has experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	0.3		
Percentage of malnutrition (weight for height <-2 SD) among children under 5	2.2	2.1	3

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Infant mortality rate (within first year of birth) in deaths per thousand newborns	14.5	9.2	12
Under-5 mortality rate	16.4	9.6	25
Maternal mortality ratio	110		70
Cardiovascular disease death rate per thousand (premature)	0.80	0.83	0.53
Cancer death rate per thousand (premature)	0.68	0.78	0.45
Digestive Disease Death Rate per thousand (premature)	0.24	0.28	0.16
Respiratory disease death rate per thousand (premature)	0.14	0.17	0.09

Diabetes death rate per thousand (premature)	0.14	0.19	0.09
Mental health death rate per thousand (premature)	0.05	0.06	0.03
Other non-communicable disease death rate per thousand (premature)	0.29	0.29	0.19

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Primary education net enrollment rate - Total	94.4	97.6	97
Primary education gross enrollment rate - Total	111.1	105.1	100
Primary education gross completion rate - Total	104.4	102.5	100
Lower secondary education gross enrollment rate - Total	108.8	100.9	100
Lower secondary education graduation rate - Total	86.7	89.7	97
Upper secondary education gross enrollment rate - Total	93.5	89.7	97
Upper secondary education graduation rate - Total	67.3	74.6	97
Vocation as % of enrollment in all programs for upper secondary education – Total	8.4	8.4	

Goal 5. Achieve gender equality and empower all women and girls

The proportion of females in the total number of persons employed in managerial positions	37.4		
Proportion of women aged 20-24 years who were married or in a union before age 18	35.6		
Percentage of seats held by women in national parliaments	9		

Goal 6. Ensure availability and sustainable management of water and sanitation for all

Percentage of people with access to safe water	98.1	99.4	97
Percentage of people with access to sanitation services – Improved	82.8	85.5	97
Percentage of people connected to wastewater collection system	53.4	64	97

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Percentage of population with access to electricity - Total	100	100	97
Renewable energy as percentage of total final energy consumption	15.8	21.7	

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Annual growth rate of real GDP per capita	-4.6	1.3	
Percentage of the total labor force that is 15 years old and over and unemployed	8.5		
Percentage of the total labor force that is 15 to 24 years old and unemployed	20		
Proportion of youth not in education; employment or training (NEET); as a percentage of the total youth population	19.3		

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Percentage of informal employment (non-agricultural)	42	28.8	
Manufacturing value-added as % of GDP	19.2	19.1	
Percentage of rural people living within two km of an all-weather road	56.9	59.9	
Connections per hundred people to fixed broadband technology	12.1	28.9	

Goal 10. Reduce inequality within and among countries				
	Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population	6.1		
	Labour share of GDP; comprising wages and social protection transfers as percentage of GDP	85.1	86.5	
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss				
	Proportion of important sites for freshwater biodiversity that are covered by protected areas	15.6		
	Proportion of important sites for terrestrial biodiversity that are covered by protected areas	47.4		
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels				
	Years of life lost to intentional injuries per thousand	19.2	20.4	
Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				
	Total government revenue as % of GDP	32.9	41.5	
	Social security and welfare taxes as % of GDP	10.3	12.7	

Table 11. SDG evaluation for selected SDG indicators for Brazil in 2015 and forecast (2030) in the IFs Current Path scenario. Indicators that are not forecast in the IFs model are left blank in 2030. Indicators without defined targets are also left blank. For indicators with absolute targets (poverty below 3 percent) the value itself is included. For indicators with relative targets, (reduce premature noncommunicable deaths by one third) the calculated value is included.

Scenarios

We developed 4 scenarios to explore potential pathways for achieving the SDGs in Brazil. Each scenario represents an intervention lasting the duration of the SDG time horizon (2017 to 2030). These scenarios simulate a series of policy packages and are intended to frame the uncertainty around potential paths of development for Brazil within the context of achieving SDG targets. The scenarios are described below and then the relative impacts of each scenario on select indicator targets in Brazil are shown in Table 12. The scenario design builds on and is informed by the trends analysis in the preceding section. More

broadly, these scenarios can be thought of as possible development narratives for Brazil. The first, Investing in Human Capabilities, reflects continued investment in human development coupled with continued social spending and welfare transfers. The second, Improving Governance, focuses on government effectiveness and corruption. The third, Trade and investment, simulates a neoclassical orientation and emphasis on investment in the economy, FDI, trade openness, and competitiveness.

Box 11. Scenario Analysis with IFs

A scenario is a "coherent, internally consistent, and plausible description of a possible future state of the world" (IPCC, 1994). Scenarios are an important tool for exploring potential future developments of complex systems and environments. IFs scenario analysis is commonly used to provide coherent, alternative stories of the future, help to frame long-term uncertainty, and allow detailed exploration of possible tradeoffs across different alternative futures (Hughes, 2005).

In the context of this report, scenarios are used to elaborate plausible future pathways of Brazil's development informed by the trends analysis in the preceding sections. The scenarios help to frame possible outcomes of distinct development pathways on specific SDG indicators as well as some of the policy choices facing Brazil today.

Scenario 1: Investing in Human Capabilities (Human Capabilities)

This scenario models a push on infrastructure spending to boost access and infrastructure quality. These interventions include holding infrastructure spending relatively constant, rather than the decline in spending (from around 2.5 percent to 2 percent) in the Current Path. Keeping in mind the focus on human capabilities, this scenario also reduces mortality rates, primarily from non-communicable disease. In this scenario there are also improvements in education spending (as a percent of GDP), though at much slower rate than was seen during the early to mid-2000s. This is in contrast to the Current Path where education spending declines from around 6.1 percent to just over 5 percent by 2030. Additionally, this scenario maintains government welfare spending (transfers) at current levels rather than the forecasted decline (from 13 to 12 percent of GDP) seen in the Current Path. Consistent with the narrative of a need to spend "smart" rather than spend "more" on infrastructure in Latin America and Brazil, IFs automatically dispenses spending increases to areas of need, rather than "doubling down" on inefficient programs or sectors.

Scenario 2: Improving Governance

This scenario models policies designed to improve governance in Brazil. This includes: a reduction in corruption, improvements in governance effectiveness, and social and economic inclusivity, with attention paid to gender empowerment. The scenario does not offer specific policy suggestions on how

Brazil should improve its governance, but explores the potential long-term impact of improving governance across different areas of human development.

In this scenario Brazil's Government Effectiveness score (based on Worldwide Governance Indicators index of the same name measured by the World Bank) increases from 2.4 in 2015 to 3.7 in 2030. This level of growth is similar to Georgia's accomplishments during the Rose Revolution in 2005 and brings Brazil up to the levels of Chile today (3.6). This scenario also incorporates similar improvements in governance transparency (initialized from the Corruption Perceptions Index from Transparency International), raising Brazil's score from 3.8 to 5.6 by 2030. This improvement makes Brazil the third most transparent country in South America behind Chile (7.2) and Uruguay (7.0). This scenario also improves gender inclusion, bringing Brazil's GEM up to 0.7 by 2030 (in line with Argentina, the highest in the region). Finally, Brazil's economic freedom score is improved from 6.3 in 2015 to 8 in 2030, gains on par with those achieved by Brazil between the mid-1980s and early 2000s following the transition away from the military regime. These scenario improvements also bring Brazil in line with that of Chile today (7.9). Forecasts of economic freedom are initialized from the economic freedom index from the Fraser Institute and includes measures such as: government size, legal structure, property rights, access to credit and sound money, freedom to trade, and regulation of credit, labor and business (Fraser Institute, 2017).

Scenario 3: Trade and Investment

This scenario models a neoclassical set of economic policies to address the productivity malaise in Brazil. It includes policies that result in an opening of the Brazilian economy to trade, including significant growth in both exports and imports as a percent of GDP. Despite these improvements, Brazil still retains one of the lowest total trade rates in the Western Hemisphere by 2030. This scenario increases FDI inflows into the economy, keeping them at around 5 percent of GDP, consistent with trends from the mid-2000s to today. This is in contrast to a Current Path forecast of FDI amounting to around 3.5 percent of GDP. This scenario also simulates growth in domestic private sector investment in the economy. Together these policies are meant to simulate a concerted effort by the government to address Brazil's longstanding productivity challenges by opening the economy and reducing barriers to trade, stimulating continued foreign direct investment, and catalyzing investment and innovation among domestic firms so that they are capable of competing globally. As with the other scenarios in this report, this scenario does not offer policy prescriptions on how stimulate, trade, FDI, and growth, rather it explores possible outcomes of doing so.

Scenario 4: An Integrated Push

This scenario would combine elements of the scenarios described above and model an "integrated push" for Brazil. This scenario combines the package of interventions in the above three scenarios to model the effects of an integrated policy push for development in Brazil. This scenario allows us to analyze the effects of an integrated approach over a specific sector focus.

2030 Scenario Results Summary

The table below shows how Brazil performs on selected SDG indicators under the Current Path and each of the scenarios. There is a more extensive table in Appendix A which contains a more complete list of SDG indicators whether a perfect match or not with variables in IFs.

SDG Goal or Indicator Description	Data and Current Path Scenario		Alternative Scenarios			
	Most Recent Data or Estimate	Current Path 2030	Human Capabilities 2030	Governance 2030	Trade & Investment 2030	Integrated Push 2030
Goal 1. End poverty in all its forms everywhere						
Percent of population below $3.10 (2011$ PPP) per day; Lognormal	8.80	7.60	5.60	6.80	8.12	5.09
Percent of the population living on less than $1.90 (2011 USD) per day	4.50	3.90	2.60	3.42	4.18	2.36
Transfers as % of total government expenditures	49.12	55.40	58.28	55.21	55.28	57.86
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture						
Percentage of undernourished population	1.50	1.27	1.23	1.22	1.22	1.12
Percentage of malnutrition (weight for height <-2 SD) among children under 5	2.20	2.13	1.65	2.10	2.10	1.61
Goal 3. Ensure healthy lives and promote well-being for all at all ages						
Infant mortality rate (deaths per thousand, within first year of life)	14.51	9.18	8.02	8.79	8.79	7.18

Cardiovascular disease death rate per thousand	0.80	0.83	0.73	0.82	0.82	0.71
Digestive death rate per thousand	0.35	0.47	0.25	0.26	0.26	0.22
Cancer death rate per thousand	0.68	0.78	0.74	0.78	0.78	0.73
Respiratory disease death rate per thousand	0.14	0.17	0.16	0.17	0.17	0.15
Diabetes death rate per thousand	0.14	0.19	0.18	0.18	0.18	0.17
Mental health death rate per thousand	0.05	0.06	0.06	0.06	0.06	0.06
Other non-communicable disease death rates per thousand	0.29	0.29	0.25	0.28	0.28	0.23
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all						
Primary education net enrollment rate - Total	94.42	97.61	97.91	97.84	97.83	98.46
Primary education gross enrollment rate - Total	111.10	105.10	104.90	105.00	105.10	104.70
Primary education gross completion rate - Total	104.40	102.50	103.20	103.20	103.20	104.70
Lower secondary education gross enrollment rate - Total	108.80	100.90	102.00	101.80	101.70	104.00
Lower secondary education graduation rate - Total	86.71	89.68	91.16	91.27	91.25	95.00
Upper secondary education gross enrollment rate - Total	93.51	89.75	95.63	90.98	90.92	97.83
Upper secondary education graduation rate - Total	67.34	74.57	91.09	76.47	76.40	96.16
Tertiary graduation rate- Total	27.06	31.48	60.60	33.87	33.40	65.74

Vocation as % of enrollment in all programs for upper secondary education – Total	8.40	8.40	8.40	8.40	8.40	8.40

Goal 6. Ensure availability and sustainable management of water and sanitation for all

Percentage of people with access to safe water	98.12	99.42	100.00	99.59	99.58	100.00
Percentage of people with access to sanitation services - Improved	82.78	85.49	99.93	85.81	85.76	99.98
Percentage of people connected to wastewater collection system	53.40	64.03	67.85	64.14	64.13	68.65

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Annual growth rate of real GDP per capita	-4.59	1.32	2.02	2.73	2.75	5.07

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Percentage of informal employment (non-agricultural)	42.21	28.02	22.64	27.15	27.09	20.48
Manufacturing Value-add (% of GDP)	19.24	19.13	19.27	19.47	21.55	22.25
Percentage of rural people living within two km of an all-weather road	56.86	59.99	66.32	60.70	60.69	67.03
Connections per hundred people to fixed broadband technology	12.14	28.87	49.27	29.32	29.20	49.91

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Years of life lost to intentional injuries per thousand	19.24	20.43	16.00	20.17	20.17	15.50

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Total government revenue as % of GDP	32.97	41.47	43.08	41.56	41.09	43.05
Social security and welfare taxes as % of GDP	10.31	12.68	13.18	12.72	12.57	13.21

Table 12. Effects of alternative scenarios on selected SDG indicators in 2030 for Brazil. Darker coloring represents a more "positive" outcome. Coloring scheme compares scenario outcomes and the Current Path for each indicator individually.

Discussion and Conclusion

The scenario results underscore the argument that there is no silver bullet for development; measuring impact depends on the definitions used and outcomes desired to achieve said "development." Among the sector-specific scenarios, Human Capabilities has some of the strongest impacts on human development indicators. Under 5 mortality falls to 8.4 per thousand compared with 9.6 in the Current Path. Deaths from premature non-communicable diseases decline, with an estimated 43,000 fewer deaths in 2030 relative to the Current Path. Life expectancy increases from 77.6 to 79.1 years in 2030. Secondary and tertiary graduation rates improve, and average education (population 15+) grows from 9.1 to 9.5 years by 2030. Safe water and sanitation rates nearly reach 100 percent.

Human Capabilities has implications for Brazil's long-term demographic composition and associated spending requirements. The population aged 65+ grows from 13.5 percent (30.6 million people 65+) in the Current Path to 13.7 percent (31.1 million people 65+) in 2030. The labor force declines by an estimated 200,000 people in 2030.

The Improved Governance scenario leads to some of the largest boosts to GDP and GDP per capita by 2030. This comes as a result of interventions designed to improve governance effectiveness, reduce corruption, and create a more transparent, and open economic environment. The Governance scenario generates sizeable returns to growth and productivity for two main reasons. First, corruption and governance issues are some of Brazil's most current challenges, accelerating progress along these dimensions pays big dividends. Secondly, strengthening governance translate to more immediate impacts on growth than similar interventions explored under the Resilience scenario. Whereas infrastructure, health, and education interventions take time to mature and impact productivity, the effects of reducing corruption, increasing transparency, and leveling the economic playing field translate quickly into a more inclusive and open society. Government revenues increase from $1.34 billion to $1.49 billion relative to the Current Path. Under Improved Governance, by 2030 Brazilian per capita (PPP) reaches an estimated 17,300 thousand USD, as compared with 16,030 thousand in the Current Path. Brazil's GDP is roughly 10 percent larger, reaching $3.58 trillion in 2030 as compared with $3.24

trillion in the Current Path. GDP growth rates in 2030 double from 1.3 percent in the Current Path to 2.7 percent.

Trade and Investment scenario also produces important positive outcomes. Total trade as a percent of GDP reaches 43.9 percent by 2030, as compared with 28.9 percent in the Current Path, FDI inflows are up to 5.5 percent (as percent of GDP), compared with 3.5 percent in the Current Path. These inputs translate into an economy that is roughly 10.4 percent larger than the Current Path.

In a possible future where Brazil's economic goals are focused on trade and investment, the economy will grow relative to the Current Path, but poverty would also increase. Under the Trade and Investment scenario poverty (people living on less than $3.10 per day) increases from 17.2 million to 18.4 million in 2030. The same year, an estimated 678,000 more people are living on less than $1.90 per day. This is important insight into the tradeoffs underlying these scenarios. Human Capabilities reduces poverty significantly because of its focus on human capital and access to infrastructure. Improving Governance reduces corruption, improves effectiveness, and promotes a more transparent and inclusive society that results in poverty reductions, though not quite on the level of those in Human Capabilities. Trade, Growth, and FDI follows a more neoclassical prescription, opening the economy to trade, increasing FDI, and boosting domestic investment as companies seek to compete and innovate with fewer trade barriers in place. This stimulates growth and boosts economic outcomes like GDP and GDP per capita, but it comes at a cost as there is less direct emphasis on distribution and social protection. Greater domestic investment means less economic activity coming from household consumption, which falls, resulting in increasing poverty. Thus economic growth is occurring, but under this scenario there is a greater focus on competition and productivity and less on social spending and protection. Extending the horizon suggests that the economic growth seen in this scenario will reduce poverty over the longer-term. By 2050, an estimated 15.2 million people in Brazil live on less than $3.10 per day, compared with around 17 million in the Current Path.

Along many of the forecasted indicators, including education, GDP, and life expectancy, the Integrated Push scenario generates the strongest impacts, suggesting that an integrated policy package is greater than the sum of sector-specific interventions. The integrated scenario leads to the greatest reduction in poverty. In that scenario, poverty (millions of people living on less than $3.10 per day) falls from 18 million in 2015 to 11.6 million in 2030, compared with close to 17.2 million along the Current Path, a 32 percent decline. Brazil's GDP reaches close to $4.21 trillion in 2030, compared with $3.2 trillion along the Current Path. GDP per capita reaches close to $20,100 under this scenario, compared with $16,000. Under the next highest scenario (Improving Governance and Trade and Investment), GDP reaches approximately $17,300. The Integrated Push scenario sets the country on a path towards productive and sustainable growth. Figure 9 shows Brazil's forecasted rates of economic convergence with U.S. GDP per capita (see figure and explanation on page 19 and 20) along the Current Path and the four scenarios out to 2050. Along the Current Path, Brazil's GDP per capita is forecast to remain around 25 percent of the U.S., and even decline by 2050. The Integrated Push clearly reverses that trend, pushing Brazil's GDP per capita to around $35,000 by 2050, approximately 48 percent of U.S. level.

Economic Convergence
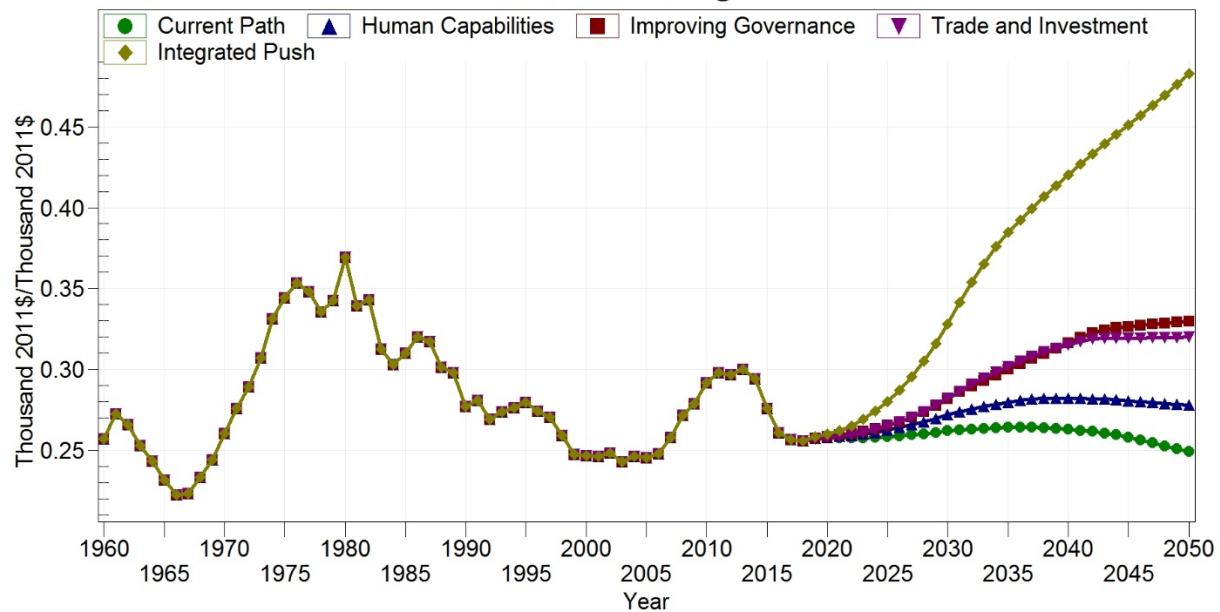
Figure 11. Convergence with US GDP per capita (2011$ at PPP) for Brazil along Current Path and scenarios from 1960 to 2050. Data from World Development Indicators. Forecast from IFs v7.31

While there are overall benefits to an Integrated Push, internal tradeoffs remain. For example, if we add up the difference in poverty (in millions) across each individual scenario relative to the Current Path, it totals a reduction of around 6.1 million people in 2030. The Integrated Push scenario reduces poverty by 5.6 million relative the Current Path in 2030. Other tradeoffs remain. All scenarios are forecast to increase carbon emissions relative to the Current Path by 2030. The Integrated Push increases emissions by 26 million tons in 2030, a 16 percent increase relative to the Current Path. Both the Human Capabilities and Integrated Push improve human development and wellbeing across the horizon, with implications for population demographics, aging, and the ability of government resources to meet elderly spending requirements.

This report has sought to unpack Brazil's development trends and illuminate policy tradeoffs in the context of progress towards the SDGs. It is also important to acknowledge the limitations of the IFs modeling effort and suggest areas of further potential research. The analysis has largely focused on a subset of SDG indicators for which there are comparable or identical forecast variables in IFs. While IFs forecasts hundreds of variables, it was not designed specifically for the SDGs. Important sectors of Brazil's development trajectory in IFs, like energy and agriculture, are not included in this report because IFs forecast variables in these sectors do not easily overlap with SDG targets in this area. Yet because IFs is integrated, Current Path trends in energy and agriculture are implicitly tied to the results of the analysis.

Brazil has made significant improvements in education, health, and infrastructure over the past two decades and achieved many of the targets set out under the MDGs. Brazil's ability to meet SDG targets will happen in an increasingly complicated operating environment. The ongoing recession and political situation puts Brazil today at a key moment in its history. The country is facing strong development headwinds in the form of flagging productivity, an aging population, and dilapidated infrastructure, all of which are complicated by the current political situation. These factors will complicate Brazil's progress towards the SDGs and achievement of Brazil's SDGs targets will be shaped by policy choices made today.

Annex 1: Table of SDGs forecasted in IFs under 3 scenarios

The table below shows all the variables in IFs that align with SDG indicators as well as all of the SDG indicators for which we have data for Brazil. Many are not directly relevant to the analysis above, so they've been left out of the body of the report.

SDG Goal and Indicator description	Data or Current Path Estimate		Alternative Scenarios			
	2015 or Most Recent Data estimate	Current Path 2030	Human Capabilities 2030	Governance 2030	Trade & Investment 2030	Integrated Push 2030
Goal 1. End poverty in all its forms everywhere						
Percentage of population below $1.25 (2005$ PPP) per day; Lognormal	4.284	3.694	2.479	3.248	3.978	2.221
Percentage of population below $1.90 (2011$ PPP) per day; Lognormal	4.506	3.885	2.624	3.42	4.183	2.355
Percentage of females 15 and older living on less than $1.90 a day at 2011 international prices	2.02					
Percentage of males 15 and older living on less than $1.90 a day at 2011 international prices	2.35					
Percentage of people 15 and older living on less than $1.90 a day at 2011 international prices	2.21					
Percentage of female 15 to 24 year olds living on less than $1.90 a day at 2011 international prices	1.99					
Percentage of male 15 to 24 year olds living on less than $1.90 a day at 2011 international prices	3.07					
Percentage of all 15 to 24 year olds living on less than $1.90 a day at 2011 international prices	2.64					
Percentage of females 25 and older living on less than $1.90 a day at 2011 international prices	2.03					
Percentage of males 25 and older living on less than $1.90 a day at 2011 international prices	2.2					
Percentage of people 25 and older living on less than $1.90 a day at 2011 international prices	2.13					
Percentage of population below $2 (2005$ PPP) per day; Lognormal	8.713	7.542	5.526	6.743	8.083	5.067

Percentage of population below $3.10 (2011$ PPP) per day; Lognormal	8.753	7.577	5.555	6.776	8.12	5.094
Proportion of population living below the national poverty line; by sex and age; Rural						
Proportion of population living below the national poverty line; by sex and age; Urban						
Proportion of population living below the national poverty line; by sex and age; Total	7.4					
Transfers as % of total government expenditures	49.12	55.42	58.28	55.2	55.28	57.86
Transfers as % of GDP	19.23	22.19	24.73	22.44	22.34	25.15
Transfers in Billion $	510.6	719.1	850	803	799.6	1058
Percentage of total government spending on essential services (education; health)	25.12	23.39	24.34	23.42	23.43	24.54
Government spending on essential services (education; health) as % of GDP	9.83	9.366	10.32	9.52	9.468	10.67
Government spending on essential services (education; health) in Billion $	261.1	303.5	354.9	340.7	338.9	448.9
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture						
Percentage of undernourished population	1.5	1.27	1.226	1.221	1.218	1.116
Proportion of the female population that has experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	8.54					
Proportion of the male population that has experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	8.54					
Proportion of the female population that has experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	0.29					
Proportion of the male population that has experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	0.29					
Proportion of the rural population that has experienced severe food insecurity in the last year as	0.29					

measured on the Food Insecurity Experience Scale						
Proportion of the urban population that has experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	0.29					
Proportion of the population that has experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	0.29					
Number of females who have experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	240.02					
Number of males who have experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	227.19					
Number of people in rural areas who have experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	85.13					
Number of people in urban areas who have experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	509.62					
Number of people who have experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	467.38					
Proportion of the rural population that has experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	8.54					
Proportion of the urban population that has experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	8.54					
Proportion of the population that has experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	8.54					

Number of people who have experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	13669.51					
Number of people living in households where at least one adult experienced severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	678.36					
Number of people living in households where at least one adult experienced moderate or severe food insecurity in the last year as measured on the Food Insecurity Experience Scale	20396.34					
Prevalence of stunting (height for age <-2 SD) among total population	3.237	2.955	2.954	2.955	2.955	2.953
Prevalence of stunting (height for age <-2 SD) in working age population	3.237	2.918	2.916	2.918	2.918	2.915
Prevalence of stunting (height for age <-2 SD) among children under 5	7.1					
Percentage of malnutrition (weight for height <-2 SD) among children under 5	2.2	2.134	1.646	2.102	2.103	1.609
Severe Acute Malnutrition (weight for height <-3 SD) among children under 5	0.4	0.4358	0.4211	0.3173	0.4234	0.2862
Percentage of land dedicated to crop	10.08	10.49	10.52	10.53	10.54	10.55
Percentage of land dedicated to grazing	23.45	23.15	23.11	23.11	23.11	23.06
Total official flows (official development assistance plus other official flows) to the agriculture sector	141.45					
Goal 3. Ensure healthy lives and promote well-being for all at all ages						
Maternal mortality ratio	110					
Percentage of births attended by skilled health personnel	98.1					
Under-five mortality rate	16.4					
Infant mortality rate in deaths per thousand newborns	14.51	9.18	8.016	8.789	8.79	7.181
Tuberculosis incidence per 100;000 population	41					
Malaria death rate per thousand	0.0003	0.0002	0.0002	0.0002	0.0002	0.0001

Number of people requiring interventions against neglected tropical diseases	11067291					
HIV cases as percentage of population	0.3908	0.4408	0.4408	0.4408	0.4408	0.4408
AIDS death rate as percentage of population	0.0073	0.0046	0.0044	0.0046	0.0046	0.0044
Cardiovascular disease death rate per thousand	1.7	2.293	2.078	2.248	2.248	1.966
Cancer death rate per thousand	1.086	1.427	1.368	1.435	1.435	1.388
Digestive disease death rate per thousand	0.3542	0.4673	0.4333	0.4569	0.4569	0.4093
Respiratory disease death rate per thousand	0.3826	0.632	0.607	0.6258	0.6259	0.592
Diabetes death rate per thousand	0.3077	0.4803	0.46	0.4753	0.4752	0.4475
Mental Health death rate per thousand	0.0553	0.0658	0.0627	0.0658	0.0658	0.0627
Other Non Communicable disease death rate per thousand	0.5844	0.857	0.7781	0.844	0.8438	0.748
Harmful use of alcohol; defined according to the national context as alcohol per capita consumption (aged 15 years and older) within a calendar year in liters of pure alcohol	8.9					
Road traffic injuries death rate per thousand	0.228	0.2354	0.226	0.2395	0.2395	0.2318
Contraception use as percentage of fertile women	80.3	86.81	87.58	88.3	88.32	91.41
Crude death rate attributed to ambient air pollution	12.96					
Crude death rate attributed to household air pollution	9.03					
Smoking Rate- Total	16.15	16.51	16.56	16.61	16.61	16.83
Gross disbursements of total ODA from all donors to medical research and basic health sectors	2.29					
Net disbursements of total ODA from all donors to medical research and basic health sectors	1.03					
Number of dentists; dental technician/assistants and related occupation personnel per 1;000 population	1.22					
Number of nursing and midwifery personnel per 1;000 population	7.44					
Number of pharmacists; pharmaceutical technicians/assistants and related occupation personnel per 1;000 population	0.72					

Number of physicians; including generalists and specialist medical practitioners per 1;000 population	1.85					
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all						
Primary education net enrollment rate - Total	94.42	97.61	97.91	97.84	97.83	98.46
Primary education gross enrollment rate - Total	111.1	105.1	104.9	105	105.1	104.7
Primary education gross completion rate - Total	104.4	102.5	103.2	103.2	103.2	104.7
Lower secondary education gross enrollment rate - Total	108.8	100.9	102	101.8	101.7	104
Lower secondary education graduation rate - Total	86.71	89.68	91.16	91.27	91.25	95
Upper secondary education gross enrollment rate - Total	93.51	89.75	95.63	90.98	90.92	97.83
Upper secondary education graduation rate - Total	67.34	74.57	91.09	76.47	76.4	96.16
Percentage of female pre-primary children who participate in one or more organized learning programme; including programmes which offer a combination of education and care	91.59					
Percentage of male pre-primary children who participate in one or more organized learning programme; including programmes which offer a combination of education and care	93.76					
Percentage of all pre-primary children who participate in one or more organized learning programme; including programmes which offer a combination of education and care	92.68					
Vocation as % of enrollment in all programs for lower secondary education - Total	0.4126	0.4111	0.4111	0.4111	0.4111	0.4111
Vocation as % of enrollment in all programs for upper secondary education - Total	8.416	8.415	8.414	8.415	8.415	8.414
Primary education net enrollment rate parity index (female/male)	0.9523	0.9932	0.9943	0.994	0.994	0.9962
Primary education gross enrollment rate parity index (female/male)	0.9642	0.9963	0.9967	0.9966	0.9966	0.9975
Primary education gross completion rate parity index (female/male)	1.006	1.037	1.037	1.037	1.037	1.035
Lower secondary education gross enrollment rate parity index (female/male)	1.008	1.047	1.043	1.044	1.044	1.037

Lower secondary education graduation rate parity index (female/male)	1.189	1.157	1.144	1.153	1.154	1.136
Upper secondary education gross enrollment rate parity index (female/male)	1.184	1.147	1.129	1.146	1.146	1.115
Upper secondary education graduation rate parity index (female/male)	1.35	1.194	1.178	1.191	1.192	1.172
Years of education obtained by population 15+ parity index (female/male)	1.047	1.05	1.047	1.05	1.05	1.044
Years of education obtained by population 25+ parity index (female/male)	1.062	1.07	1.067	1.071	1.071	1.065
Ratio of girls' to boys' proficiency in functional literacy skills						
Ratio of girls' to boys' proficiency in functional numeracy skills						
Ratio of students from low to high socio-economic groups' proficiency in functional literacy skills						
Ratio of students from low to high socio-economic groups' proficiency in functional numeracy skills						
Ratio of girls' to boys' participation in organized learning in the year before primary school	0.98					
Ratio of female to male teachers in pre-primary education who are trained						
Ratio of girls' to boys' mathematics achievement in grades 2 & 3	1.14					
Ratio of girls' to boys' reading achievement in grades 2 & 3	1.21					
Ratio of rural to urban students' mathematics achievement in grades 2 & 3	1.47					
Ratio of rural to urban students' reading achievement in grades 2 & 3	0.83					
Ratio of students from low to high socio-economic groups' mathematics achievement in grades 2 & 3	0.44					
Ratio of students from low to high socio-economic groups' achievement in reading in grades 2 & 3	0.54					
Ratio of girls' to boys' mathematics achievement by the end of primary	0.91					

Ratio of girls' to boys' reading achievement by the end of primary	1.07					
Ratio of rural to urban students' mathematics achievement by the end of lower secondary						
Ratio of rural to urban students' reading achievement by the end of lower secondary						
Ratio of students from low to high socio-economic groups' achievement in mathematics by the end of lower secondary						
Ratio of students from low to high socio-economic groups' achievement in reading by the end of lower secondary						
Ratio of female to male teachers in upper secondary education who are trained						
Ratio of female to male teachers in primary education who are trained						
Ratio of rural to urban students' mathematics achievement by the end of primary	0.67					
Ratio of rural to urban students' reading achievement by the end of primary	0.89					
Ratio of students from low to high socio-economic groups' achievement in mathematics by the end of primary	0.51					
Ratio of students from low to high socio-economic groups' achievement in reading by the end of primary	0.79					
Ratio of girls' to boys' mathematics achievement by the end of lower secondary						
Ratio of girls' to boys' reading achievement by the end of lower secondary						
Ratio of female to male teachers in lower secondary who are trained						
Gross disbursements of total ODA from all donors for scholarships	13.77					
Percentage of female pre-primary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						

Percentage of male pre-primary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of all pre-primary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of female primary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of male primary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of all primary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of female lower secondary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of male lower secondary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of all lower secondary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of female upper secondary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Percentage of male upper secondary teachers who have received at least the minimum organized pedagogical training						

required by the country to teach at that level						
Percentage of all upper secondary teachers who have received at least the minimum organized pedagogical training required by the country to teach at that level						
Goal 5. Achieve gender equality and empower all women and girls						
Percentage of ever-partnered women and girls aged 15-19 years who have experienced physical; sexual or psychological violence by a current or former intimate partner; in the previous 12 months						
Percentage of ever-partnered women and girls aged 15-49 years who have experienced physical; sexual or psychological violence by a current or former intimate partner; in the previous 12 months						
Percentage of ever-partnered women and girls aged 20-24 years who have experienced physical; sexual or psychological violence by a current or former intimate partner; in the previous 12 months						
Percentage of ever-partnered women and girls aged 25-29 years and older who have experienced physical; sexual or psychological violence by a current or former intimate partner; in the previous 12 months						
Percentage of ever-partnered women and girls aged 30-34 years who have experienced physical; sexual or psychological violence by a current or former intimate partner; in the previous 12 months						
Percentage of ever-partnered women and girls aged 35-39 years and older who have experienced physical; sexual or psychological violence by a current or former intimate partner; in the previous 12 months						
Percentage of ever-partnered women and girls aged 40-44 years who have experienced physical; sexual or psychological violence by						

a current or former intimate partner; in the previous 12 months						
Percentage of ever-partnered women and girls aged 45-49 years who have experienced physical; sexual or psychological violence by a current or former intimate partner; in the previous 12 months						
The proportion of girls and women aged 15-49 years who have undergone female genital mutilation/cutting						
Proportion of women aged 20-24 years who were married or in a union before age 15	10.5					
Proportion of women aged 20-24 years who were married or in a union before age 18	35.6					
Average time women spend on household provision of care services (e.g. childcare and care of sick; elderly; or disabled household members)	2.71					
Average time men spend on household provision of care services (e.g. childcare and care of sick; elderly; or disabled household members)	0.83					
Average time women spend on provision of services for household consumption (e.g. food preparation; dishwashing; cleaning; childcare; and care of sick or elderly household members)	13.33					
Average time men spend on provision of services for household consumption (e.g. food preparation; dishwashing; cleaning; childcare; and care of sick or elderly household members)	3.13					
Average time women spend on provision of non-care-related services for household consumption (e.g. food preparation; dishwashing; cleaning; and shopping)	14.93					
Average time men spend on provision of non-care-related services for household consumption (e.g. food preparation; dishwashing; cleaning; and shopping)	5.14					

Indicator						
Percentage of seats held by women in national parliaments	9					
The proportion of females in the total number of persons employed in senior and middle management positions						
The proportion of females in the total number of persons employed in managerial positions	37.4					
Proportion of women aged 15-49 years (married or in union) who make their own decisions on sexual relations; use of contraception; and reproductive healthcare						
The proportion of females who own a mobile telephone						
The proportion of males who own a mobile telephone						
The proportion of individuals who own a mobile telephone						
Goal 6. Ensure availability and sustainable management of water and sanitation for all						
Percentage of people with access to safe water	98.12	99.42	100	99.59	99.58	100
Percentage of people with access to improved sanitation	82.78	85.49	99.93	85.81	85.76	99.98
Percentage of people connected to wastewater collection system	53.4	64.03	67.85	64.14	64.13	68.65
Percentage of people connected to wastewater treatment system	26	43.71	67.85	44.79	44.76	68.65
Level of water stress: freshwater withdrawal as a percentage of available freshwater resources	2.179	2.28	2.323	2.321	2.34	2.438
Amount of water and sanitation-related official development assistance that is part of a government coordinated spending plan	99.38					
Countries with clearly defined procedures in law or policy for participation by service users/communities in planning program in drinking-water supply (Rural)	1					
Countries with clearly defined procedures in law or policy for participation by service users/communities in planning program in drinking-water supply (Urban)	1					

The level of rural users/communities participating in planning programs in drinking water supply	2					
The level of urban users/communities participating in planning programs in drinking water supply	2					
The level of all users/communities participating in planning programs in hygiene promotion	2					
Countries with clearly defined procedures in law or policy for participation by service users/communities in planning program in sanitation (Rural)	1					
Countries with clearly defined procedures in law or policy for participation by service users/communities in planning program in sanitation (Urban)	1					
The level of rural users/communities participating in planning programs in sanitation	2					
The level of urban users/communities participating in planning programs in sanitation	2					
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all						
Percentage of population with access to electricity - Total	99.81	99.51	100	99.6	99.56	100
Percentage of population with primary reliance on clean fuels and technology	93.14					
Renewable energy as percentage of total final energy consumption	15.75	21.72	21.27	20.99	21.07	19.55
Energy intensity measured in terms of primary energy and GDP	0.0006	0.0007	0.0007	0.0007	0.0007	0.0006
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all						
Annual growth rate of real GDP per capita	-4.588	1.322	2.023	2.733	2.752	5.072
Annual growth rate of real GDP per employed person	-0.0183	0.0077	0.011	0.0139	0.014	0.0245
Annual growth rate of real GDP per employed person conveys the annual percentage change in real Gross Domestic Product per employed person.	-1.17					
Percentage of informal employment (non-agricultural)	42.21	28.02	22.64	27.15	27.09	20.48

Percentage of the female labor force that is 15 years old and over and unemployed	10.1					
Percentage of the female labor force that is 15 to 24 years old and unemployed	21.2					
Percentage of the female labor force that is 25 years old and over and unemployed	6.1					
Percentage of the male labor force that is 15 years old and over and unemployed	7.3					
Percentage of the male labor force that is 15 to 24 years old and unemployed	13.8					
Percentage of the male labor force that is over 25 years old and unemployed	3.3					
Percentage of the total labor force that is 15 years old and over and unemployed	8.5					
Percentage of the total labor force that is 15 to 24 years old and unemployed	20					
Percentage of the total labor force that is 25 years old and over and unemployed	6					
Proportion of youth not in education; employment or training (NEET); as a percentage of the total youth population	19.28					
Proportion of young females not in education; employment or training (NEET); as a percentage of the total youth population	25.4					
Proportion of young males not in education; employment or training (NEET); as a percentage of the total youth population	13.25					
The number of children aged 5-17 years who are reported to have been engaged in child labour in the past week divided by the total number of children aged 5-17 in the population	5.3					
The number of female children aged 5-17 years who are reported to have been engaged in child labour in the past week divided by the total number of children aged 5-17 in the population	2.7					

The number of male children aged 5-17 years who are reported to have been engaged in child labour in the past week divided by the total number of children aged 5-17 in the population	7.8					
The number of children aged 5-17 years who are reported to have been engaged in child labour in the past week divided by the total number of children aged 5-17 in the population	5.3					
The number of female children aged 5-17 years who are reported to have been engaged in child labour in the past week divided by the total number of children aged 5-17 in the population	2.7					
The number of male children aged 5-17 years who are reported to have been engaged in child labour in the past week divided by the total number of children aged 5-17 in the population	7.8					
The frequency rates of fatal occupational injuries among female employees	1.23					
The frequency rates of fatal occupational injuries among male employees	11.85					
The frequency rates of fatal occupational injuries among total employees	7.43					
The frequency rates of non-fatal occupational injuries among female employees	1141.96					
The frequency rates of non-fatal occupational injuries among male employees	1983.71					
The frequency rates of non-fatal occupational injuries among total employees	1609.32					
The percentage of adults (ages 15+) who report having an account (by themselves or together with someone else) at a bank or another type of financial institution or personally using a mobile money service in the past 12 months	74.62					
The number of automated teller machines (ATMs) per 100;000 adults	114					

The number of commercial bank branches per 100;000 adults	20.67					
The gross commitments of total Official Development Assistance (ODA) from all donors for aid for trade						
The gross commitments of total Official Development Assistance (ODA) from all recipients for aid for trade	712.93					
The gross disbursements of total Official Development Assistance (ODA) from all donors for aid for trade	712.93					
The gross disbursements of total Official Development Assistance (ODA) from all recipients for aid for trade	622.16					
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation						
Percentage of rural people living within two km of an all weather road	56.86	59.99	66.32	60.7	60.69	67.03
Rail freights million ton-kilometer	267700					
Rail passenger-kilometers	15877000000					
Air freight	1493.94					
Air transport; passengers carried	102.04					
The volume of mail carried by air transport	83454000					
The sum of the freight volumes reported for the air carriers in terms of metric tonnes of cargo respectively	255629					
The sum of the passenger reported for the air carriers in terms of number of people respectively	1492716					
Manufacturing value added as a % of GDP	19.24	19.13	19.27	19.47	21.55	22.25
Manufacturing value added per capita	248	273.9	291.7	307.8	340.7	412
Manufacturing employment as a percentage of total employment	10.73	10.73	10.73	10.73	10.73	10.73
The share of manufacturing employment in total employment	12.3					
CO2 emissions per unit of value added (tied to energy production) in thousand tons per dollar	0.0517	0.0497	0.0482	0.0472	0.0472	0.0445
Research and development spending as % of GDP	1.16	1.179	1.159	1.231	1.23	1.298
Researchers (in full-time equivalent) per million inhabitants	698.1					
Total official flows for infrastructure; by recipient	2161.71					

Connections per hundred people to fixed broadband technology	12.14	28.87	49.27	29.32	29.2	49.91
Connections per hundred people to mobile broadband technology	79.41	152.6	153.1	153.3	153.3	154
Proportion of population covered by a mobile network; by technology	92.11					
Proportion of population covered by a mobile network; 3g	93.53					
Proportion of population covered by a mobile network; 4g	56.72					
Goal 10. Reduce inequality within and among countries						
Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population	6.14					
Total growth rates of household expenditure or income per capita	4.07					
Labour share of GDP; comprising wages and social protection transfers in billion Dollars	2259	2804	3049	3105	3104	3752
Labour share of GDP; comprising wages and social protection transfers as percentage of GDP	85.07	86.52	88.71	86.77	86.73	89.16
Proportion of developing countries in the membership of the Asian Development Bank						
Proportion of developing countries in the membership of the African Development Bank	1.25					
Proportion of developing countries in the membership of the Bank for reconstruction and development	0.53					
Proportion of developing countries in the membership of the Financial Stability Board	4.17					
Proportion of developing countries in the membership of the Inter-American Development Bank	2.08					
Proportion of developing countries in the membership of the International Finance Corporation	0.54					
Proportion of developing countries in the membership of the International Monetary Fund	0.53					
Proportion of developing countries in the membership of the UN Economic and Social Council	1.85					
Proportion of developing countries in the membership of the UN General Assembly	0.52					

Proportion of developing countries in the membership of the UN Security Council	6.67					
Proportion of developing countries in the membership of the World Trade Organization	0.62					
Proportion of voting rights of developing countries in the Asian Development Bank						
Proportion of voting rights of developing countries in the African Development Bank	0.41					
Proportion of voting rights of developing countries in the Financial Stability Board	5.26					
Proportion of voting rights of developing countries in the Inter-American Development Bank	11.28					
Proportion of voting rights of developing countries in the International Bank for Reconstruction and Development	1.85					
Proportion of voting rights of developing countries in the International Finance Corporation	2.08					
Proportion of voting rights of developing countries in the International Monetary Fund	2.24					
Proportion of voting rights of developing countries in the UN Economic and Social Council	1.85					
Proportion of voting rights of developing countries in the United Nations General Assembly	0.52					
Proportion of voting rights of developing countries in the United Nations Security Council	6.67					
Proportion of voting rights of developing countries in the World Trade Organization	0.62					
Net foreign aid in Billion $ (Sender is negative; Recipient is positive)	1.545	1.351	1.433	1.491	1.49	1.749
Foreign direct investment annual inflows in Billion $	98.21	112.5	130.2	143.2	197	265.4
Total resource flows for development in Billion $	99.75	113.8	131.6	144.7	198.5	267.2
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable						
The number of urban population living in slums; informal settlements or inadequate housing as measured	38490.69					

by proportion of urban population living in slums.						
The proportion of urban population living in slums; informal settlements or inadequate housing as measured by proportion of urban population living in slums.	22.3					
Ratio of crop land to population; in hectares per million people	0.4092	0.3874	0.3874	0.3888	0.3891	0.3881
Ratio of grazing land to population; in hectares per million people	0.9516	0.8551	0.8505	0.8531	0.8531	0.8481
Urban-population weighted PM2.5 levels in residential areas of cities with more than 100k residents	18.22	12.87	12.32	12.7	12.74	11.95
Goal 12. Ensure sustainable consumption and production patterns						
Loss at the consumer level	10	10	10	10	10	10
Loss at the production level	11.11	11.11	11.11	11.11	11.11	11.11
Loss at the supply chain level	9.931	9.178	9.105	9.018	9.01	8.762
Compliance with the Basel Convention on hazardous waste and other chemicals	100					
Compliance with the Montreal Protocol on hazardous waste and other chemicals	16.67					
Compliance with the Rotterdam Convention on hazardous waste and other chemicals	100					
Compliance with the Stockholm Convention on hazardous waste and other chemicals	100					
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development						
Coverage of protected areas in relation to marine areas; by percentage	1.68					
Coverage of protected areas in relation to marine areas; Area protected	61881					
Coverage of protected areas in relation to marine areas; total coastal area	3672584.3					
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss						
Forest area as a percentage of total land area	58.91	58.88	58.9	58.9	58.9	58.94
Proportion of important sites for freshwater biodiversity that are covered by protected areas	15.57					
Proportion of important sites for terrestrial biodiversity that are covered by protected areas	47.36					

Total official development assistance for biodiversity; by donor						
Total official development assistance for biodiversity; by recipient	207.56					

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels						
Number of victims of intentional injuries per thousand	0.3633	0.4033	0.3166	0.3983	0.3983	0.3071
Years of life lost to intentional injuries per thousand	19.24	20.43	16	20.17	20.17	15.5
Years of living with disability due to intentional injuries per thousand	9.755	9.934	8.268	9.838	9.839	8.074
Unsentenced detainees as a proportion of overall prison population	40.61					
Proportion of children under 5 years of age whose births have been registered with a civil authority	95.9					
The compliance of existing national human rights institutions with the Principles relating to the Status of National Institutions	2					

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development						
Percentage of domestic budget funded by domestic taxes	84.23	103.6	101.6	102.3	101.7	99.06
Total government revenue as % of GDP	32.97	41.47	43.08	41.56	41.09	43.05
Household taxes as % of GDP	11.1	14.24	14.8	14.27	14.11	14.79
Firm taxes as % of GDP	4.753	5.799	6.007	5.776	5.71	5.911
Indirect taxes (taxes on goods and services) as % of GDP	6.636	8.625	8.975	8.665	8.566	9.023
Social security and welfare taxes as % of GDP	10.31	12.68	13.18	12.72	12.57	13.21
Net official development assistance as % of GDP (Sender is negative; Recipient is positive)	0.0582	0.0417	0.0417	0.0417	0.0416	0.0416
Volume of remittances as % of GDP (Sender is negative; Recipient is positive)	0.0349	0.0464	0.0438	0.0421	0.042	0.0358
Debt service as percentage of exports of goods and services	38.1					
Fixed Internet broadband subscriptions per 100 inhabitants	12.14	28.87	49.27	29.32	29.2	49.91
ICT Infrastructure Index	49.82	76.29	83.09	76.44	76.4	83.3
Percentage of individuals using the Internet	39.2					
Dollar value of financial and technical assistance (including through North-South; South-South	628.7					

and triangular cooperation) committed to developing countries						
Share of global exports (Percentage)	1.301	1.33	1.37	1.414	1.963	2.175

Table 13. Effects of different scenarios on SDG indicator outcomes in 2030 for Brazil. This Table provides a more complete list of SDG indicators than Table 12 in the main text. SDG indicators without forecasts in the table are those that do not align with IFs forecast variables or map to other variables in IFs. In lieu of forecasts, most recent data for those indicators are provided.

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