

Africa's Pulse

APRIL 2018 | VOLUME 17

AN ANALYSIS OF ISSUES SHAPING AFRICA'S ECONOMIC FUTURE



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Executive Summary

- ▶ Economic growth in Sub-Saharan Africa is estimated to have picked up to 2.6 percent in 2017 from 1.5 percent in 2016. This upswing reflected, on the supply side, rising oil and metals production, encouraged by recovering commodity prices, and improving agricultural conditions following droughts. On the demand side, growth was supported by a rebound in consumer spending as inflation moderated, and a recovery in fixed investment as economic activity picked up among oil and metals exporters.
- ▶ Recent data point to a moderate strengthening of growth in the region. Growth is projected to pick up to 3.1 percent in 2018, slightly below what was forecasted in the October issue of *Africa's Pulse*, and to firm to an average of 3.6 percent in 2019–20, reflecting a gradual pick-up in growth in Nigeria, South Africa, and Angola—the region's largest economies. These forecasts are predicated on the expectations that oil and metals prices will remain stable, robust expansion in global trade will continue, external financial market conditions will remain supportive, and governments in the region will implement reforms to tackle macroeconomic imbalances and boost investment.
- ▶ Many challenges remain. Growth in the non-resource-industrial sectors in oil and metals exporters has yet to pick up, underscoring the slow structural transformation in the region; the availability of good jobs has not kept pace with the number of entrants in the labor force; public debt burdens are rising, fueling debt sustainability risks; and poverty is widespread. While the region's per capita gross domestic product (GDP) growth will turn positive in 2018, it will remain insufficient to reduce poverty significantly. The total poverty headcount at the international poverty line (\$1.90/day in 2011 PPP) is projected to decline only slightly.
- ▶ The scope for demand-side policies to support growth generally is limited. Fiscal policy looks set to remain tight, constrained by the need to tackle rising debt levels and rebuild buffers to enhance resilience. On the other hand, easing price pressures, due to ongoing improvements in agricultural production and greater currency stability, allow for a more accommodative monetary stance in some countries. However, without a renewed focus on structural reforms, progress to improve the enabling environment for private sector activity will be stymied, and a faster pick-up in GDP growth in the region in the near term will be difficult. Across the region, reforms are particularly needed to lift productivity and help advance economic diversification. Increasing the quantity and quality of electric power, telecommunications, transport, and water and sanitation infrastructure would be critical to these efforts.
- ▶ Moderate growth is projected for the region, but with considerable variation across countries. Among Sub-Saharan Africa's largest economies, Nigeria is seeing a recovery in oil production, but continued challenges in the non-oil industry and services sectors will weigh on activity. The growth forecasts for Angola and South Africa have been revised slightly upward. In Angola, the revisions reflect the expectation that a more efficient foreign exchange allocation system, increased availability of foreign exchange due to higher oil prices, rising natural gas production, and improved business sentiment would help support the rebound in economic activity. In South Africa, slowing inflation and improving business confidence are expected to help sustain the ongoing recovery in domestic demand, especially in investment. However, although political transitions have opened opportunities for reforms in Angola and South Africa, each country faces challenges in translating expectations of reform into stronger investment and growth.
- ▶ An uneven recovery is expected in the other oil and metals exporters. Rising mining output as new projects come online, combined with stable commodity prices, are expected to lift growth in some countries, including the Democratic Republic of Congo, Mauritania, and Zambia. But growth will be moderate in others, reflecting a more gradual recovery in the mining sector. The recovery in some oil exporters in the Central African Economic and Monetary Community (CEMAC) will be slower than previously expected, due to the need for continued fiscal consolidation, as they adjust to high debt levels and low external buffers.

- ▶ Among non-resource intensive countries, activity in 2018 and 2019–20 is expected to remain robust. Solid growth, supported by infrastructure investment, will continue in the West African Economic and Monetary Union, led by Côte d'Ivoire and Senegal. Following a dip in 2017, growth prospects have strengthened in most of East Africa, including Kenya, Rwanda, and Uganda, owing to improving agriculture sector growth following droughts and a rebound in private sector credit growth. Elsewhere, although growth in Ethiopia is expected to soften, as policies are tightened to contain inflation, it will remain high, as government-led infrastructure investment continues.
- ▶ While risks to the outlook have become more balanced, downside risks predominate. On the upside, stronger than expected activity in advanced economies could provide positive spillovers to the region. Tighter global financing conditions and weaker than expected commodity prices are the main external downside risks. Domestic risks include heightened security issues, delayed fiscal adjustment, and weak implementation of structural reforms.
- ▶ Public debt levels in the region have been rising from 2013 on, following a period of declining and stable debt levels resulting from debt relief under the Heavily Indebted Poor Country and Multilateral Debt Relief Initiatives. The main drivers of the recent increase in public debt-to-GDP are rising fiscal deficits and the depreciation of exchange rates, especially in commodity exporting countries. Weaker economic performance also contributed to increases in public debt relative to GDP. Debt sustainability risks in the region have increased significantly over the past few years, with 18 countries at high risk of debt distress by March 2018, compared with eight in 2013. The composition of public debt has changed, away from traditional toward new sources of financing. The share of concessional and multilateral lending is on a clear downward trend, and by 2016 the bulk of bilateral lending was provided by non-Paris Club creditors. Market-based external debt has emerged as a new source of financing for several lower-middle-income countries, but also low-income countries. Although international bond issuances allow countries to diversify their investor base and complement multilateral and bilateral financing, large (bullet) repayments from 2021 on constitute significant refinancing risk for the region.
- ▶ The special topic of this issue of *Africa's Pulse* explores options for accelerating electrification in Sub-Saharan Africa, the role of innovation in facilitating such expansion, and the implications of achieving rapid electrification for inclusive economic growth and poverty reduction in the region. Countries' national electrification plans typically have focused on the expansion of the national electricity grid using large-scale fossil fuel and hydroelectric generation facilities and, more recently, some grid-scale investments in solar and wind power generation; off-grid solutions have been limited.
- ▶ All this has undergone considerable change over the past decade or so, spurred by innovations in home-scale solar power production and solar power-based mini-grids. Technical advances raise the question of the extent to which Sub-Saharan Africa could "leapfrog" over the traditional stages of national grid-based electrification that took place in today's advanced economies, through much greater reliance on "mini-grids" or "micro-grids" serving small concentrations of electricity users, and off-grid, home-scale systems.
- ▶ In sorting through various possibilities for accelerated electrification, it is important to keep in mind that national electrification strategies generally seek to address several development objectives. These include facilitating accelerated income growth and job creation, and improving lives and livelihoods in more remote areas, as well as limiting environmental and health damages from providing electricity. On the one hand, to accomplish this range of objectives, given the changes in generation technology and the expectation of rapid future growth in electricity demand, the evolution of electricity systems in Sub-Saharan Africa will need to involve more than one national grid. The path to universal

electrification also will incorporate interconnected or stand-alone “mini-grids” and “micro-grids” serving small concentrations of electricity users, and off-grid home-scale systems. On the other hand, as rural populations continue to migrate to rapidly growing urban areas in Sub-Saharan Africa, economies of scale and density will lower the costs of grid-supplied power in urban and peri-urban areas.

The key conclusions that emerge are as follows:

- i. Substantial cost reductions from rapid technological improvements from innovations in home-scale solar power production provide valuable opportunities to improve the lives of people without access to electricity in more lightly populated rural and remote areas of Sub-Saharan Africa. However, home systems in themselves cannot do that much to increase incomes and employment and reduce poverty in those areas, given the limited quantities of electricity they provide compared with the electricity needed for most productive uses.
- ii. Extension of the national power grid to those lightly populated rural and remote areas is usually costly, and often it has little impact on economic development because of the limited amounts that people can afford to pay for electricity. Much may be gained by initially targeting grid extension to areas with higher potential for significant uptake and expansion of productive uses, while pursuing the provision of smaller-scale alternatives in other areas.
- iii. Mini-grids using solar power also have benefited from rapid advances in solar power technology. Accordingly, mini-grids are a very interesting possibility for scaling up electricity availability in areas where grid extension is costly or can only be accomplished some ways into the future. Although there has been limited investment in mini-grids so far in Sub-Saharan Africa outside Tanzania, several other countries, including Nigeria and Rwanda, have been undertaking significant regulatory reforms to lower barriers to mini-grid investment. A major challenge for inducing private sector mini-grid investment is confidence with respect to cost recovery, and what happens to mini-grid assets when the grid begins to penetrate the service territory.
- iv. A well-thought-out, evidence-based plan for national electrification is crucial. Such a plan should include staged rollouts for grid extension and targeted investments in mini-grid development to expand electricity access for productive uses. In areas with high potential for expanding energy-intensive productive uses, new industrial zones could be grid-connected sooner to foster economic development, while other areas with lower potential demands for productive uses could be served by mini-grids. Over time, as incomes rise and populations agglomerate in higher-productivity locations, the national grid can spread out.
- v. Improved electricity sector governance is a top priority for effectively expanding electricity access in Sub-Saharan Africa. Especially important are steps to rationalize electricity pricing, reduce regulatory barriers that limit private sector investment in grid or off-grid power production, make utility operations more efficient and transparent, and foster more independent sector regulation. These steps are essential to raise economic efficiency, provide a more positive investment environment, expand private sector participation, and increase public confidence that the public interest is being served. Taking advantage of past and ongoing innovation to improve governance systems and enhance understanding of organizational behavior may offer even greater opportunities than the increased uptake of technical innovations. While reforms are difficult, without such steps, there are doubts about how much can be gained from investment programs for accelerating national electrification.

Section 1: Recent Trends and Developments

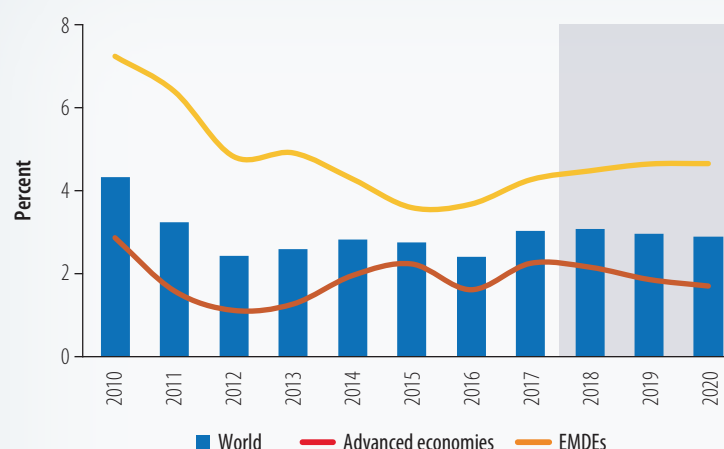
1.1 GLOBAL TRENDS

Global growth remains robust. Activity in advanced economies is picking up, led by investment. Among emerging market and developing economies (EMDEs), commodity exporters have emerged from the recession, helped by improving commodity prices, and the Chinese economy is expanding in line with expectations. Oil and metals prices increased in 2017 and are expected to remain stable. Private capital flows to EMDEs have been resilient, reflecting robust growth prospects, improving external financing needs, and relatively stable currencies. However, as global interest rates continue to increase, EMDE external financing conditions could become increasingly challenging.

The external environment facing Sub-Saharan Africa remains favorable

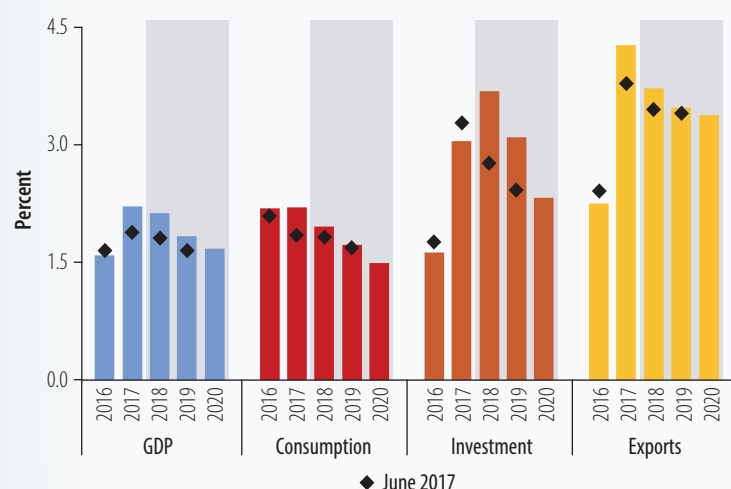
Global economic activity is vigorous. Global growth is estimated to have reached a stronger than expected 3 percent in 2017, up from a post-crisis low of 2.4 percent in 2016 (figure 1.1). This improvement reflected an investment-led pick-up in advanced economies and a growth acceleration in EMDEs, where activity in commodity exporters rebounded (figures 1.2 and 1.3). Incoming data point to the continuation of strong growth in 2018. The global composite Purchasing Managers' Index (PMI) rose to 54.8 in February, its highest reading since mid-2014, with advanced economies as well as EMDEs registering continued expansion.

FIGURE 1.1: Global GDP Growth



Global GDP grew by an estimated 3 percent in 2017, up from a post-crisis low of 2.4 percent in 2016

FIGURE 1.2: Advanced Economies: Contribution to GDP Growth by Demand Components



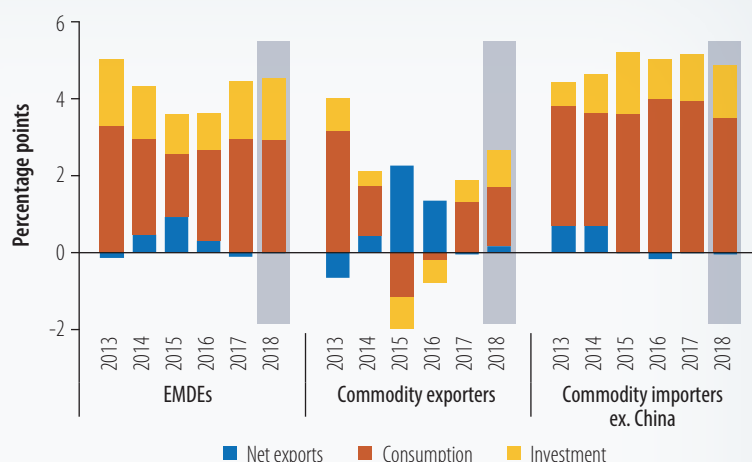
Investment led the pick-up in growth in advanced economies

Source: World Bank.

Note: In figure 1.1, EMDEs = emerging market and developing economies. The shaded area indicates forecasts. Aggregate growth rates are calculated using constant 2010 U.S. dollar GDP weights. Data for 2017 are estimates. In figure 1.2, the diamonds correspond to the June 2017 edition of the Global Economic Prospects report. Shaded areas indicate forecasts. Aggregate growth rates and contributions are calculated using constant 2010 U.S. dollar GDP weights.

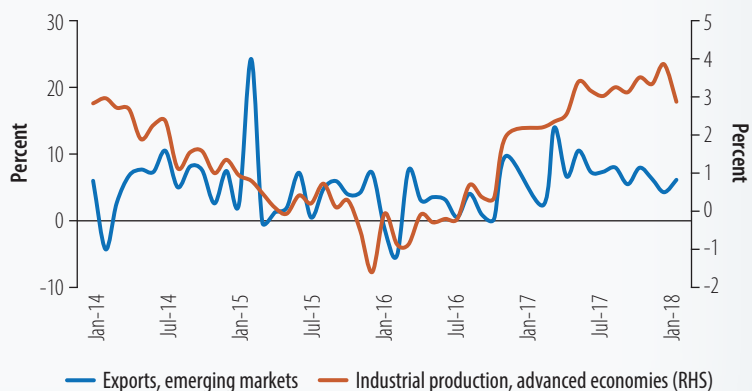
The acceleration in growth in EMDEs was led by investment and consumption

FIGURE 1.3: EMDEs: Contribution to GDP Growth by Demand Components



Strong demand from advanced economies helped drive exports from emerging economies, which grew 7 percent

FIGURE 1.4: Industrial Production and Export Growth



Source: World Bank.

Note: In figure 1.3, shaded areas indicate forecasts. Data for 2017 are estimates. The figure is based on a sample of 155 EMDEs for which demand components are available and projected. In figure 1.4, the last observation is January 2018.

Survey indicators point to continued global goods trade momentum despite uncertainty due to U.S. tariffs. Global goods trade volumes rose 4.7 percent (year-on-year) in 2017, from 2.7 percent in 2016. Strong demand from advanced economies helped drive exports from emerging economies, which grew by 7 percent (figure 1.4). Trade indicators remained resilient in early 2018. Global PMI export orders stood at 53.3 in February, down slightly from the previous month's seven-year high. However, the United States' recent imposition of import tariffs of 25 percent on steel and 10 percent on aluminum has added to global uncertainty.

Commodity prices increased in 2017 and are expected to stabilize in 2018 and 2019. Crude oil prices averaged US\$53 per barrel (bbl) in 2017, a 23.3 percent increase over their 2016 levels, and remained above US\$60/bbl in early 2018. An

agreement between most Organization of the Petroleum Exporting Countries (OPEC) and some non-OPEC oil producers to extend production cuts to the end of 2018 helped boost prices. Oil demand has also been robust. However, U.S. oil production has continued to rise, which has led to a moderation in prices. The World Bank forecasts oil prices to average US\$62/bbl in 2018 and US\$63/bbl in 2019, US\$4/bbl above the October forecasts.

Non-oil commodity prices increased by 5.6 percent in 2017, following a 2.6 percent decline in 2016. This improvement reflected strong gains for metals prices, which rose 22 percent in 2017 due to strong demand from China. Metals prices have been stable in early 2018 and are expected to decline marginally in 2018 and 2019, as Chinese demand gradually slows. Agricultural prices rose moderately in the first quarter of 2018, following three years of price stability. The price uptick mainly reflected fears of drought-driven supply disruptions in South America. However, the stocks-to-use ratios for most grains—a measure of global supply availability relative to demand—remain high. See box 1.1 for a discussion of

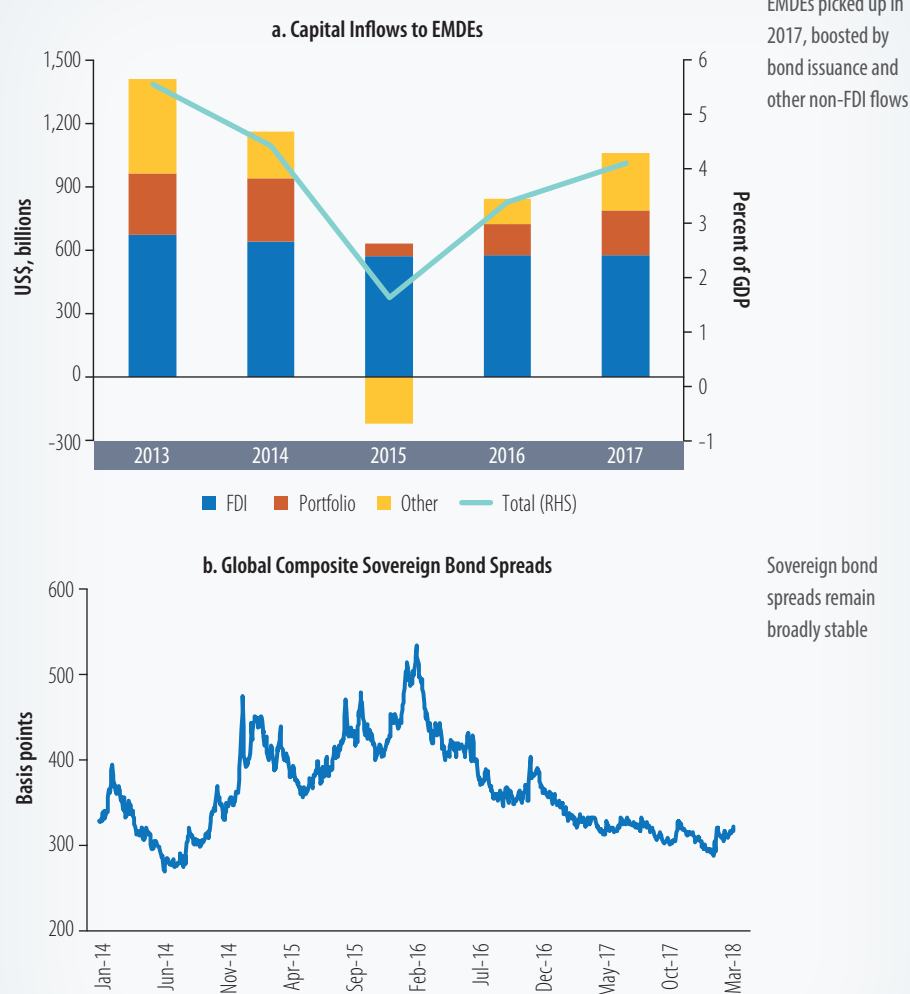
commodity price trends and volatility. The evidence shows a decline in commodity price volatility, a welcome development from a policy perspective.

Global financing conditions remain generally supportive despite some tightening. After recovering from a period of turbulence in February, financial market volatility returned in late March amid fears of increasing trade protectionism. U.S. 10-year bond yields—which had been climbing steadily since the beginning of the year—have stabilized after reaching a four-year high of 2.9 percent in late February. The U.S. dollar has been broadly stable against a trade-weighted basket of currencies in recent months.

Capital flows to EMDEs have remained resilient through the first quarter of 2018. Capital flows to EMDEs strengthened in 2017 (figure 1.5a). After weathering relatively well the February turbulence (due to rising inflation expectations and prospects of faster normalization of U.S. monetary policy), EMDE financial markets remained stable in

March. Although outflows took place following the market turmoil in February, they were less pronounced than during prior episodes of volatility. Sovereign bond spreads narrowed more than 10 basis points after spiking in February, and bond issuance activity continues to be sustained (figure 1.5b). The underlying financial resilience in EMDEs reflects favorable global economic conditions, including robust global trade, recovering commodity prices, and a weaker U.S. dollar. Capital inflows are expected to be sustained in 2018, assuming continued recovery of EMDE growth. However, foreign direct investment (FDI) flows are projected to remain relatively subdued, as flows to China continue to decelerate and commodity prices only recover slowly. As global interest rates continue to increase, EMDE external financing conditions could become increasingly challenging in 2018 and 2019.

FIGURE 1.5: Global Capital Flows



Sources: Bank for International Settlements; International Monetary Fund; J.P. Morgan; World Bank.
 Note: Panel a is based on the top 28 recipients of capital flows. The "other" investment category includes all financial transactions not covered in direct investment, portfolio investments, or reserve assets. Data for 2017 are estimates. In panel b, the last observation is March 22, 2018.

1.2 SUB-SAHARAN AFRICA

Economic activity continues to strengthen in Sub-Saharan Africa, supported by favorable external and domestic conditions. Output growth rebounded from 1.5 percent in 2016, the lowest pace in more than two decades, to an estimated 2.6 percent in 2017, broadly in line with expectations. Regional growth is projected to pick up to 3.1 percent in 2018, and firm to 3.5 percent in 2019 and 3.7 percent in 2020, reflecting expectations that oil and metals prices will remain stable, global trade will continue to see a robust expansion, and external financial market conditions will remain supportive. Growth performance will be uneven across countries. While Nigeria, South Africa, and Angola are expected to see a gradual pick-up in growth, economic expansion will continue at a solid pace in the West African Economic and Monetary Union (WAEMU), and strengthen in most of East Africa. Despite the upturn in economic activity in the region, important vulnerabilities remain: growth in the non-resource-industrial sectors in oil and metals exporters has yet to pick up, underscoring the slow structural transformation in the region; employment opportunities are lagging; public debt relative to gross domestic product (GDP) is rising; and poverty is widespread. As countries look to rebuild policy space through fiscal consolidation, the scope to undertake countercyclical fiscal policies will remain limited. This places a renewed emphasis on policy actions to boost domestic revenue mobilization and improve the efficiency of public expenditure. Faster progress on poverty reduction in the region will require further acceleration in per capita income growth, supported by structural reforms that increase productivity and facilitate export diversification. Improving the quantity and quality of public infrastructure, especially electricity infrastructure—the special topic of this report (section 3)—will be critical to achieving development goals.

RECENT ECONOMIC DEVELOPMENTS

The economic recovery in the region is continuing but growth remains modest

Sub-Saharan Africa's GDP growth rose in 2017, to an estimated 2.6 percent, broadly in line with the October forecast (figure 1.6d). The turnaround in economic activity gained momentum in the second half of 2017, reflecting developments in Nigeria and South Africa—the region's two largest economies. Nigerian real GDP growth doubled to 1.4 percent (year-on-year) in the third quarter, as oil production increased and foreign exchange availability improved (figure 1.6a; figure 1.7b). Growth picked up to 1.9 percent in the fourth quarter, supported by a solid expansion in the agriculture sector and a rebound in retail trade and transport industries, reflecting an increase in household spending. However, growth in the oil sector slowed (compared to the third quarter) and activity in the services sector continued to contract. For 2017 as a whole, the Nigerian economy grew 0.8 percent, following a contraction of 1.6 percent in 2016.

Meanwhile, South Africa's real GDP rose at a quarter-on-quarter seasonally adjusted annualized rate (saar) of 3.1 percent in the fourth quarter of 2017, following an increase of 2.3 percent (saar) during the third quarter. For the year as a whole, GDP rose 1.3 percent, up from 0.6 percent in 2016 (figure 1.6b). The pick-up in growth in South Africa reflected, on the supply side, a strong rebound in the agriculture sector, after a severe contraction in 2016 due to drought, as well as a recovery in the mining sector, supported by favorable commodity prices. However, growth in finance, real estate, and business services—South Africa's strongest growth sector in the past—moderated, and the manufacturing sector contracted. On the demand side, a rise in household consumption was the main driver of growth, supported by gains in

FIGURE 1.6: GDP Growth, Sub-Saharan Africa and Selected Countries



a. Economic activity picked up in the second half of 2017 in Nigeria, with Q3 and Q4 (y-o-y) growth of 1.4 and 1.9 percent, respectively

b. South Africa's GDP rose at 3.1 percent (saar) in 2017 Q4, and by 1.3 percent for the year, exceeding consensus expectations

c. Growth performance was mixed across countries, with growth accelerating in more countries than it slowed

d. Regional growth, excluding Angola, Nigeria and South Africa, edged up from 4.2 percent in 2016 to an estimated 4.6 percent in 2017

Sources: National Bureau of Statistics, Nigeria; Statistics South Africa; Trading Economics; World Bank.

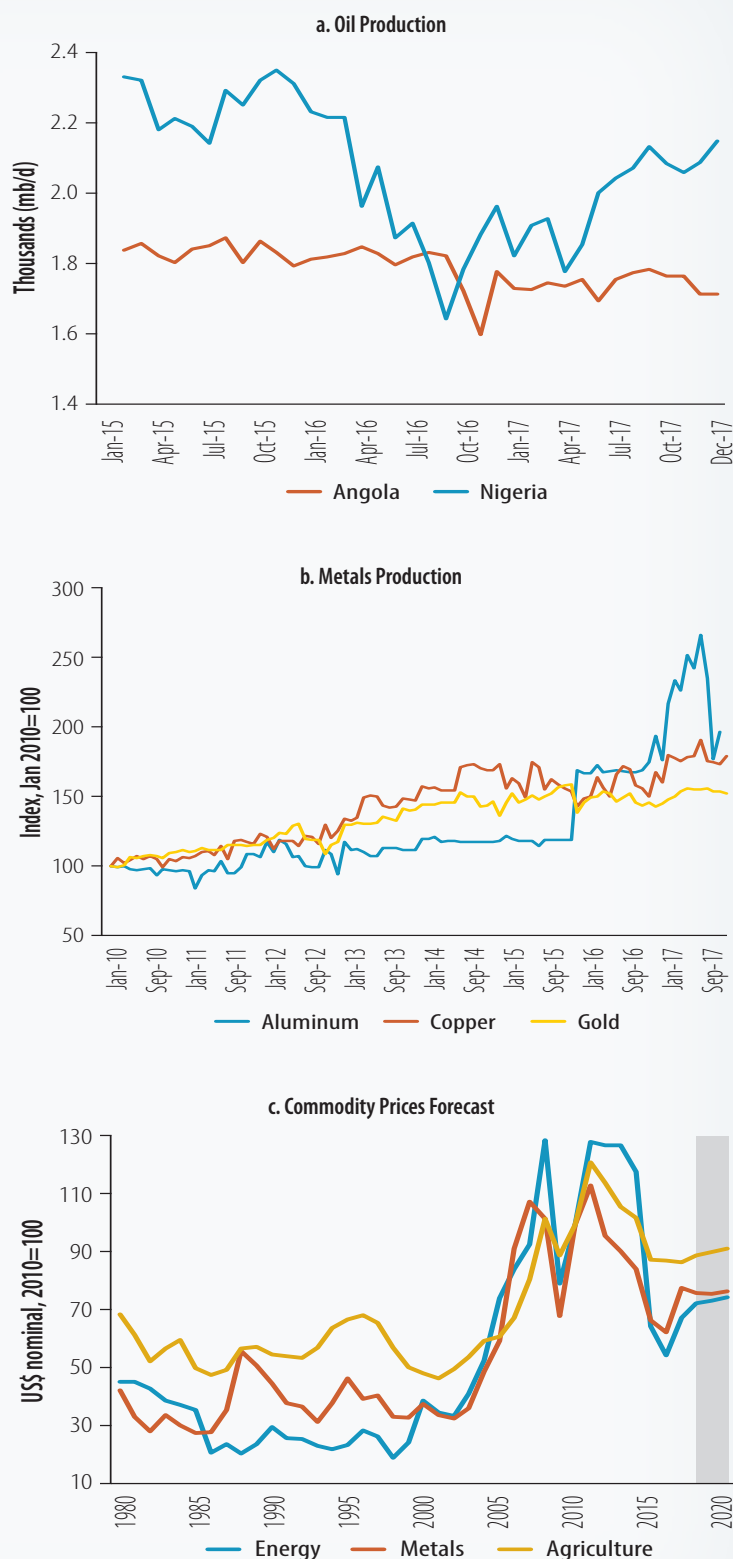
Note: In panels a and b, the last observation is 2017Q4. In panel c, WAEMU = West African Economic and Monetary Union.

employment and an increase in real wages as inflation moderated. A recovery in private fixed investment in the fourth quarter of 2017 also contributed to the increase in domestic demand (World Bank 2018).

Elsewhere in the region, performance was mixed. GDP growth remained weak among oil exporters in the Central African Economic and Monetary Community (CEMAC), with activity still contracting in several countries—notably, Chad, the Republic of Congo, and Equatorial Guinea—as they continued to adjust to the impact of low oil revenues. Economic activity slowed more than expected in some countries, reflecting the effects of a contraction in the mining sector (for example, Botswana and Namibia) and tight liquidity conditions (for example, Kenya and Sierra Leone). Overall, growth accelerated in more countries than it slowed. Countries such as Angola, Ghana, and Guinea benefited from the recovery in oil and metals prices; favorable international capital market conditions supported growth in Côte d'Ivoire and Senegal; and improving agricultural production lifted growth in Rwanda and Uganda. Rising consumer spending,

The recovery in oil and metals prices in 2017 underpinned the expansion in oil and mining production

FIGURE 1.7: Oil and Metals Production and Commodity Prices



Sources: International Energy Agency; World Bureau of Metal Statistics; World Bank.

Note: In panel a, the last observation is December 2017. In panel b, the index is rebased in metric ton measurement. mb/d = million barrels per day.

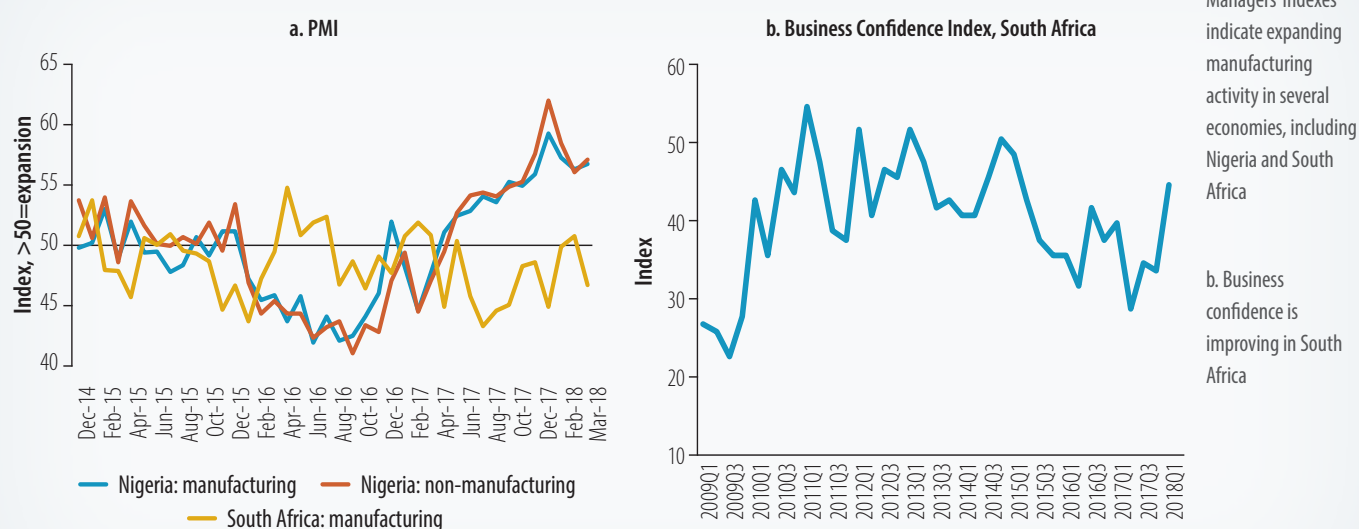
helped by declining food prices and recovering remittance flows, also supported the pick-up in economic activity (for example, The Gambia). Regional growth, excluding Angola, Nigeria, and South Africa, edged up from 4.3 percent in 2016 to an estimated 4.7 percent in 2017 (figure 1.6d).

However, many challenges persist. Growth in non-resource-industrial sectors has yet to pick up. For example, the recovery in Nigeria was mostly driven by the oil and agriculture sectors. In some cases, unemployment is high; it rose to 18.8 percent in Nigeria, and eased slightly to 26.7 percent in the fourth quarter of 2017 in South Africa mainly because of a decline in the labor force participation rate. Across the region, public debt levels are rising as a percentage of GDP (see section 2), and extreme poverty is elevated. Regional GDP per capita growth in 2017 was still negative.

Recent high-frequency data and sentiment indicators point to continued moderate strengthening of the recovery in the region. The PMIs indicate expanding manufacturing activity in several economies, including Ghana, Kenya, Nigeria, Uganda, and Zambia. Following an encouraging start to the year, South Africa's PMI fell back into contractionary territory in March, reflecting a decline in exports due to the rand's strength (figure 1.8a).

Political transitions in Angola, South Africa, and Zimbabwe are boosting investor confidence, as the new governments are introducing policies and signaling reforms that could help increase private investment (figure 1.8b). Elsewhere, mining production is set to rise further among metals exporters, as new mines come on stream and investment in existing mines continues, encouraged by stable metals prices (for example, in the Democratic Republic of Congo and Zambia). Robust public spending and infrastructure investment continue to support activity in non-resource intensive countries such as Côte d'Ivoire and Senegal. However, growth in oil production in Angola and Nigeria—the region's two largest oil exporters—is set to moderate as oil fields mature.

FIGURE 1.8: Activity Indicators and Business Confidence Index



Sources: Central Bank of Nigeria and Central bank of South Africa.
Note: In both panels, the last observation is March 2018.

Source: Data from the Bureau for Economic Research, South Africa, March 2018.

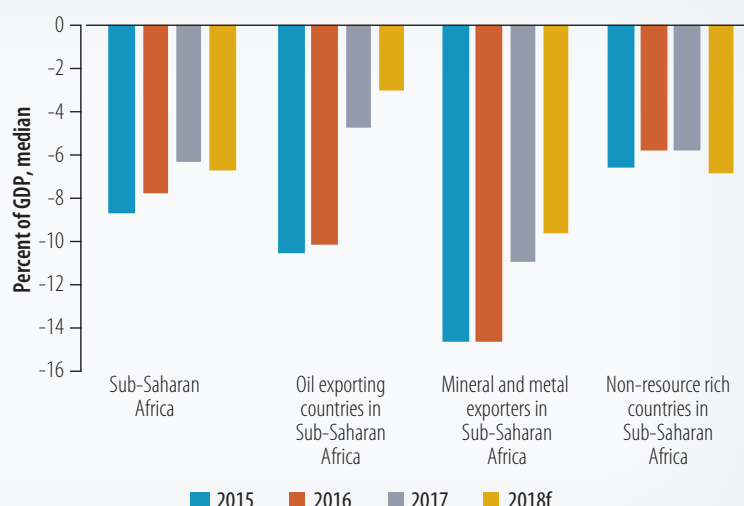
Current account deficits are narrowing but remain elevated

The median current account deficit, as a share of GDP, declined from 7.9 percent in 2016 to 6.3 percent in 2017, helped by the recovery in commodity prices, but is projected to edge up to 6.8 percent in 2018 (figure 1.9). Drivers underlying the evolution of the current account vary by resource dependence. Among oil exporters, current account deficits narrowed from 10.3 percent of GDP in 2016 to 4.8 percent in 2017, reflecting gains in Nigeria where the current account surplus rose to 2.2 percent of GDP, as oil exports increased. Current account deficits fell significantly among oil exporters in CEMAC, partly due to import compression. The current account position in oil exporters is expected to narrow further in 2018, helped by continued improvements in their terms-of-trade, although rising demand due to a pick-up in growth could lead to some reversal of the import compression in some countries.

Among metals exporters, current account deficits narrowed by nearly 4 percentage points to 11 percent of GDP in 2017. The improvement was broad-based, with most metals exporters benefiting from higher metals prices, but pronounced in some countries. In Mozambique, strong coal exports, combined with subdued import growth due to weak demand, helped reduce the current account deficit from

The median current account deficit as a share of GDP narrowed to 6.3 percent in 2017, helped by the recovery in commodity prices, but is projected to edge up in 2018

FIGURE 1.9: Current Account Balance



Source: World Bank staff estimates.

an average of 37 percent of GDP in 2011–16 to less than 20 percent in 2017. However, current account deficits among metals exporters are expected to narrow only marginally in 2018, as metals prices stabilize and the pick-up in mining investment leads to an increase in imports in several countries.

Among non-resource intensive countries, where public investment in infrastructure has remained strong, the median current account deficit remained

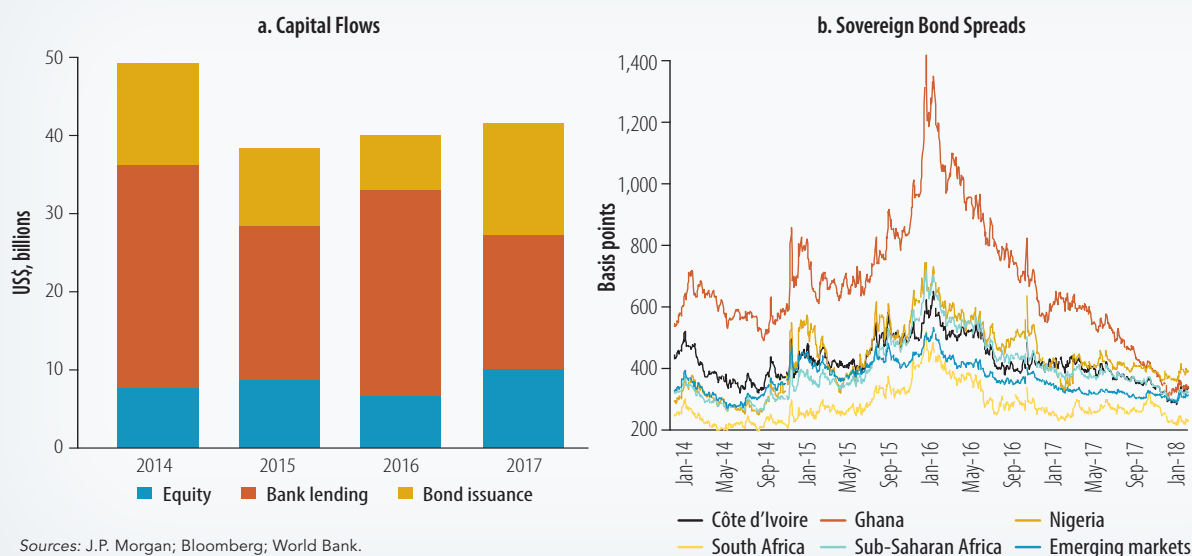
sizable in 2017 and broadly unchanged at 5.8 percent of GDP. Current account deficits are expected to widen to 6.9 percent of GDP in 2018, due to strong demand and rising import levels. The deficits will be wider among larger countries such as Ethiopia and Kenya, reflecting their high public investment levels.

A mix of FDI, bond, and other portfolio flows helped finance the current account deficits in the region. FDI flows rose in 2017, after three consecutive years of contraction. Nonetheless, with commodity prices below their historical highs, FDI flows are expected to remain moderate, although non-oil FDI flows in infrastructure and business services are rising in some countries (for example, Ethiopia). In Nigeria, FDI contributed just 3 percent to total inflows in the third quarter of 2017 (National Bureau of Statistics 2018). By contrast, portfolio flows rose sharply in the region in 2017 (figure 1.10a). Attracted by yields significantly above the average global yields, nonresident portfolio inflows increased substantially in South Africa and Nigeria, as well as in other frontier market economies, such as Ghana and Kenya. Eurobond issuances increased sharply, as investor sentiment toward EMDEs improved. Corporate and sovereign bond issuances more than doubled to \$14.4 billion in 2017, with several countries returning to the international capital markets; among these were Côte d'Ivoire, Nigeria, and Senegal. Global financial market conditions remained favorable in early 2018, and portfolio inflows have continued, led by several large Eurobond issuances by Côte d'Ivoire, Kenya, Nigeria, and Senegal. Sovereign bond spreads continue to be low (figure 1.10b).

External buffers are low

The median level of foreign reserves in the region was three months of imports in 2017, the same as in 2016, and is expected to remain broadly unchanged in 2018. However, the aggregate figure hides considerable variations among countries in the region. The improvement in the current account balance and increase in capital inflows boosted foreign exchange reserves in some oil and metals exporters. In particular, foreign reserves rose to nine months of imports in Nigeria by the end of 2017. South Africa also saw an increase in reserves to nearly five months of imports. Meanwhile, a large number of countries had reserve levels less than the three months of imports benchmark in 2017, and these trends are expected to improve only slightly in 2018.

FIGURE 1.10: Capital Flows and Sovereign Bond Spreads



Sources: J.P. Morgan; Bloomberg; World Bank.

Note: In panel b, the last observation is March 7, 2018.

Foreign reserve positions in the CEMAC region are still half their peak level of 5.4 months of imports in 2014. Progress in reconstituting external buffers remains slow in CEMAC countries where exports are highly concentrated, including Chad, the Republic of Congo, and Equatorial Guinea. The low levels of foreign exchange reserves in many countries suggest that vulnerabilities to terms-of-trade shocks remain high in the region, and the need to build strong reserve buffers to enhance resilience remains a major policy challenge.

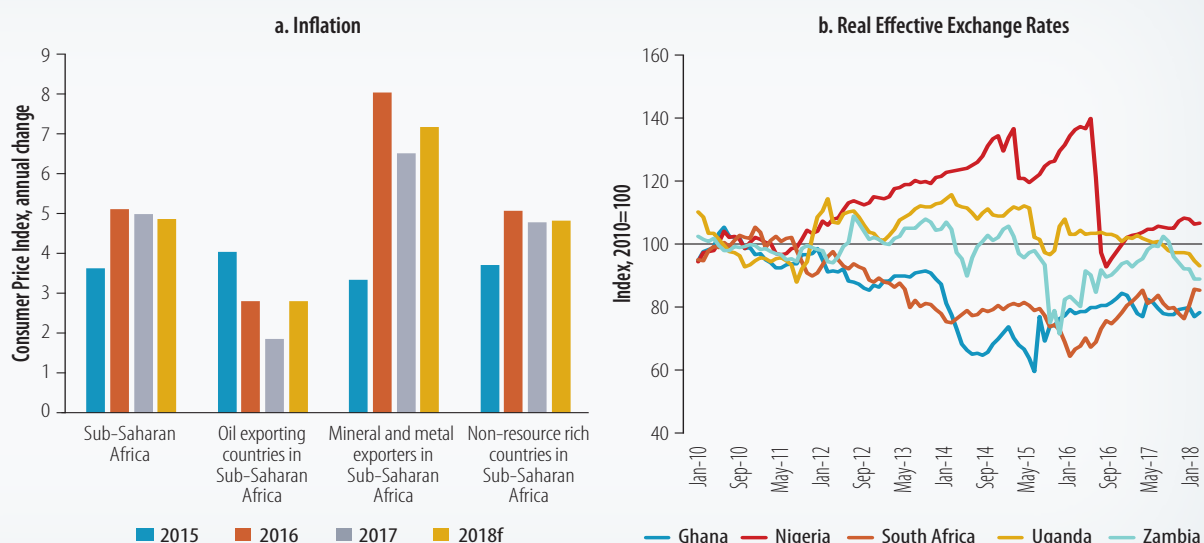
Price pressures are easing

The ongoing improvements in agricultural production have helped moderate price pressures in the region. After rising rapidly to 5.2 percent in 2016, the median annual consumer price inflation eased slightly to 5.1 percent in 2017, with significant variations among countries (figure 1.11). Among oil exporters, inflation declined from 2.9 percent in 2016 to 1.9 percent in 2017, reflecting the generally low inflation in the CEMAC region due to the stable peg of the currency to the euro. In metals exporters, inflation slowed to 6.6 percent from 8.2 percent in 2016; and among non-resource intensive countries, inflation fell from 5.1 to 4.8 percent. Apart from declining food prices, greater currency stability also contributed to the slowing trend in inflation. Exchange rate pressures fell notably in 2017, reflecting improved trade balances due to recovering commodity prices, tighter domestic policies in some countries, and increased foreign financing.

Inflation continued to ease across most of the region in the first quarter of 2018, and the median inflation rate is projected to decline to 4.9 percent. The improving inflation outlook prompted central banks in some countries, such as Uganda, South Africa, and Zambia, to cut interest rates further, and others to start an easing cycle (for example, Kenya). However, despite recent decreases, inflation rates remain in the high double digits in some countries, including Angola, where the government abandoned the peg to the U.S. dollar, contributing to inflationary pressures. In Nigeria, supply disruptions are contributing to food inflation. The monetary policy stance remains tight in Angola and Nigeria, with high nominal interest rates.

Price pressures have eased on slowing food inflation and greater currency stability

FIGURE 1.11: Inflation and Exchange Rates



Source: International Monetary Fund, World Bank staff estimates.

Fiscal policy looks set to remain tight

The median fiscal deficit narrowed from 4.3 percent of GDP in 2016 to 4.1 percent in 2017 and is expected to fall to 3.6 percent in 2018 (figure 1.12). However, progress varied, and the need to achieve sustainable fiscal positions in the region remains critical. Among oil exporters, fiscal deficits narrowed from 4.2 percent in 2016 to 3.4 percent in 2017, and a further improvement to 1.9 percent is expected in 2018. Large expenditure cuts among CEMAC countries account for the narrowing deficits. Meanwhile, fiscal deficits widened in Angola and Nigeria and are expected to remain elevated, reflecting limited progress in boosting non-oil revenues.

Among metals exporters, the median fiscal deficit widened from 4.2 to 5.1 percent and is expected to pull back to 4.5 percent of GDP in 2018, reflecting higher spending levels and a modest contribution to tax revenues from non-mining sectors. In South Africa, weak growth contributed to poor fiscal revenue collection, and the bailing-out of poorly-performing state-owned enterprises put additional pressures on expenditure. However, the 2018 budget has restored a commitment to fiscal consolidation with a set of measures to improve tax collection and control spending.

In non-resource intensive countries, budget deficits are narrowing gradually from elevated levels. The median fiscal deficit contracted from 4.7 percent in 2016 to 3.9 percent in 2017 and is expected to narrow further to 3.7 percent in 2018, reflecting some improvement in domestic revenue mobilization. High spending levels, reflecting the scaling up of infrastructure investment in many cases, but also rising current expenditures, continue to exert pressure on the fiscal deficit.

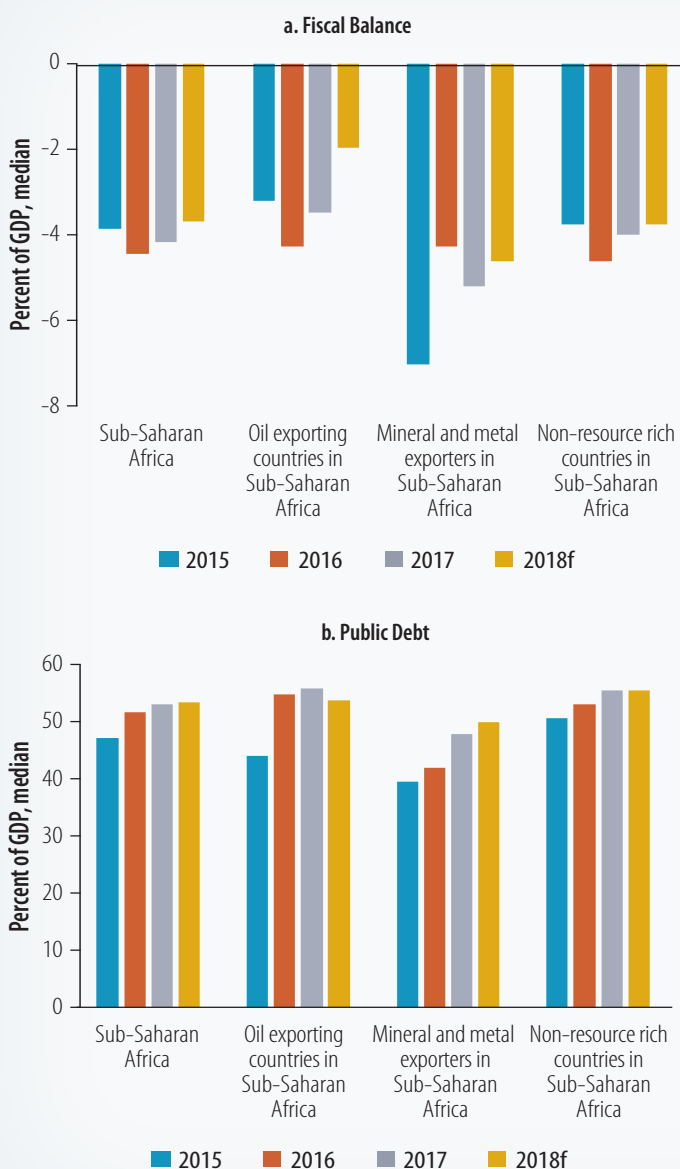
Large fiscal deficits have resulted in rising public debt levels in the region. The median government debt rose to 53 percent of GDP in 2017, above the median of 47 percent of GDP for other EMDEs. Government debt rose sharply among oil producers, as they delayed adjusting to the fall in oil prices. Government

debt more than doubled among oil producers in CEMAC. However, government debt also rose rapidly among the fast-growing non-resource intensive countries, for example, Côte d'Ivoire and Senegal, as they continued to borrow to finance ambitious investment programs. In metals exporters, such as Sierra Leone and Niger, which suffered severe terms-of-trade shocks, debt levels remain elevated. Mozambique defaulted on portions of its external debt, which it is seeking to restructure.

Among the regions' three largest economies—Angola, Nigeria, and South Africa—public debt ratios are particularly high in Angola. Government debt in Angola reached over 75 percent of GDP in 2016 and is estimated at 65 percent in 2017. The majority of this debt is denominated in foreign currency and is owed to commercial creditors. Reflecting the heavy burden of its debt, the Angolan government recently signaled its intention to restructure it. The government debt burden in South Africa is substantial and rising. In the budget speech of February 21, 2018, the new government outlined additional steps that could put government debt back on a sustainable path. Government debt in Nigeria—estimated at around 20 percent of GDP in 2017—remains relatively small, despite rising borrowing in recent years. However, debt service costs relative to revenue are unsustainably high.

The median public debt-to-GDP ratio in the region is expected to stabilize in 2018, reflecting ongoing efforts to reduce fiscal deficits. To contain the rise in public debt levels, further fiscal consolidation will be necessary across the region, particularly through tighter control of current expenditures. Section 2 analyzes fiscal and debt risks in Sub-Saharan Africa.

FIGURE 1.12: Fiscal Balance and Public Debt



a. The median fiscal deficit narrowed from 4.3 percent of GDP in 2016 to 4.1 percent in 2017, and is expected to narrow further in 2018

b. Public debt levels are rising in the region, and the median government debt relative to GDP was 53 percent in 2017, above the median of 47 percent for other EMDEs

Source: World Bank staff estimates.

ECONOMIC OUTLOOK

Economic growth to remain modest

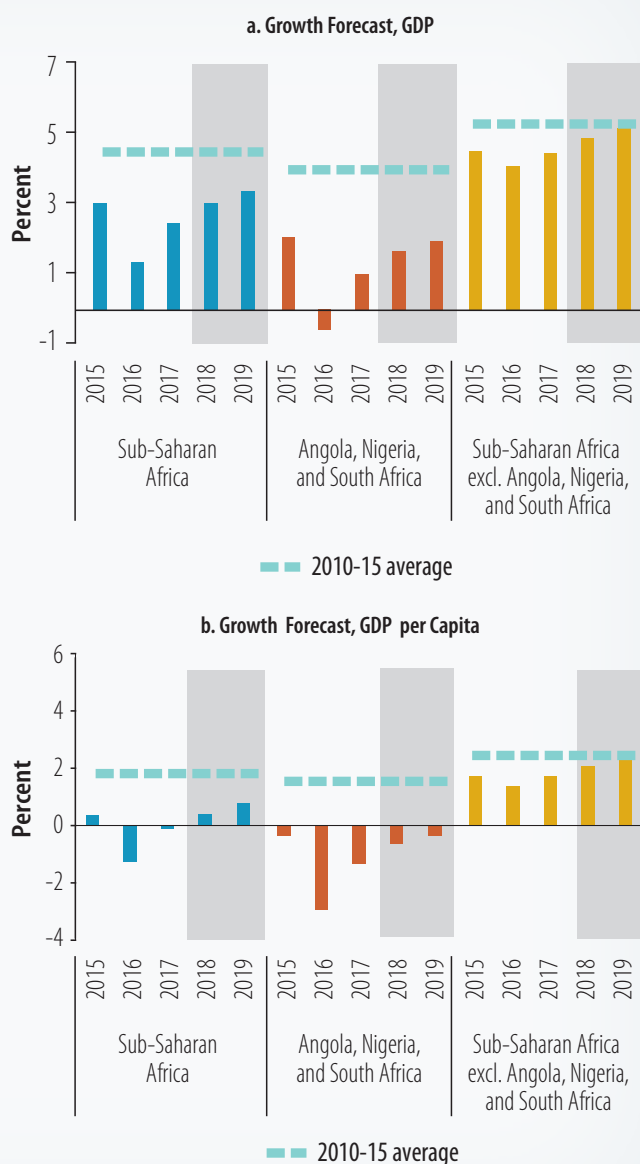
Growth in the region is projected to pick up to 3.1 percent in 2018, and to firm to 3.5 percent in 2019 and 3.7 percent in 2020 (figure 1.13). These forecasts are predicated on the expectations that oil and metals prices will remain stable, expansion in global trade will stay robust, and external financial market conditions will continue to be supportive. However, structural constraints will prevent a faster pick-up in GDP growth in the region without renewed progress in structural reform.

Among the region's largest economies, the forecasts for Nigeria were revised downward. Growth forecasts for 2018 and 2019–20 are 0.4 and 0.5 percentage points lower, respectively, than in October, reflecting a slower than previously anticipated recovery in the oil sector due to emerging capacity constraints and

continued challenges to growth in the non-oil industry and services sectors. The growth forecasts for Angola and South Africa have been revised slightly upward. In Angola, growth is projected to reach 1.7 percent in 2018 and 2.4 percent by 2020, helped by a more efficient foreign exchange allocation system, increased availability of foreign exchange due to higher oil prices, rising natural gas production, and improved business sentiment. In South Africa, the economy is expected to grow at 1.4 percent in 2018, and expand by 1.8 percent in 2019 and 1.9 percent in 2020, on the expectation that slowing inflation and improving sentiment would help sustain the ongoing recovery in domestic demand, especially in investment. However, although political transitions have opened opportunities for reforms in Angola and South Africa, they each face challenges in translating expectations of reforms into stronger investment and growth.

An uneven recovery is expected in other oil and metals exporters. Rising oil and mining output as new projects come online, combined with stable commodity prices, are expected to boost growth in some countries, including the Democratic Republic of Congo and Mauritania. But growth will be moderate in others,

FIGURE 1.13: Outlook for GDP and GDP per Capita Growth



Source: World Bank.

Note: In both panels, shaded areas represent forecasts.

reflecting a more gradual recovery in the mining sector. The recovery will be slower than anticipated in some oil exporters in the CEMAC region, reflecting the need for fiscal consolidation as they continue to adjust to high debt levels and low external buffers.

Among non-resource intensive countries, activity in 2018 and 2019–20 is expected to remain robust. Solid growth, supported by infrastructure investment, will continue in WAEMU, led by Côte d'Ivoire and Senegal. Following a dip in 2017, growth prospects have improved in most of East Africa, including Kenya, Rwanda, and Uganda, owing to improving agriculture sector growth following droughts and a rebound in private sector credit growth. Elsewhere, although growth in Ethiopia is expected to soften, as policies are tightened to contain inflation, it will remain high, as government-led infrastructure investment continues. In some smaller economies (The Gambia and the Comoros, for example), improved political stability and rising remittance flows will allow for a modest pick-up in activity. However, in Malawi, the spread of the fall armyworm—a pervasive agricultural pest—will weigh heavily on activity.

Although per capita GDP growth in the region will turn positive, it will remain well below its long-term average and inadequate to reduce significantly the region's high poverty levels. The total poverty headcount in the region, at the international poverty line (\$1.90/day at 2011 Purchasing Power Parity exchange rates), is projected to decline only slightly, even as more than one-fifth of African countries have poverty rates well over 50 percent. Faster poverty reduction in the region will require acceleration in GDP per capita growth. Structural reforms that increase productivity and support export diversification, including by improving the quantity and quality of electric power, telecommunications, transport, and water and sanitation infrastructure, will be critical to achieving desired development goals.

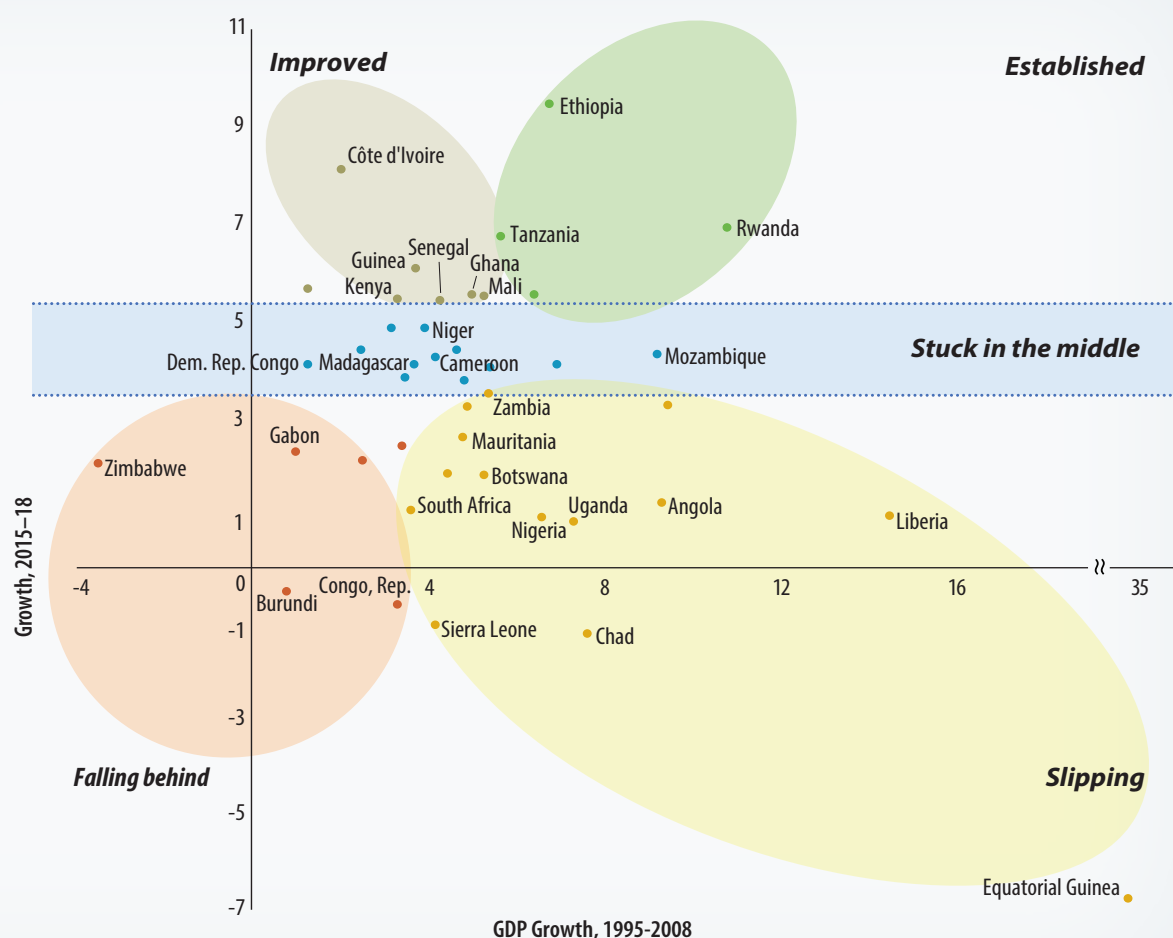
GROWTH RESILIENCE: TAKING STOCK

Overall, external headwinds and macroeconomic vulnerabilities during 2015–17 took a toll on the resilience of growth trajectories across Sub-Saharan African countries. In the April 2017 issue of *Africa's Pulse*, 45 Sub-Saharan African countries were categorized into four groups based on a comparison of their average annual GDP growth rates during 1995–2008 and 2015–17. We revisit the categorization by using growth rates for 2015–18. This more recent period better captures the resiliency of countries to the 2014–15 commodity shock, their reduced macroeconomic policy space, and the adequacy of policy response. The thresholds used to classify the countries remain the same: the top and bottom terciles of the average annual growth rate of the 45 countries between 1995 and 2008—that is, 5.4 and 3.5 percent, respectively.

The latest data reveal that 11 countries experienced growth rates above 5.4 percent in 2015–18 (as opposed to seven countries in the April 2017 issue of *Africa's Pulse*). The 11 countries are Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Guinea, Guinea-Bissau, Kenya, Mali, Rwanda, Senegal, and Tanzania (figure 1.14). These countries house nearly one-third of the region's population and account for 20 percent of the region's total GDP. Growth for most of the high-performing countries in the region (that is, established and improved countries) was driven by the performance of investment and exports—although for some, rising investment came at the cost of lower efficiency of spending. While countries in the established group (Burkina Faso, Ethiopia, Rwanda, and Tanzania) are not resource abundant, the growth performance in some of the improved countries was driven by more favorable commodity prices and the recovery in the production of their corresponding commodities. For instance, the expansion of economic activity in

Eleven countries have annual average growth rates in 2015–18 that exceed the top tercile of the regional distribution in 1995–2008

FIGURE 1.14: Taxonomy of Countries in Sub-Saharan Africa: GDP Growth in 2015–18 versus 1995–2008



Source: World Bank staff calculation based on the WDI database.

some of these countries was supported by a rebound in agriculture (Côte d'Ivoire and Mali) and partly by improved international prices of their corresponding commodities (cashew nuts in Guinea-Bissau).

For countries that are stuck in the middle, with growth rates that failed to exceed 5.4 percent in 2015–18, growth was mostly driven by (private and public) consumption. Countries with investment-led growth had problems of spending inefficiencies. In some of these countries—especially commodity exporters—the income gains from positive terms-of-trade might explain the expansion of consumption. This group of countries houses nearly one-fourth of the region's population and accounts for 14 percent of the region's total GDP. Countries with economic performance that lost steam in 2015–18 relative to 1995–2008 represent almost 40 percent of the region's population and more than 60 percent of its economic activity. Their median rate of GDP growth decelerated from 6 percent per year in 1995–2008 to 1.2 percent per year in 2015–18. This group includes the three largest countries in the region (Nigeria, South Africa, and Angola) and comprises many commodity exporters, and growth performance was driven by total consumption (including private and public) rather than investment. In the few cases where growth was investment led, inefficiencies in investment spending were observed. The group of slipping countries includes the largest number of countries with macroeconomic vulnerabilities—that is, restricted macroeconomic policy space, low external buffers, and rising debt.

Finally, seven countries (Burundi, the Comoros, the Republic of Congo, Gabon, Lesotho, Swaziland, and Zimbabwe) continued to register poor growth performance in 1995–2008 and 2015–18. Their median growth rate decelerated from 2.6 percent in 1995–2008 to 2.1 percent in 2015–18. Some of these countries are oil exporters (the Republic of Congo and Gabon), while some others are categorized as fragile (Burundi and the Comoros). On the one hand, consumption rather than investment drives economic activity in the countries in this group. On the other hand, the performance of the Republic of Congo and Gabon is explained by investment deceleration—which likely reflects lower oil prices. Additionally, some of these countries are facing high debt vulnerability (the Republic of Congo and Zimbabwe).

That the growth recovery for most countries is tied to the fortunes of commodities—international price fluctuations, climatic conditions, and recovery of production—underscores the need for governments in the region to push diversification strategies to the top of the economic policy agenda. Economic growth needs to become less vulnerable to fluctuations in commodity prices. Policies to foster non-resource activities should be implemented, that is, actions to improve the investment climate, infrastructure, and governance. Regional efforts to promote foreign trade, improve connectivity through transport infrastructure, and accelerate access to electricity for Africa’s farms and firms should also be considered.

RISKS TO THE OUTLOOK

More balanced in the near term, but tilted to the downside in the medium term

On the upside, economic activity could strengthen more than envisaged in the United States and the Euro Area—among the region’s largest trade partners—which could generate positive spillovers that would help boost growth in the region through higher exports, investment, and remittances.

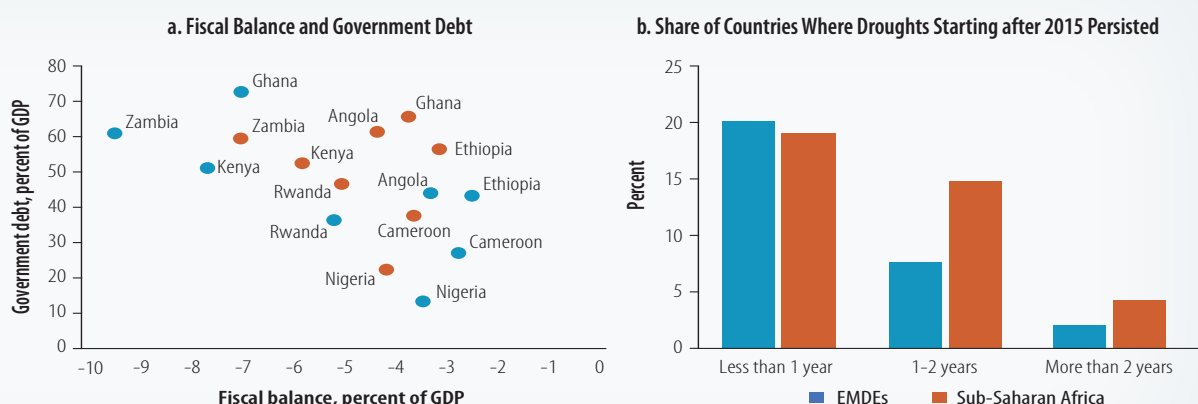
On the downside, a more abrupt tightening cycle than expected could diminish investor appetite for higher-risk assets in some frontier markets. Countries that rely on foreign financing to support large current account deficits are most vulnerable to this risk. A collapse in commodity prices could have a greater impact on sentiment toward Sub-Saharan Africa, given the heavy dependence of many of the region’s economies on commodity exports. A possible trigger could be a slowdown in Chinese growth, given the risks posed by interest rate hikes or trade tensions with the United States. A collapse in oil and metals prices would severely undermine efforts at fiscal consolidation, derailing progress in reining in the region’s debt burden (figure 1.15).

On the domestic front, political transitions have opened opportunities for critical reforms in several major Sub-Saharan African countries—Angola, South Africa, and Zimbabwe—which the new governments have begun to implement. In Angola, a new exchange rate regime has been introduced to address concerns about foreign exchange convertibility in the country. The government also announced policies to streamline investment procedures, reform the oil sector to boost hydrocarbon production, and privatize state-owned enterprises to increase the competitiveness of the non-oil economy. In Zimbabwe, policies that had discouraged investment in the country and harmed growth over the past decade are being repealed. The new government also signaled its commitment to improve the rule of law, protect property rights, and embark on fiscal consolidation. In South Africa, the change in political leadership is expected to allow for progress in addressing the country’s macroeconomic imbalances, and improving the fiscal management and transparency of the large state-owned enterprises as well as the country’s regulatory environment. A faster implementation of these reforms than assumed in the baseline could bolster the long-term growth outlook for these countries.

a. A collapse in oil and metals prices would severely undermine efforts at fiscal consolidation, derailing progress in reining in the region's debt burden

b. Droughts that started after 2015 have lasted longer in Sub-Saharan Africa than in other EMDE regions

FIGURE 1.15: Vulnerability to Shocks



Sources: International Monetary Fund; Emergency Events Database (www.emdat.be, Brussels, Belgium); Université Catholique de Louvain.
Note: In panel a, blue data points represent 2015 values; red data points represent 2018 World Bank forecasts.

On the downside, the risk of an uptick in political tension persists. Potential areas of stress include some of the region's largest economies, such as Ethiopia, due to the recently imposed state of emergency, and Nigeria, as the general election approaches. More broadly, an increase in political disruption could derail countries' reform agendas. The risk of fiscal slippage remains important in the region. Promised reforms to increase domestic revenue mobilization and streamline public expenditures to stabilize government debt in some countries, including Angola, Kenya, and Zambia, might fall short of expectations. The recurrence of droughts poses another significant downside risk. Data indicate that droughts that started after 2015 have lasted longer in Sub-Saharan Africa than in other EMDE regions. A sudden return of drought conditions could severely disrupt the ongoing economic recovery in the region.

Policy makers can shape the outlook and reduce risks through appropriate policy choices

A key macroeconomic challenge is to achieve sustainable fiscal positions, which includes stabilizing high and rising public debt levels in some cases. While the seriousness of this challenge varies across countries, it suggests that policy actions should continue to focus on mobilizing domestic revenue to create fiscal space, increasing the efficiency of public expenditure, and strengthening debt management.

Among the region's largest economies, the forecasts for Nigeria were revised downward. The growth forecasts for 2018 and 2019-20 are 0.4 and 0.5 percentage points lower than in October, respectively, reflecting a slower than previously anticipated recovery in the oil sector due to emerging capacity constraints and continued challenges to growth in the non-oil industrial sectors. The low foreign reserve cover underscores the region's continued vulnerability to terms-of-trade and other exogenous shocks and the need for policy actions to enhance resilience. Fiscal adjustment, supported by monetary policy tightening, will be necessary in some cases.

Structural constraints such as high unemployment rates in some countries and barriers for the private sector to enter sectors dominated by inefficient state-owned enterprises continue to weigh on economic activity. Without significant progress in structural reform, these structural constraints will prevent a faster pick-up in per capita growth and the pace of poverty reduction. Across the region, reforms are particularly needed to lift productivity and help advance economic diversification. Increasing the quantity and quality of infrastructure would be critical to these efforts.

Most industrial commodity prices have strengthened since their early 2016 lows; however, agricultural prices have remained relatively stable (figure B1.1.1). Oil prices have averaged around US\$65 per barrel (bbl) during the first quarter of 2018. Metals prices, which posted large gains last year, have been range-bound during the past few months. The decline in commodity prices since their 2008 and 2011 peaks is also associated with a decline in commodity price volatility, a welcome development from a policy perspective. From a longer-term view, however, real commodity prices are much higher than their lows reached during 1985–2004 or 1998 (figure B1.1.2).

Recent developments and outlook

The agreement between most Organization of the Petroleum Exporting Countries (OPEC) and some non-OPEC oil producers to extend production cuts to the end of 2018 boosted prices in late 2017 and early 2018, which reached US\$66/bbl at the start of the year. Oil demand has also been robust, with consumption estimated to reach 1.4 million barrels per day (mb/d) more in the first quarter of 2018 from a year earlier. However, oil production in the United States is strengthening and expected to surpass its 1970 peak, potentially reaching 11.5 mb/d. The United States, whose oil output surge reflects continuing productivity improvements of its shale industry, is projected to become the world's top producer, above Saudi Arabia and the Russian Federation.

FIGURE B1.1.1: Recent Commodity Price Trends



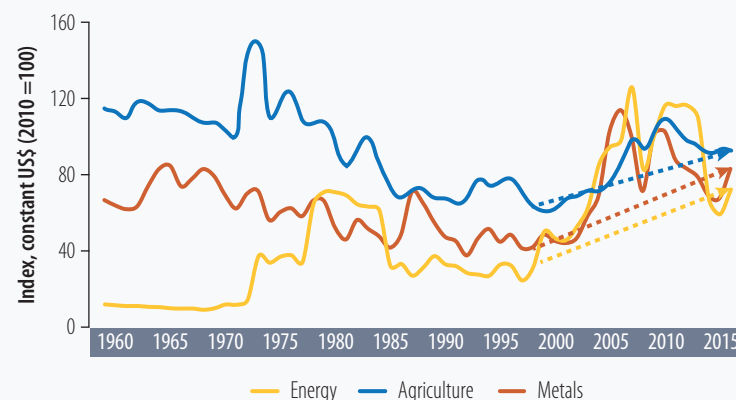
Source: World Bank.

Note: The last observation is February 2018.

BOX 1.1: Commodity Prices: Recent Developments and Prospects

Energy and metals prices have strengthened since their early 2016 lows

FIGURE B1.1.2: Long-Term Commodity Price Trends

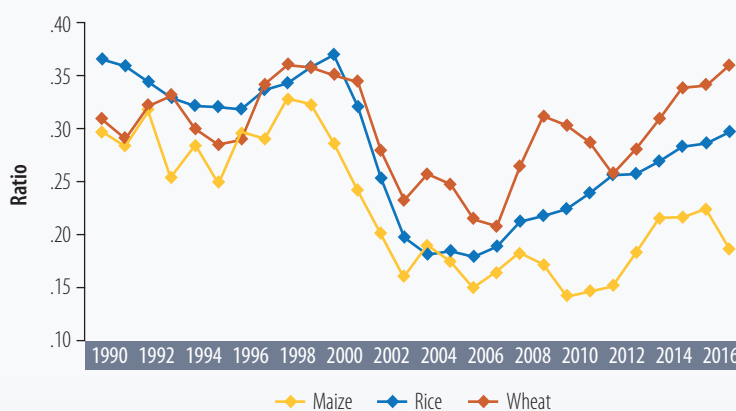


Source: World Bank.

Note: The last observation is February 2018.

Commodity prices are much higher than the 1985–2004 average

FIGURE B1.1.3: Stocks-to-Use Ratios



Source: U.S. Department of Agriculture.

Note: Values are based on the U.S. Department of Agriculture's March 8, 2018 data release.

Stocks-to-use ratios have recovered relative to their lows in 2007

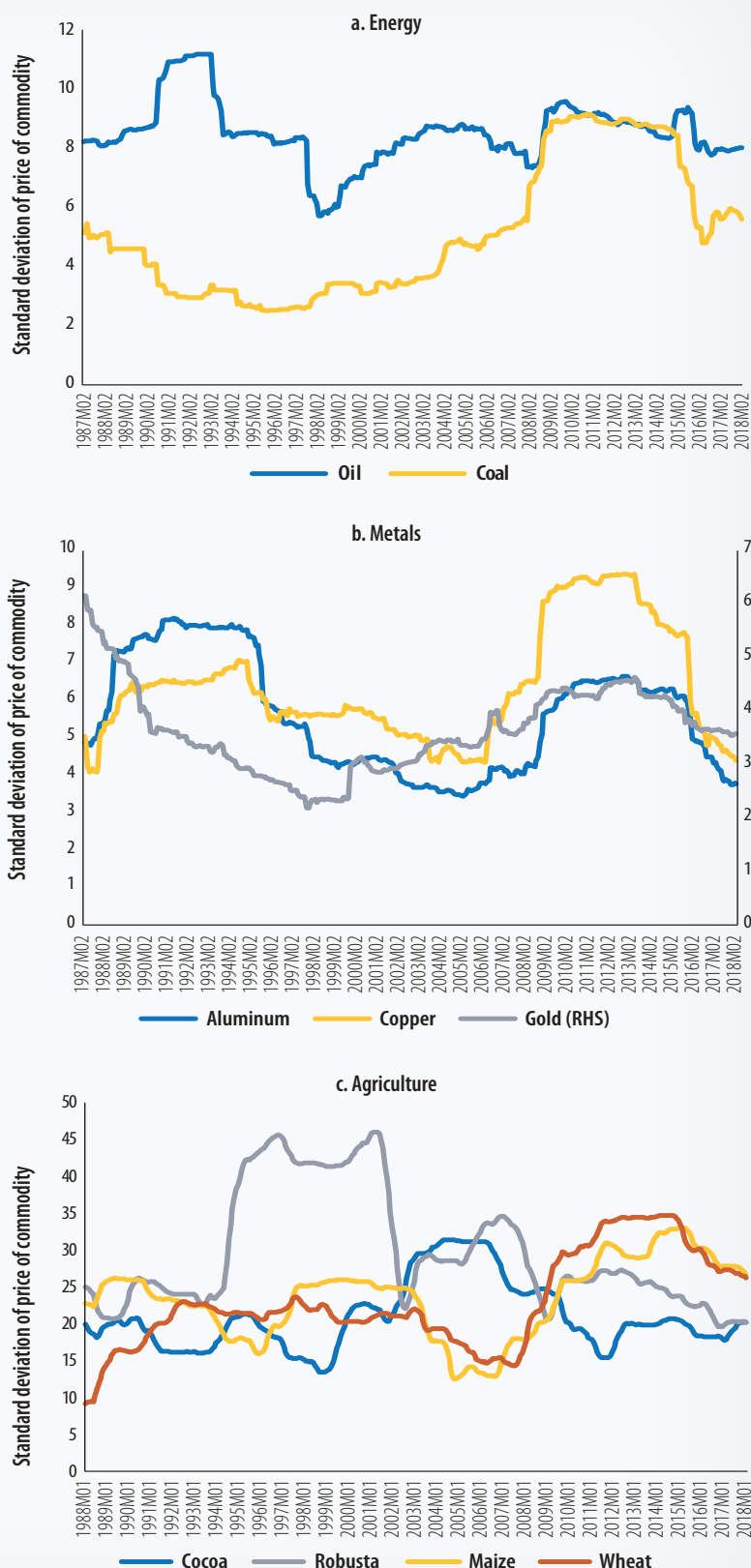
BOX 1.1:
Continued

Oil prices are expected to average US\$62/bbl in 2018 and US\$63/bbl in 2019. Downside risks to prices arise from further technological improvements of the U.S. shale oil industry or a premature end to the OPEC/non-OPEC cuts. Upside price risks primarily arise from geopolitical tensions involving key oil producers in the Middle East and North Africa, or further deterioration of the República Bolivariana de Venezuela's oil industry, whose oil exports have declined by 0.7 mb/d over the past two years.

Metals prices, which increased 22 percent in 2017 due to strong demand and supply cuts in China aiming to contain pollution, have been stable during the first quarter of 2018, as Chinese demand has slowed, and are expected to decline marginally in 2018 and 2019. (China accounts for more than 50 percent of global metals consumption, up from 10 percent two decades ago.) Upside risks to prices include stricter pollution-control policies in China or weak Chinese demand.

Agricultural prices made some marginal gains in early 2018 compared with a year earlier, following three years of price stability. The price uptick was primarily driven by fears of drought-driven supply disruptions in South America, notably in soybeans and wheat in Argentina. Yet, stocks-to-use ratios for most grains—a measure of global supply availability relative to demand—remain high, reducing the likelihood of a food price spike (figure B1.1.3).

FIGURE B1.1.4: Commodity Price Volatility



Source: Staff calculations, World Bank.

Focus on volatility

BOX 1.1:
Continued

There has been a general decline in the volatility of commodity prices after a surge that occurred after the 2008 financial crisis, albeit at different magnitudes for various commodities. This box analyzes price volatility patterns for several commodities, using the standard deviation of returns (first difference of prices) over an eight-year rolling window.

Except for 1990 (the Gulf War), volatility in oil prices was relatively low throughout the sample, ranging between 5.7 and 8.5 (figure B1.1.4a). Volatility rose sharply in 2008, following the financial crisis, and remained high, with a further uptick in 2014 following the oil price plunge—oil price volatility started declining in 2015. Coal prices exhibited low volatility until reaching a record high during the financial crisis, stabilizing for the next six years before plummeting in 2015. Interestingly, the level prevailing at the end of the sample is the same as that before the financial crisis.

The volatility of metals prices, particularly aluminum and copper, rose considerably in 2008 as well (figure B1.1.5b). The downward trend transpired at the same time as the one observed in coal. And, just like in the case of coal, the levels reached in 2018 are the same as those before the crisis. The volatility patterns among the prices of the two metals and coal are remarkably similar, which is not surprising, since they all respond to the same fundamentals, mostly associated with demand from China. The volatility in gold prices has been relatively stable since 1999, with a gradual upturn, followed by a gradual decline starting in 2013.

For agricultural commodity prices, there is a different pattern between beverage commodity prices (namely cocoa and coffee robusta) and grains (maize and wheat, figure B1.1.6c). The only noticeable divergence between cocoa and coffee robusta price volatility occurred in 1994 and 2002. The downward trend in the two series commenced in 2007, with a slight upturn in 2009 for coffee robusta. The patterns observed for maize and wheat resemble those for metals and coal. The different volatility patterns of coffee and cocoa reflect that they are both tree crops and global production is dominated by a few players (Brazil and Vietnam for the former and Côte d'Ivoire and Ghana for the latter), implying that weather patterns and policy choices have a large impact on the prices of these commodities.

Table B1.1.1 summarizes the volatility measure for various commodity prices, including energy (oil and coal), metals (aluminum, copper, and gold), and agricultural commodities (cocoa, maize, coffee robusta, and wheat). Volatility in commodity prices was generally higher in 2008–12, a reflection of the heightened uncertainty during the global financial crisis. It appears that price volatility for most commodities returned to its long-term average after 2013.

TABLE B1.1.1: Volatility of Commodity Prices, 1980–2018

Period	Energy		Metals			Agriculture			
	Coal	Oil	Aluminum	Copper	Gold	Cocoa	Maize	Robusta	Wheat
1980–2018	5.09	8.54	5.58	6.33	3.62	20.93	23.55	29.68	22.96
2008–12	8.64	8.93	5.95	8.69	4.29	20.29	25.61	25.63	29.38
2013–18	7.09	8.45	5.41	6.79	3.96	19.45	30.03	22.68	30.89

Source: Staff calculations.

Note: Price volatility is calculated as the standard deviation of returns over an eight-year (96-month) rolling window as follows: $\text{Vol}(P) = \text{STDEV}[\log p(t) - \log p(t-1)]$, where STDEV denotes standard deviation, $p(t)$ is the price of the commodity in period t , $p(t-1)$ is the price of the commodity in period $t-1$, and \log represents the natural logarithm.

Section 2: Emerging Fiscal and Debt Risks in Sub-Saharan Africa¹

The widening primary deficits in Sub-Saharan Africa in the post-global financial crisis period, weaker currencies, and rising borrowing costs—along with poorer growth prospects—are creating perverse dynamics of debt accumulation that might jeopardize public debt sustainability. This section looks at the behavior of the different categories of government revenues and expenditures, with the goal of understanding whether recent patterns of revenues and expenditures in the region might exacerbate or mitigate the sustainability risks. It also examines how the dynamics and composition of public debt have changed in recent years.

The analysis shows that, on average, countries in the region have levels of noninterest government expenditure that are greater than the tax revenue collected in the post-2009 period. At the same time, interest payments are larger than nontax revenues, thus contributing to a deficit in the primary and overall balance of the government. The main contributors to tax revenues and their increase in the post-2009 period are taxes on goods and services among non-resource rich countries and taxes on income, profits, and capital gains for resource rich countries. On the one hand, given their sensitivity to economic activity, a growth deceleration may be associated with a more than proportional deceleration in the collection of these taxes. On the other hand, expenditures on goods and services as well as compensation of employees are the largest components of noninterest expenditure in the region. These expenditures exhibit pro-cyclicality in many countries. In sum, growth deceleration would reduce tax revenues at a faster pace than government expenditures—which are primarily earmarked.

Larger fiscal deficits are contributing to rising public debt levels in the region, among other factors. From 2013 onward, the dynamics and composition of public debt changed significantly. Public debt increased from an average of 37 percent of gross domestic product (GDP) in 2013 to 56 percent in 2016, with more than two-thirds of the countries experiencing an increase of more than 20 percentage points. Debt sustainability risks in the region have increased significantly over the past few years, with 18 countries at high risk of debt distress as of March 2018, compared with eight in 2013. The composition of public debt has changed, away from traditional toward new sources of financing. The share of concessional and multilateral lending is on a clear downward trend, and by 2016 the bulk of bilateral lending was provided by non-Paris Club creditors. Market-based external debt has emerged as a new source of financing for several lower-middle-income countries (LMICs), but also low-income countries (LICs). Although international bond issuances allow countries to diversify their investor base and complement multilateral and bilateral financing, large (bullet) repayments from 2021 on constitute significant refinancing risk for the region.

2.1 GOVERNMENT REVENUES AND EXPENDITURES IN THE POST-CRISIS PERIOD

Volume 16 of *Africa's Pulse* documented the behavior of the primary balance and fiscal space in Africa since 2000 (World Bank 2017a). Several stylized facts emerged from this analysis. (i) The region as a whole registered a primary surplus in the run-up to the global financial crisis. Sub-Saharan Africa was running a

¹ This subsection draws on a background paper, "Emerging Fiscal Risks in Sub-Saharan Africa," prepared by Cesar Calderon and Punam Chuhan-Pole.

median primary surplus of 0.6 percent of GDP during 2006–08. (ii) Countercyclical spending undertaken amid the global financial crisis shifted the region's primary surplus in 2006–08 into a primary deficit of 2.2 percent of GDP in 2009–10. (iii) Primary deficits in Sub-Saharan Africa initially narrowed in 2011–12 (to a median deficit of about 1.2 percent of GDP) but widened later amid the collapse of international commodity prices (to a median primary deficit of 2.2 percent of GDP in 2016).

The idea is to examine how the patterns of revenues and expenditures in the region are affecting sustainability. To accomplish this task, annual information was collected on the different categories of revenues and noninterest expenditure for 24 countries in the region with more than 10 consecutive annual observations from 1990 to 2015.² Total revenues of the central government are distinguished between tax revenues and nontax revenues (that is, grants and other revenues). In the former group, the main data source (World Development Indicators) distinguishes four categories: (i) taxes on goods and services; (ii) taxes on income, profits, and capital gains; (iii) taxes on international trade and transactions; and (iv) other taxes (including property income, interest, fines, penalties, and forfeits, among others). Noninterest government expenditure comprises the following: (i) goods and services (used for the production of market and nonmarket goods and services plus goods purchased for resale less the net change in inventories of work in progress, finished goods, and goods held for resale), (ii) compensation of employees (wages and salaries and social contributions), (iii) subsidies and other transfers, and (iv) other expenses (including property expenses other than interest).

How did revenues and expenditures behave in the post-global financial crisis period?

Figure 2.1 depicts the behavior of tax revenues in Sub-Saharan Africa for the region and for the groups of non-resource rich, resource rich, and fragile countries. Figure 2.1a plots the level of tax revenues (expressed as a percentage of GDP) for 2010–12 and 2013–15. Figure 2.1b shows the changes in tax revenues (in percentage points of GDP) between these two periods. As primary balances deteriorated in 2013–15 vis-à-vis 2010–12, how did revenues behave?

First, government revenues for the region as a whole grew by about 1 percentage point of GDP in 2013–15 relative to 2010–12 (from 15 to about 16 percent of GDP). There were some changes in the composition of revenues: revenues from taxes on goods and services increased and those from taxes on international trade declined.

Second, tax revenues as a percentage of GDP increased in 2013–15 vis-à-vis 2010–12 for non-resource rich and resource rich countries, with the pace of increase being faster among the former group. Tax revenues among non-resource rich countries grew by 2.7 percentage points of GDP over the earlier period, while those of resource rich countries only increased by 1.5 percentage points of GDP. By 2013–15, domestic resource mobilization (as proxied by the tax-to-GDP ratio) was higher among non-resource rich countries than among resource rich countries (19.4 and 14.5 percent of GDP, respectively).

Third, the sources of tax increases differed between non-resource rich countries and resource rich countries. The bulk of the tax revenue increases among non-resource rich countries came from taxes on

2 The sample of 24 Sub-Saharan African countries includes: Angola, Burundi, Benin, Burkina Faso, Botswana, Côte d'Ivoire, Democratic Republic of Congo, Republic of Congo, Ethiopia, The Gambia, Lesotho, Madagascar, Mali, Mauritius, Namibia, Nigeria, Senegal, Sierra Leone, São Tomé and Príncipe, Swaziland, the Seychelles, Togo, South Africa, and Zambia.

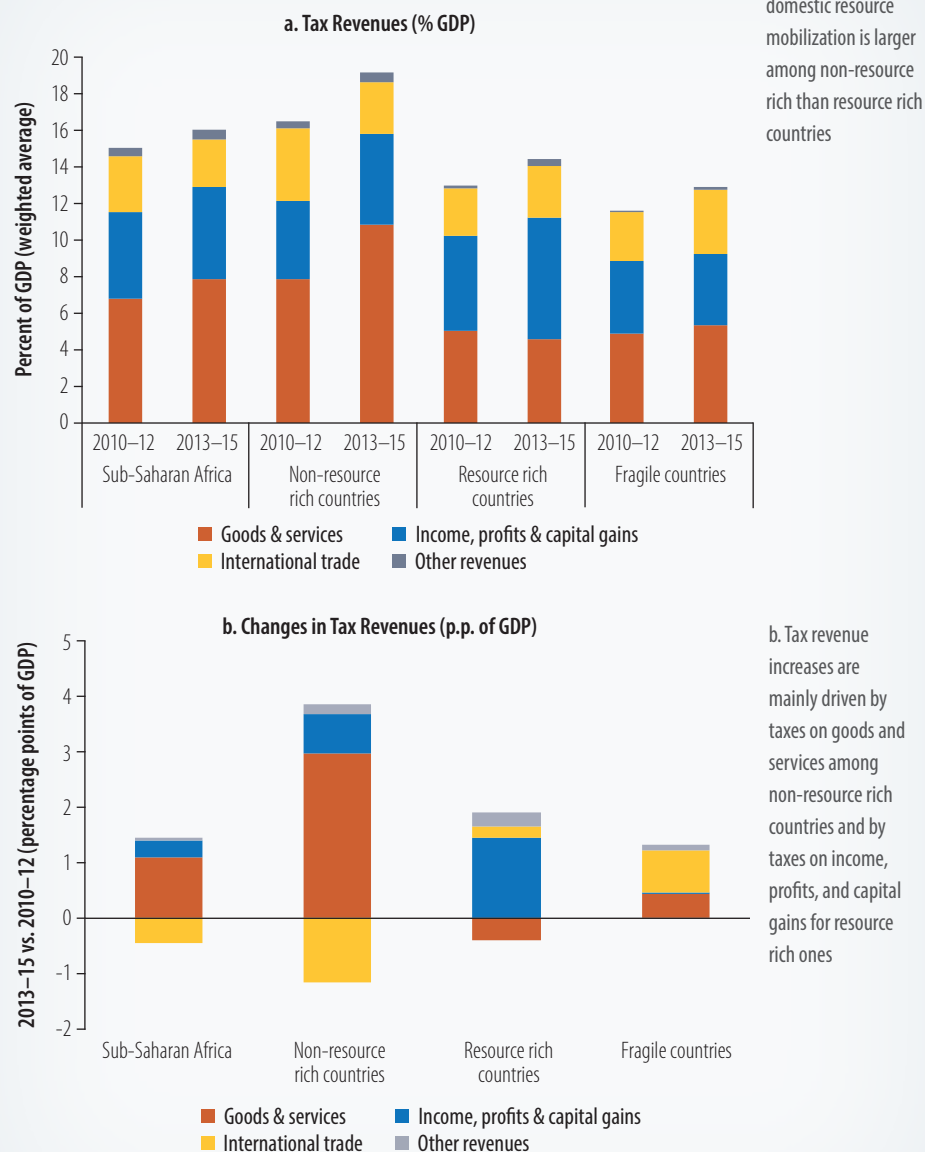
goods and services.³ This category includes value-added taxes, general sales taxes, single-stage and cumulative multistage taxes, excises, and others. The increase in tax revenues among resource rich countries was mainly driven by taxes on income, profits, and capital gains—which includes taxes levied on salaries, interest, dividend and royalty incomes, profits of corporations, and others.⁴

Finally, tax revenues among fragile states grew by about 1.3 percentage points of GDP during 2013–15 vis-à-vis 2010–12. The bulk of the tax increases is attributed to taxes on international trade (which includes customs and other import duties and taxes on exports) and, to a lesser extent, revenues from taxes on goods and services. On average, tax revenues were about 13 percent of GDP in 2013–15.

Figure 2.2 depicts the behavior of noninterest government spending in Sub-Saharan Africa—including groups of countries

classified according to their extent of natural resource abundance and condition of fragility. Analogously to figure 2.1, figure 2.2a, reports the levels of government expenditure excluding interest payments as a percentage of GDP for 2010–12 and 2013–15. Figure 2.2b, decomposes the variation in government expenditure-to-GDP into four categories (goods and services, compensation of employees, subsidies and other transfers, and other expenses). The data shed light on how the pattern of fiscal expenditures in the two periods under study has changed.

FIGURE 2.1: Composition of Tax Revenues in Sub-Saharan Africa



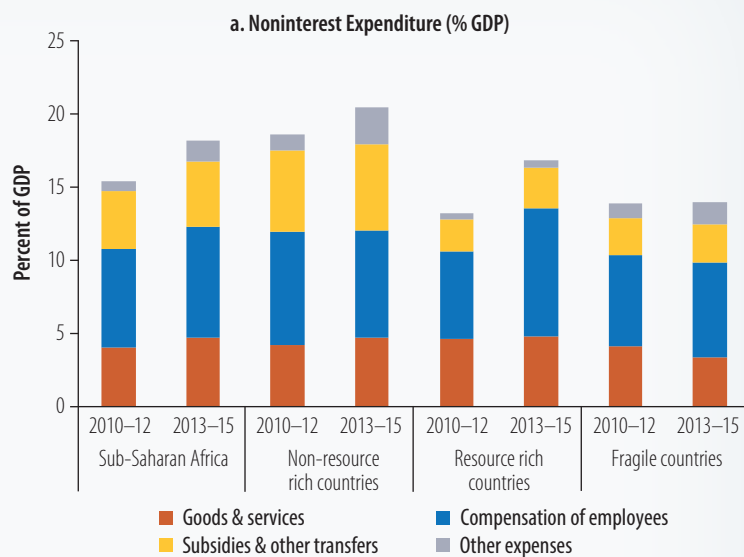
Source: World Bank World Development Indicators.
Note: The figures reported are population-weighted averages.

³ Taxes on goods and services are all taxes levied on the production, extraction, sale, transfer, leasing, or delivery of goods and rendering of services. They also include taxes on the use of goods and on permission to use goods or perform activities.

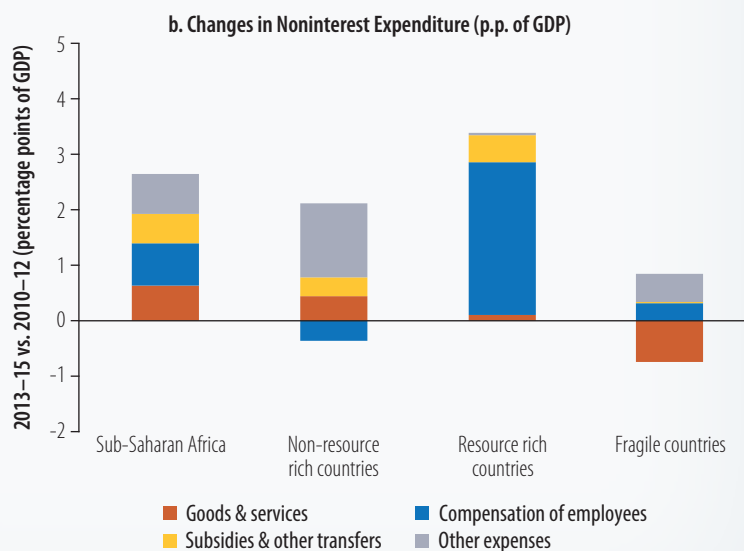
⁴ More specifically, taxes on income, profits, and capital gains include taxes levied on (i) wages, salaries, tips, fees, commissions, fringe benefits, and other compensation for labor services; (ii) interest, dividends, rent, and royalty incomes; (iii) capital gains and losses, including capital gain distributions of investment funds; (iv) profits of corporations, partnerships, sole proprietorships, estates, and trusts; (v) taxable portions of social security, pension, annuity, life insurance, and other retirement account distributions; and (vi) miscellaneous other income items.

a. The levels of noninterest government expenditure are larger among non-resource rich than resource rich countries

FIGURE 2.2: Composition of Noninterest Government Expenditure in Sub-Saharan Africa



b. The large increase in primary government expenditure among resource rich countries is primarily driven by public wages



Source: World Bank World Development Indicators.

Note: The figures reported are population-weighted averages.

First, noninterest government expenditure in Sub-Saharan Africa increased, on average, from 15.4 percent of GDP in 2010–12 to 18.3 percent of GDP in 2013–15—thus implying that primary government spending grew by 2.8 percentage points of GDP in 2013–15 vis-à-vis 2010–12. For the region as a whole, this increase was experienced across all categories, with the largest contribution coming from compensation of employees (0.82 p.p. of GDP) and other expenses (0.77 p.p. of GDP).

Second, noninterest government expenditure is larger among non-resource rich countries than among resource rich ones: it represents 20.5 percent of GDP for the former group and 16.9 percent of GDP for the latter group in 2013–15. Additionally, noninterest government spending grew in 2013–15 compared with 2010–12. It increased by 1.9 percentage points of GDP for non-resource rich countries and 3.6 percentage points for resource rich countries.

The bulk of the increase in expenditures among resource rich countries is explained by compensation of employees (public wages); the change in expenditure among non-resource rich countries is attributed to other expenses. The largest expenditure category as a percentage of GDP is compensation of employees in resource rich and non-resource rich countries (at 8.8 and 7.3 percent of GDP in 2013–15, respectively).

Finally, fragile countries have the lowest level of noninterest government expenditure (14 percent of GDP in 2013–15). Their level of government expenditure barely increased in 2013–15 relative to 2010–12 (about 0.1 percentage point of GDP). Looking at the composition of expenditure, the decline in expenditure on goods and services is largely offset by increases in the other expenditure categories.

Cyclical Properties of the Revenue and Expenditure Categories in Sub-Saharan Africa

Breaking with history, countercyclical government expenditures amid the 2008–09 global financial crisis were part of the fiscal policy toolkit of Sub-Saharan African countries. The key to this change in behavior was the presence of fiscal space to finance countercyclical actions among countries in the region. In turn, this broader space was attributed, among other things to: (i) adequate policy buffers (especially higher public savings among resource abundant countries), (ii) lower public debt burden among countries in the region (especially among Heavily Indebted Poor Countries), and (iii) access to global capital markets (thanks to global investors searching for yields).

The countercyclical expenditure undertaken by Sub-Saharan African countries in the downturn were not met by measures to rein in spending and boost revenues when growth in the region resumed—especially among countries that managed to generate growth momentum. The plunging international prices of extractives (energy, minerals, and metals) sharply reduced government revenues in resource rich countries, thus cutting back the amount of resources to finance government expenditure. Most countries in the region now face the need to implement fiscal consolidation measures to reduce fiscal imbalances and stabilize government debt (Calderon, Chuhan-Pole, and Some 2017).

Short-run fiscal policies are typically designed to stabilize economic activity. However, the evidence shows that fiscal policy has been pro-cyclical across countries in Sub-Saharan Africa and over time, and that this pro-cyclical bias is influenced by structural and policy factors. For instance, fiscal policy pro-cyclicality is exacerbated by: (i) lower foreign aid and fiscal space (Lledó, Yackovlev, and Gadenne 2011), and (ii) weak governance (Calderón and Nguyen 2016; Calderon, Chuhan-Pole, and Lopez-Monti 2017).

Pro-cyclical bias in fiscal policy may not only destabilize economic activity, but also hinder the capacity to repay debt, as growth prospects are less favorable, currencies weaken, and borrowing costs increase as imbalances continue to widen. The aim is to investigate the cyclical properties of the categories of revenues and expenditures in Sub-Saharan Africa. To accomplish this task, annual data on fiscal indicators and the level of economic activity for 24 Sub-Saharan African countries from 1990 to 2015 are used. The sample is restricted to countries with at least 10 annual consecutive years of data.

Cyclical Stance of Government Revenues and Expenditures in Sub-Saharan Africa

Table 2.1 reports the coefficient of output growth from a basic regression that runs the growth rate of the fiscal indicator on output growth and the lagged dependent variable. The table shows the pooled least squares and fixed effects and time effects estimators. The regression results are summarized below.

First, total revenues and tax revenues have a positive and significant coefficient regardless of the method of estimation used. This implies that tax revenues tend to increase (decline) in periods of upswing (downswing) of economic activity in Sub-Saharan Africa. The estimates presented in table 2.1 suggest that an increase in the growth rate of GDP by 100 basis points is associated with an increase in the growth rate of tax revenues of 143-159 basis points.

TABLE 2.1: Cyclicality of Fiscal Revenues and Expenditures in Sub-Saharan Africa

	Pooled Least Squares		Fixed + Time Effects	
	d ln(GDP) Coeff.	Standard Deviation	d ln(GDP) Coeff.	Standard Deviation
Total revenues	1.3311	(0.323) **	1.5016	(0.387) **
Tax revenues	1.4346	(0.285) **	1.5916	(0.343) **
Goods & services	1.1576	(0.376) **	1.8388	(0.444) **
Income, profits & capital gains	0.9022	(0.443) **	1.3333	(0.486) **
Trade	1.4285	(0.417) **	1.8548	(0.438) **
Other tax revenues	2.0191	(2.030)	1.6861	(2.504)
Grants and other revenues	1.7232	(1.202)	1.4425	(1.337)
Noninterest expenditure	0.9665	(0.301) **	1.0789	(0.265) **
Goods & services	0.9948	(0.426) **	1.0958	(0.428) **
Compensation of employees	0.5468	(0.351)	0.7132	(0.271) **
Subsidies and other transfers	2.6101	(1.641)	1.8868	(2.000)
Other expense	25.9612	(28.187)	12.4367	(14.485)
Country effects	No		Yes	
Time effects	No		Yes	

Note: ** (*) implies statistical significance at the 5 (10) percent level. The regression analysis includes the lagged dependent variable.

Dependent Variable: Fiscal indicator (constant prices, growth rates). Sample: 24 SSA countries, 1990-2015 (annual).

Second, taxes on goods and services; taxes on income, profits, and capital gains; and taxes on international trade also enter with a positive and significant coefficient, irrespective of the method of estimation. The sensitivity of tax revenues to fluctuations in economic activity is larger among international trade taxes and the smallest among taxes on income, profits, and capital gains. For instance, an increase in GDP growth by 100 basis points is associated with an increase in the growth rate of taxes on income, profits, and capital gains of 90-133 basis points. A similar increase in the growth rate would be related to an increase in the growth of international trade tax revenues of 143-185 basis points.

Third, there is a positive and significant relationship between the growth rate of noninterest government expenditure and the rate of GDP growth. This statistical relation is robust to the different methods of estimation. The estimates suggest that a hike in the GDP growth rate of 100 basis points is associated with an increase in the growth of spending of 97-108 basis points.

Fourth, the different categories of noninterest government expenditure do not necessarily enter with a significant coefficient (although the coefficient is positive). In some cases, the significance depends on the method of estimation. Focusing on the method that accounts for fixed and time effects, only two categories of expenditure exhibit a positive and significant relationship: spending on goods and services and compensation of employees. When fixed and time effects are accounted for, the estimates in table 2.1 suggest that an increase of 100 basis points in the rate of growth of GDP would be associated with an increase of 110 basis points in the growth rate of spending on goods and services. An analogous increase in the growth rate is related to an increase in the growth rate of public wages of about 70 basis points.

Table 2.2 explores the possible sensitivity of the cyclical properties of revenues and expenditures in Sub-Saharan Africa to: (i) natural resource abundance, and (ii) post-global financial crisis patterns of behavior. The table only reports the estimates that account for fixed and time effects.

TABLE 2.2: Cyclicalities of Fiscal Revenues and Expenditures in Sub-Saharan Africa: Natural Resources and Post-Global Financial Crisis

	Natural Resources		Time Variability	
	d ln(GDP)	d ln(GDP) x Nat. Res	d ln(GDP)	d ln(GDP) x D(2010-5)
Total revenues	1.0121 ** (0.463)	0.5357 (0.519)	1.5452 ** (0.435)	-0.3015 (0.656)
Tax revenues	1.5466 ** (0.390)	0.0491 (0.399)	1.5836 ** (0.384)	0.0557 (0.667)
Goods & services	2.6579 ** (0.737)	-0.9047 (0.639)	1.9087 ** (0.487)	-0.4780 (1.014)
Income, profits & capital gains	0.9651 * (0.585)	0.4001 (0.531)	1.0855 ** (0.529)	1.6843 * (0.956)
Trade	2.5464 ** (0.553)	-0.7526 * (0.413)	1.9406 ** (0.473)	-0.5968 (1.080)
Other tax revenues	6.2262 (4.361)	-4.7554 * (2.936)	2.1488 (2.627)	-4.0754 (7.600)
Grants and other revenues	1.4316 (1.846)	0.0120 (1.637)	2.0422 (1.472)	-4.2384 (3.210)
Noninterest expenditure	1.1159 ** (0.404)	-0.0410 (0.329)	1.1933 ** (0.297)	-0.7326 (0.513)
Goods & services	1.1551 ** (0.580)	-0.0646 (0.663)	1.1843 (0.476)	-0.6027 (0.851)
Compensation of employees	0.9167 ** (0.403)	-0.2224 (0.298)	0.7837 ** (0.301)	-0.4751 (0.463)
Subsidies and other transfers	2.8518 (3.144)	-1.0426 (2.224)	2.4268 (2.560)	-3.2500 (4.471)
Other expense	32.3042 (36.096)	-19.9914 (25.077)	20.7174 (21.839)	-40.7987 (45.377)

Note: ** (*) implies statistical significance at the 5 (10) percent level. The regression analysis includes the lagged dependent variable.

Dependent Variable: Fiscal indicator (constant prices, growth rates). Sample: 24 SSA countries, 1990-2015 (annual).

Resource Abundance

Compared with the baseline regression in table 2.1, the specification of the regression equation now introduces an interaction term between the rate of growth of GDP and a dummy that takes the value 1 (2) for non-oil (oil) abundant countries, and 0 for non-resource abundant countries. Table 2.2 (columns 1 and 2) reports the regression coefficients of GDP growth alone and its interaction with a dummy for natural resources.

The regression estimates in table 2.2 point to a positive and significant coefficient for total revenues; tax revenues; taxes on goods and services; taxes on income, profits, and capital gains; and international trade taxes in Sub-Saharan Africa. This points to the pro-cyclical behavior of the different categories of taxes in African countries. Examining the interaction, the coefficient estimate is negative and significant

for international trade taxes. This finding implies that the sensitivity of taxes on international trade to output fluctuations is higher among non-resource rich countries than among resource rich ones, and it is relatively smaller among oil abundant countries.⁵

For noninterest government expenditure and its categories, the coefficient estimates are positive and significant for noninterest expenditure, expenditure on goods and services, and public wages (compensation of employees). Additionally, the interaction coefficient fails to be significant. This implies that: (i) expenditures on goods and services and public wages are pro-cyclical and their sensitivity to the cycle is similar for non-resource rich countries and resource rich countries, and (ii) subsidies and other transfers (as well as other expenses) appear to exhibit cyclical behavior.

Cyclical Stance of Taxes and Revenues over Time

Compared with the baseline regression in table 2.1, the specification in table 2.2 (columns 3 and 4) is augmented by an interaction term between the rate of growth of GDP and a dummy that takes the value 1 for the post-global financial crisis period (that is, 2010–15) and 0 otherwise. That is, the regression tests whether the cyclical properties of the different types of revenues and expenditures in the region changed after the global financial crisis.

Examination of the coefficient estimate of real GDP growth indicates that noninterest expenditure and public wages remain pro-cyclical (that is, they have a positive and significant coefficient for GDP growth), while the coefficients of the other three categories of expenditure (goods and services, subsidies and transfers, and other expenses) fail to be statistically significant. The coefficient of the interaction term is negative but fails to be significant for all the expenditure categories. The sign of the interaction coefficient points to a reduction in the pro-cyclicality of spending, but the sensitivity in 2010–15 fails to be statistically different from that during 1990–2009.

Heterogeneity in the Cyclical Stance of Taxes and Revenues across Countries in the Region

It is likely that differences in the cyclical stance of taxes and revenues in the region can be found at the country level. The literature argues that cross-country differences in access to external borrowing or in the level of institutional quality, among others, may explain those differences.

Figure 2.3 plots the correlation between growth of GDP and growth of: (i) tax revenues; (ii) taxes on goods and services; (iii) taxes on income, profits, and capital gains; and (iv) taxes on international trade. This correlation coefficient is computed for 24 countries in the region with annual information from 1990 to 2015. All the variables involved in the correlation analysis are expressed in log differences.

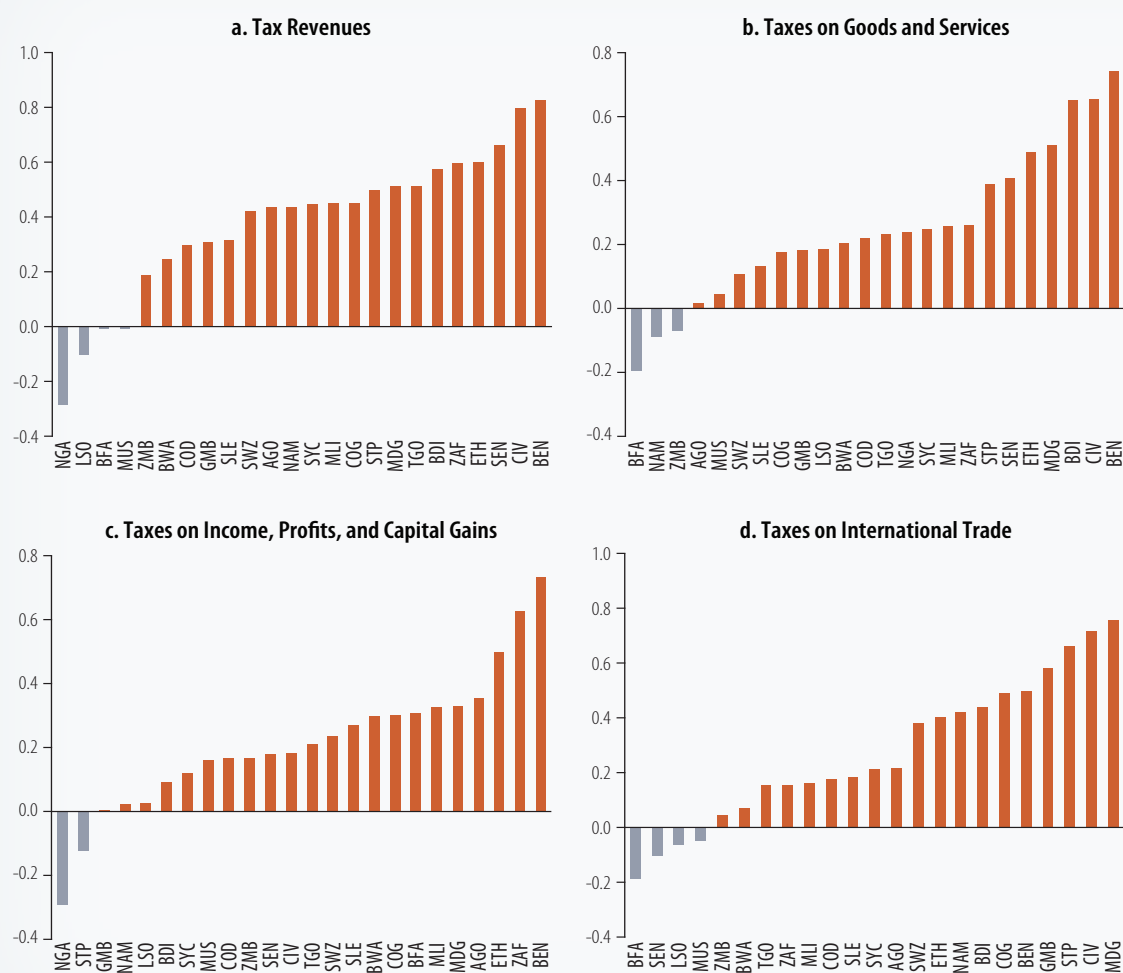
Figure 2.3 shows that tax revenues are positively correlated with output in 20 of the 24 countries, and those positive correlations fluctuate between 0.19 (Zambia) and 0.83 (Benin). The median value of the 20 positive coefficients of correlation is 0.46 (Republic of Congo). This implies that for the majority of

⁵ The regression estimates suggest that the sensitivity of international trade tax revenues on output fluctuations for non-resource rich countries is higher than that for non-oil resource rich and oil resource rich countries.

countries in the region, tax revenues (in real terms) increase when there is a boom in economic activity and tend to decline when there is a recession.

Analogously, the majority of countries in the region (between 19 and 21) exhibit a positive correlation between growth of GDP and the rate of growth of the three categories of tax revenues. The median positive correlations across countries in the region are 0.24 for taxes on goods and services (Nigeria); 0.22 for taxes on income, profits, and capital gains (Togo and Swaziland); and 0.38 for taxes on international trade (Swaziland).

FIGURE 2.3: Cyclicalities of Revenues across Sub-Saharan Africa: 24 Countries, 1990–2005 (annual)
(correlation between the growth rate of GDP and the growth rate of tax revenue categories)



For most countries in Sub-Saharan Africa, tax revenues are procyclical. They tend to increase during upswings and decline during downswings.

Source: World Bank World Development Indicators.

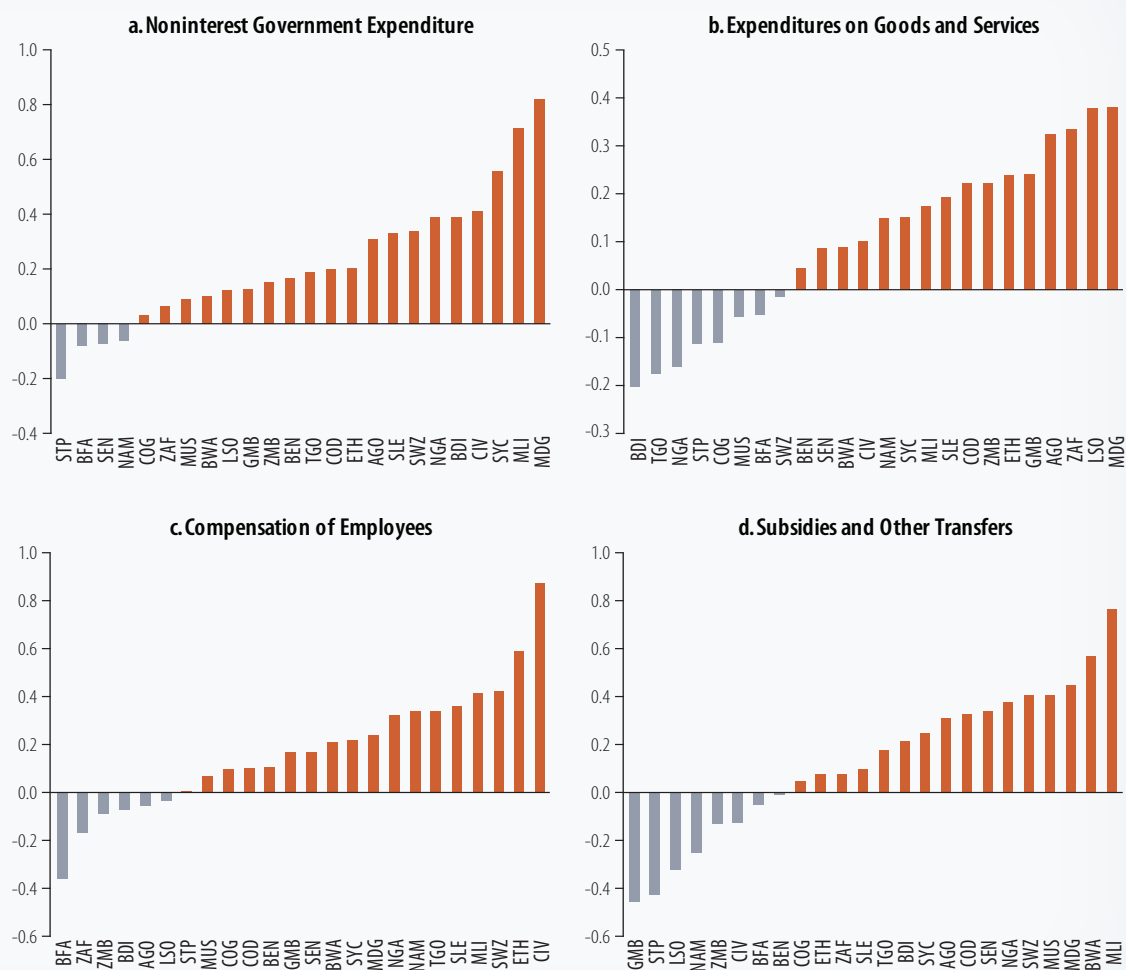
Note: The figures report the country correlation between the growth rate of GDP and the growth rate of the corresponding tax revenue category in real terms.

Figure 2.4 plots the correlation between growth of GDP and growth of: (i) noninterest government expenditure, (ii) spending on goods and services, (iii) compensation of employees, and (iv) subsidies and other transfers. Again, output and expenditure indicators are in real terms and expressed in log differences. The correlation between growth in real GDP and that of noninterest government spending is pro-cyclical for 20 countries and countercyclical for four countries in the region. The median correlation for the countries with countercyclical noninterest expenditure is -0.08 (Senegal), and that for countries with pro-cyclical bias is 0.21 (Democratic Republic of Congo and Ethiopia).

For expenditures on goods and services, about 16 of the 24 countries exhibit a pro-cyclical stance over the past 25 years. The median correlation for the eight countries with countercyclical behavior is -0.11 (Republic of Congo and Namibia), and that of the 16 countries with pro-cyclical behavior is 0.21 (Democratic Republic of Congo and Zambia). Spending on goods and services is the most pro-cyclical in Lesotho and Madagascar, with a correlation coefficient close to 0.4.

Government expenditure is pro-cyclical for most countries in the region

FIGURE 2.4: Cyclicity of Expenditures across Sub-Saharan Africa, 24 Countries, 1990–2005 (annual)
(correlation between the growth rate of GDP and the growth rate of expenditure categories)



Source: World Bank World Development Indicators.

Note: The figures report the country correlation between the growth rate of GDP and the growth rate of the corresponding expenditure category in real terms.

For 18 of the 24 countries in the sample, public wages exhibit pro-cyclical behavior. The median correlation for the six countries that exhibit countercyclical behavior is 0.083 (Burundi and Zambia), and that of the 18 countries with pro-cyclical behavior is 0.23 (the Seychelles and Madagascar). The countries in the region with the greatest positive correlation between growth of public wages and that of real GDP are Côte d'Ivoire (0.88) and Ethiopia (0.6).

Finally, the behavior of subsidies and other tariffs is countercyclical for eight countries and pro-cyclical for 16 countries. The median correlation for the eight countercyclical countries is -0.2 (Zambia and Namibia), and for the 16 pro-cyclical countries it is 0.32 (Angola and Democratic Republic of Congo). This correlation exceeds 0.5 for Botswana and Mali (0.57 and 0.77, respectively).

On average, countries in the region have levels of noninterest government expenditure that are greater than the tax revenue collected. At the same time, interest payments are larger than nontax revenues, thus contributing to a deficit both in the primary and overall balance of the government. The main contributors to tax revenues and to their increase in the post-2009 period are taxes on goods and services among non-resource rich countries and taxes on income, profits, and capital gains for resource rich countries. On the one hand, lower growth prospects and lower commodity prices may hurt the amount collected from these taxes. And given their sensitivity to economic activity, a growth deceleration may be associated with a more than proportional deceleration in the collection of these taxes. On the other hand, expenditures on goods and services as well as compensation of employees are the largest components of noninterest expenditure in the region. While public wages among non-resource rich countries declined as a percentage of GDP, they exceeded 7 percent of GDP in 2013–15. For resource rich countries, the increase in noninterest government expenditure is primarily driven by public wages and they were on average close to 9 percent of GDP in 2013–15. A large portion of government expenditure is earmarked (if we also consider interest payments). In sum, growth deceleration would reduce tax revenues at a faster pace than government expenditures—which are primarily earmarked. Larger deficits, as argued in this report, are contributing to rising public debt stocks.

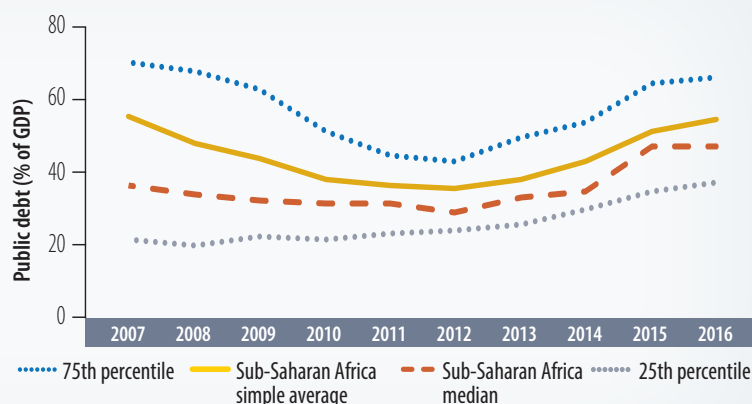
2.2 DEBT TRENDS AND EMERGING RISKS IN SUB-SAHARAN AFRICA

Sub-Saharan Africa's average public debt level was on a downward trajectory until 2012. Throughout the end of the 1990s and the 2000s, 30 African LICs benefitted from more than US\$100 billion in nominal debt relief provided under the Heavily Indebted Poor Country (HIPC) and Multilateral Debt Relief Initiatives (MDRI). Average public debt levels in Sub-Saharan Africa therefore declined until 2012.

From 2013 onward, the dynamics and composition of public debt changed significantly (figure 2.5). Between 2012 and the end of 2016, public debt in the region increased from 37 to 56 percent of GDP on average. More than two-thirds of the countries in Sub-Saharan Africa saw their public debt relative to GDP rise by more than 10 percentage points, while one-third of the countries experienced an increase of more than 20 percentage points. And the composition of public debt changed significantly. Countries shifted away from traditional concessional sources of financing, toward more market-based and domestic debt. The share of multilateral and concessional debt declined and the share of non-Paris Club debt increased.

Reversing a declining trend, public debt increased from 37 to 56 percent of GDP between 2013 and 2016

FIGURE 2.5: Public Debt Trends



Sources: World Bank; IMF World Economic Outlook Database, October 2017.

The fast and broad-based debt re-accumulation since 2013, and the increasing exposure to market risks raises concerns about debt sustainability. The number of Sub-Saharan African countries at high risk of debt distress, based on the LIC Debt Sustainability Framework (DSF), more than doubled between 2013 and 2018.

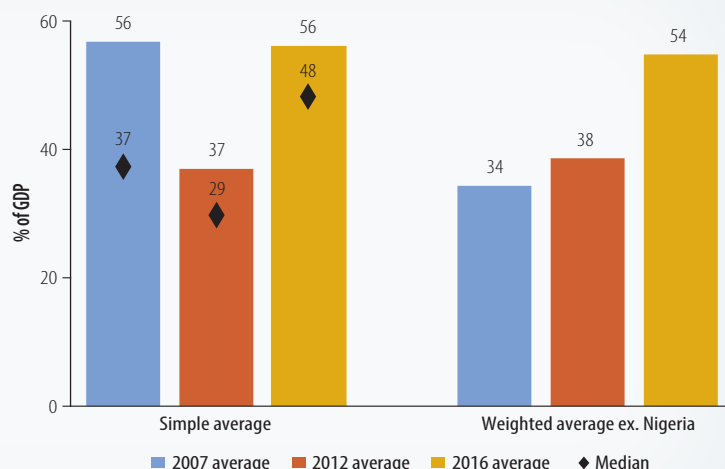
This section discusses key trends in the changing debt dynamics in Sub-Saharan Africa. The analysis

is based on a set of 45 countries.⁶ For each of these countries, public debt refers to general government gross debt. Public debt is evaluated at three points in time: 2007, after the delivery of the first wave of debt relief under HIPC and MDRI to 17 of 30 countries; in 2012, after the financial and economic crisis and the last year before the dynamics changed noticeably and on a broad basis; and in 2016, for which the most recent data for most of the countries are available.⁷

The subsections that follow (i) discuss public debt dynamics by country classification and identify fast borrowers, (ii) identify drivers of public debt, (iii) analyze the changing currency composition, and (iv) highlight emerging risks.

Public debt relative to GDP increased sharply on average between 2012 and the end of 2016

FIGURE 2.6: Public Debt in Sub-Saharan Africa



Sources: World Bank; IMF World Economic Outlook Database, October 2017.

Public Debt Dynamics

Public debt has been rising across all income groups in the region, with the largest increase recorded by LMICs. Between 2012 and 2016, average public debt as a percentage of GDP in Sub-Saharan Africa climbed from 37 to 56 percent, and median public debt increased from 29 to 48 percent (figure 2.6).⁸ LMICs experienced a drop in average and median debt levels between 2007 and 2012. By 2016, average public debt reached 67 percent

⁶ Eritrea and Somalia are excluded due to the lack of reliable data; the Seychelles is excluded due to its high-income status.

⁷ At the time this section was drafted, 2017 public debt numbers were to a large part estimates.

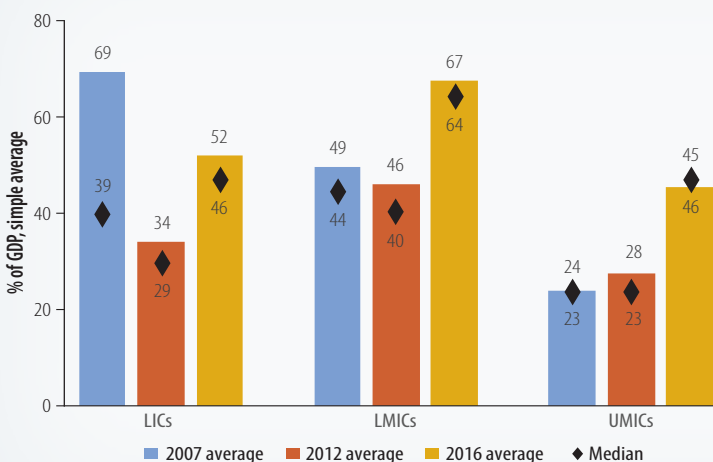
⁸ Using GDP-weighted averages does not change this narrative. Although debt increased only moderately between 2007 and 2012, debt accumulation accelerated significantly in the region thereafter in GDP-weighted terms.

of GDP and the median was 64 percent, more than 20 percentage points above the 2012 level (figure 2.7). The pattern of re-accumulation of public debt was the same for LICs, where median public debt increased by 17 percentage points to 46 percent of GDP in 2016. Median public debt levels in upper-middle-income countries (UMICs) increased by 23 percentage points during the same time.

The increase in public debt levels affected all country categories but was most pronounced in oil exporting countries (figure 2.8). From 2012 until the end of 2016, the median public debt of commodity exporting countries increased by 22 percentage points, as the commodity price boom came to an end and fiscal positions deteriorated. The debt dynamics were even worse for oil exporters, where median debt-to-GDP more than doubled over a span of four years. Angola and Gabon saw their debt levels soar by more than 100 percent; the debt-to-GDP ratio of the Republic of Congo more than tripled between 2012 and 2016. Only Nigeria maintained public debt below 20 percent of GDP as of the end of 2016.⁹ Public debt levels also increased in some small states, reaching levels close to or above 100 percent of GDP (Cabo Verde, The Gambia, and São Tomé and Príncipe).¹⁰

Fast borrowers had among the highest debt-to-GDP levels in 2016.¹¹ Figures 2.9 and 2.10 add more granularity to the broader debt trends over the past several years. The figures show the 75th percentile of countries with the highest debt levels in 2016, as well as the sharpest increases in public debt between 2013 and 2016, respectively. Roughly half of the fast-borrowing countries over the

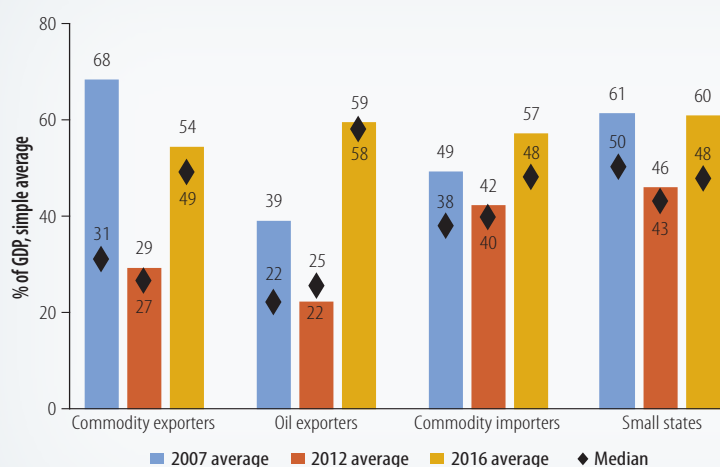
FIGURE 2.7: Public Debt by Income Group



Sources: World Bank; IMF World Economic Outlook Database, October 2017.

LMICs experienced the strongest increases in debt-to-GDP after 2012

FIGURE 2.8: Public Debt by Resource Dependence



Sources: World Bank; IMF World Economic Outlook Database, October 2017.

Oil exporters' public debt relative to GDP more than doubled on average between 2013 and 2016, and that of commodity importers also increased

⁹ The debt numbers for Nigeria cover central government debt only, compared with general government debt for the other countries.

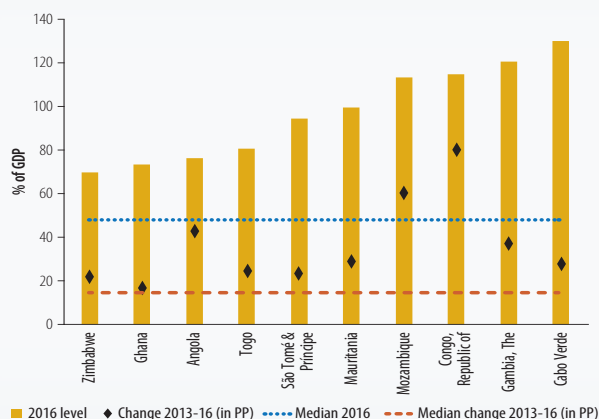
¹⁰ The Gambia and São Tomé and Príncipe are HIPC countries that exited the initiative with public debt levels above 60 percent of GDP given a relatively high share of domestic debt in GDP.

¹¹ Fast borrowers are comprised of countries in the upper quartile of the distribution of the change in public debt between 2013 and 2016, measured in percentage points.

past four years can be found in the 75th percentile of debt-to-GDP. Six of the 10 fastest-borrowing countries are commodity dependent. Yet, nearly half of the fastest borrowers are not commodity exporters, such as The Gambia, Mozambique, and Cabo Verde.

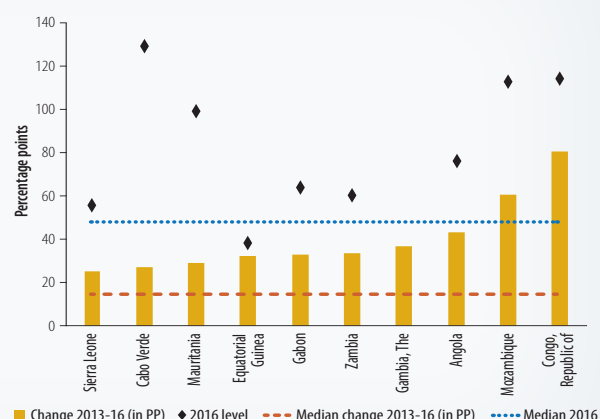
Only half of the fast-borrowing countries are commodity dependent, underlining that the increase in public debt was broad-based

FIGURE 2.9: Public Debt, Selected Countries, 2016



Sources: World Bank; IMF World Economic Outlook Database, October 2017.

FIGURE 2.10: Changes in Public Debt, Selected Countries, 2013–16



Sources: World Bank; IMF World Economic Outlook Database, October 2017.

Drivers of Public Debt¹²

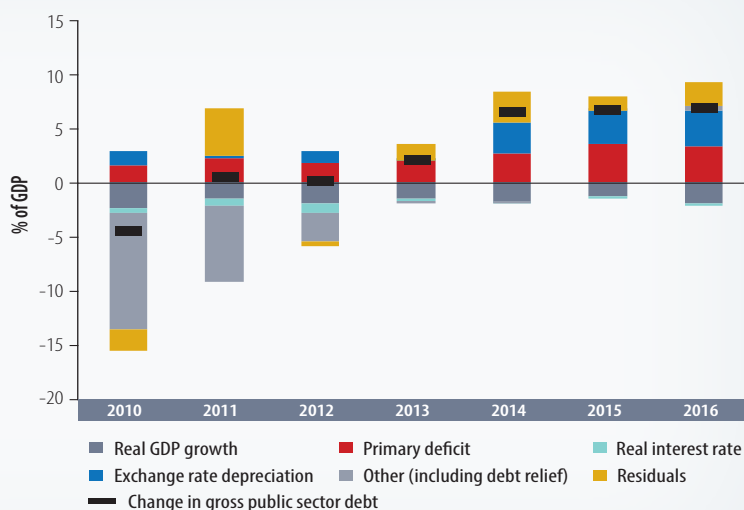
Worsening fiscal positions and exchange rate depreciation were the main drivers behind the recent increase in public debt (figure 2.11). Until 2012, debt relief, which is included under the category “Other” significantly contributed to the decline in average public debt in the region. This effect faded after nearly

all countries had reached the HIPC completion point.¹³ Strong average economic growth also played a key role in suppressing public debt-to-GDP ratios.

Since 2013, widening primary deficits and exchange rate depreciations have pushed public debt upward. Particularly, commodity exporters saw their exchange rates depreciate with falling commodity prices (figure 2.12), which in turn increased the burden of servicing and repaying foreign currency denominated debt.

Debt relief played a key role in bringing down public debt in the region. Rising fiscal deficits and depreciating exchange rates drove debt accumulation from 2013 onward

FIGURE 2.11: Drivers of Public Debt



Source: World Bank/IMF LIC DSA database.

¹² In the analysis of the drivers of public debt, debt is defined as public and publicly guaranteed debt. The sample of Sub-Saharan African countries used for this exercise comprises 31 countries that were analyzed under the Low-Income Country Debt Sustainability Framework.

¹³ In 2015, Chad became the last African country to receive debt relief under HIPC and MDRI. The remaining HIPCs are Somalia, Sudan, and Eritrea, which have not reached decision point yet.

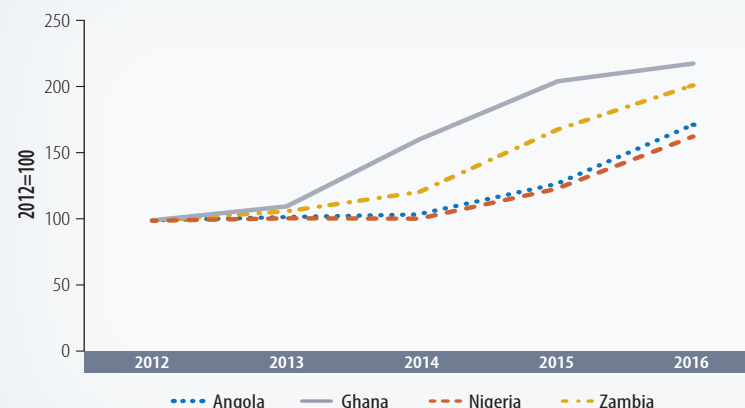
Public Debt in Detail

Alongside the recent increase in public debt, the currency composition of debt portfolios has been changing.¹⁴ Foreign currency denominated debt still accounts for the larger part of total debt; however, domestic currency denominated debt has been increasing at a faster pace. For the whole region, median foreign currency denominated debt stood at 29 percent of GDP at the end of 2016, and median domestic currency debt was 23 percent of GDP. Between 2012 and 2016, however, median domestic currency debt increased by 11 percentage points, and median foreign currency debt by 8 percentage points (figures 2.13 and 2.14).

The increase in domestic currency debt was particularly pronounced in UMICs (figure 2.13). Median levels increased from 11 percent of GDP in 2012 to 26 percent in 2016. The median domestic debt of LICs and LMICs increased too, although at lower rates than UMICs, 9 and 8 percentage points, respectively. The heavier reliance on domestic currency financing in UMICs is not surprising, as these countries have deeper and more developed domestic debt markets and are therefore able to raise more

¹⁴ The set of countries used for the analysis of domestic and foreign currency denominated debt is smaller than the set of countries used for the total public debt analysis. For several countries, the split between domestic and external debt is not reported: Benin, Burkina Faso, the Democratic Republic of Congo, Gabon, Lesotho, Madagascar, Malawi, Mauritius, Nigeria, São Tomé and Príncipe, and Zimbabwe.

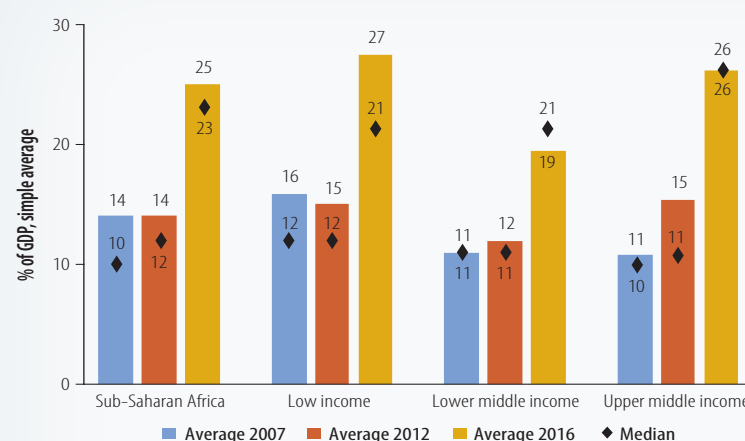
FIGURE 2.12: Exchange Rate Movements



Source: World Bank World Development Indicators.

Many commodity-exporting countries saw their exchange rates depreciate sharply, increasing the burden of foreign currency debt

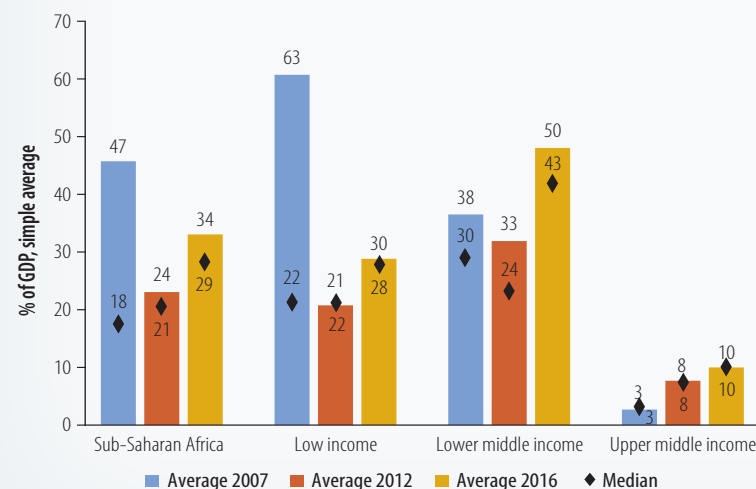
FIGURE 2.13: Domestic Currency Public Debt by Income Group



Sources: World Bank; IMF World Economic Outlook Database, October 2017.

Domestic debt increased at a fast pace after 2012, across all income categories

FIGURE 2.14: Foreign Currency Public Debt by Income Group



Sources: World Bank; IMF World Economic Outlook Database, October 2017.

Foreign currency debt still accounts for the larger part of total public debt, except for UMICs

domestic financing. Commodity exporters and small states, of which only a few are UMICs, have experienced the steepest increase in domestic debt.

LMICs have recorded substantial increases in foreign currency denominated debt since 2013 and the highest share as a percentage of GDP in 2016 (figure 2.14). During the recent episode of accelerated borrowing, median foreign currency debt increased by 19 percentage points in LMICs, from 24 to 43 percent of GDP. One emerging factor behind this increase in LMIC debt was the tapping of international capital markets. During the past few years, Sub-Saharan African countries have issued international market-based bonds at an increasing pace. Most of the countries that issued such bonds were LMICs, such as Angola, Ghana, Côte d'Ivoire, Kenya, and Nigeria.

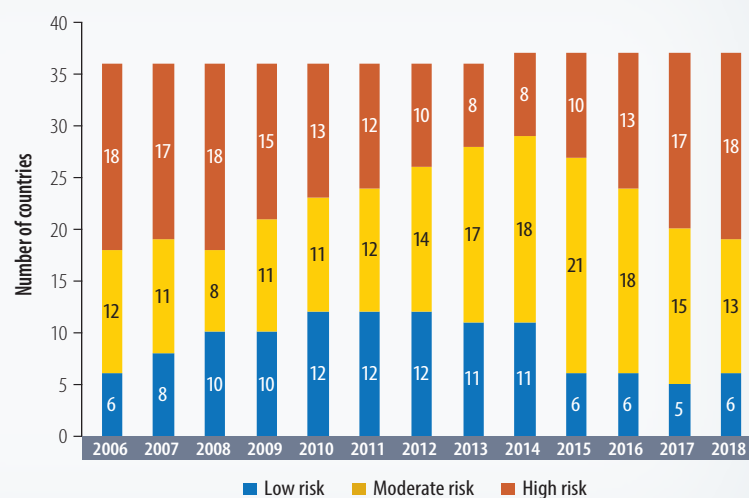
Emerging Risks

The LIC DSF monitors and analyzes the public debt situation in LICs on an annual basis and assesses the countries' risk of debt distress. In 2006, 18 countries in the region were at a high risk of debt distress, roughly equaling the number of countries at moderate and low risk combined (figure 2.15).¹⁵ After the region received more than US\$100 billion in debt relief under HIPC and MDRI in nominal terms, debt sustainability ratings improved. The number of countries at high risk of debt distress decreased to eight in 2013. After 2014, however, LIC DSF ratings started to deteriorate, in line with the re-accumulation of public debt. By March 2018, 18 countries, or more than 40 percent of the LIC DSA countries, were at high risk of debt distress, more than twice as many as in 2013.

The 2017 review of the LIC DSF introduced reforms to ensure that the framework remains appropriate for the rapidly changing financing landscape facing LICs.¹⁶ Additionally, the revised LIC DSF aims to improve insights about debt vulnerabilities. The basic architecture of the LIC DSF remains intact, but it is supplemented by a set of reforms including, among others, the simplification of debt indicators and thresholds, tailored stress tests, and an assessment of other potential risk factors (box 2.1).

The number of countries at high risk of debt distress more than doubled between 2013 and 2018, reaching 18 as of March 2018

FIGURE 2.15: Evolution of the Risk of Debt Distress: LIC DSF Countries in Sub-Saharan Africa



Source: World Bank/IMF LIC DSA database.

Note: Covers all IDA-eligible countries with LIC DSAs, including inactive countries.

¹⁵ The number of Sub-Saharan African countries for which LIC DSAs have been prepared has changed over time. As of now, DSAs are available for 37 International Development Association-eligible countries, including three inactive countries and countries in arrears to the World Bank, that is Eritrea, Sudan, and Zimbabwe. Somalia does not have an official LIC DSA and is excluded.

¹⁶ The World Bank Board paper on the revised LIC DSF can be found at: <http://documents.worldbank.org/curated/en/823731506617907804/Review-of-the-debt-sustainability-framework-for-low-income-countries-proposed-reforms>.

BOX 2.1:
Low-Income
Country Debt
Sustainability
Framework

Since 2005, the Low-Income Country Debt Sustainability Framework (LIC DSF) has been the foundation for assessing debt dynamics in LICs. Countries are classified as having weak, medium, or strong capacity for carrying debt, which determines thresholds for liquidity and solvency debt indicators. On an annual basis, this set of indicators is evaluated against the respective thresholds for the country category, under baseline and several risk scenarios. Informed by the outcomes of the baseline and stress scenario analysis, the LIC debt sustainability analysis results in a rating for countries as having a low, moderate, or high risk of debt distress or of being in debt distress.

The LIC DSF aims at informing authorities on current and future fiscal policy and borrowing decisions, and development partners about a country's capacity to carry additional debt and the risks attached to the various forms of financing. LIC DSF ratings have important operational implications for country authorities and the World Bank, as the International Development Association uses DSF ratings to determine the amount of grant financing in a country's annual resource envelope. Additionally, other multilateral lenders use the results of the framework to inform their lending decisions to LICs.

The LIC DSF was reviewed on four separate occasions, most recently in 2017, presenting a set of reforms implemented to account for changes LICs face in the financing environment, and to improve the predictive power of the framework. Specifically, the reforms complemented the use of the Country Policy and Institutional Assessment with additional country-specific information to classify a country's debt-carrying capacity, streamlined the use of solvency/liquidity indicators, incorporated tools to strengthen the baseline projections, introduced tailored stress tests to strengthen the risk analysis, expanded guidance on adding granularity to the risk rating, and expanded guidance for greater scrutiny in the application of judgement. Trainings on the new framework were rolled out in November 2017, and the new LIC DSF will be effective from July 1, 2018.

In line with the deterioration in LIC DSF risk ratings, sovereign debt ratings by major rating agencies deteriorated over the past two years. Between 2016 and the first quarter of 2018, 12 Sub-Saharan African countries' long-term foreign currency debt was downgraded at least one notch by one of the three major rating agencies.¹⁷ In contrast, only two countries, Burkina Faso and Senegal, received an upgrade by at least one notch over the same period.

The composition of debt portfolios has changed over the past few years, away from traditional concessional sources of financing and toward new bilateral lenders and more market-based borrowing. The share of multilateral and concessional debt (from multilateral and bilateral sources) in the region's total external public debt peaked in 2005. Thereafter, the shares of multilateral and concessional debt in regional debt stocks have fallen continuously. As of 2016, multilateral debt accounted for less than 40 percent of external public and publicly guaranteed (PPG) debt on average (figure 2.16).

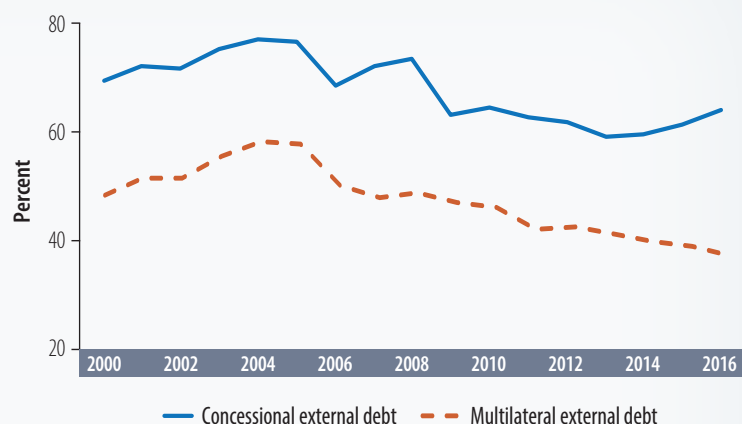
Between 2007 and 2016, the share of external commercial debt in total external PPG debt fell before rising to levels close to those in 2017. Sub-Saharan African countries increasingly issued international bonds.¹⁸ The share of bonds in total PPG debt increased from 9 percent in 2007 to 19 percent in 2016

¹⁷ Fitch, Moody's, and Standard & Poor's.

¹⁸ Commercial debt covers commercial bank loans from private banks and other private financial institutions.

The shares of concessional and multilateral debt in PPG external debt have decreased

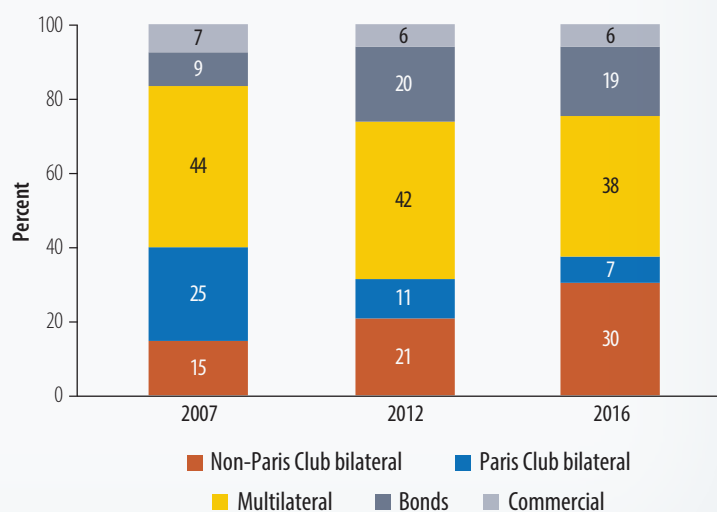
FIGURE 2.16: Shares of Concessional and Multilateral Debt in Public and Publicly Guaranteed External Debt (%)



Source: World Bank, International Debt Statistics.

Countries shifted away from traditional multilateral and bilateral sources of debt, toward bond issuance and non-Paris Club bilateral creditors

FIGURE 2.17: Composition of Public and Publicly Guaranteed External Debt over Time (%)



Source: World Bank, International Debt Statistics.

(figure 2.17). Total bilateral debt was on a downward trend until 2016, falling slightly below the share of 40 percent it reached in 2007.

The composition of bilateral lending has changed significantly, as countries have shifted from Paris Club debt toward non-Paris Club creditors. Within one decade after HIPC and MDRI, the share of non-Paris Club creditors in total PPG external debt doubled, from 15 percent in 2007 to 30 percent in 2016, while the share of Paris Club bilateral debt decreased from 25 to 7 percent (figure 2.17). At the end of 2016, non-Paris Club debt accounted for 80 percent of total bilateral debt. This trend is even more pronounced in commodity exporting countries, where the share of non-Paris Club creditors increased to nearly 90 percent of total bilateral debt at the end of 2016.

In addition, Sub-Saharan African countries have tapped international markets at an increasing pace. The first LIC/LMIC of the region to issue an

international bond was Ghana, which issued a 10-year U.S. dollar denominated international bond in 2007. Since then, other LICs and especially LMICs of the region have issued bonds in international markets at an accelerating pace. By 2018, 16 countries have issued bonds, several of them on a regular basis, with issuances of considerable size (figure 2.18). The conditions for international bond issuances have been favorable, with high and steady demand from investors.

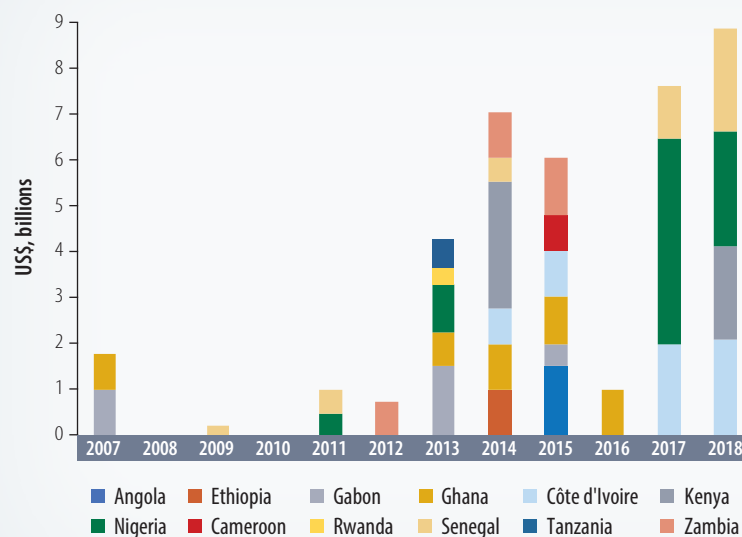
Until 2015, Africa's emerging market bond index (EMBI) spread was roughly aligned with JP Morgan's Global EMBI spread over the U.S. Treasury. Since 2015, however, African countries have issued continuously above

the Global EMBI spread, and significantly above Asian and European emerging economies (figure 2.19). In the first quarter of 2018, the gap between the Global and African spreads closed, as Kenya and Nigeria issued international bonds. Kenya issued 10- and 30-year bonds of US\$1 billion each, with coupon rates of 7.25 and 8.25 percent, respectively. Nigeria issued a total of US\$2.5 billion, with coupons of 7.1 percent for a 12-year bond and 7.6 percent for a 20-year bond.

From 2021 onward, international bonds start maturing and large repayments pose significant refinancing risk to the region (figure 2.20). Access to international financial markets comes with several benefits to issuing countries, such as the ability to raise large volumes in a short time span, diversification of the investor base, and supplementing low domestic savings rates. Nevertheless, international bond issuances can increase refinancing risks, particularly if issuances are large and debt management frameworks are relatively weak. They can expose countries to changes in market sentiments and risk assessments, exchange rate fluctuations, and changes in global market conditions. This holds true especially if bonds were issued in a bullet structure, where the principal is due at maturity.

In addition to refinancing risk, liquidity risks have increased in several Sub-Saharan African countries as changes in the level and composition of PPG external debt levels raised debt service payments. Several countries breached their respective thresholds, indicating potential liquidity bottlenecks.

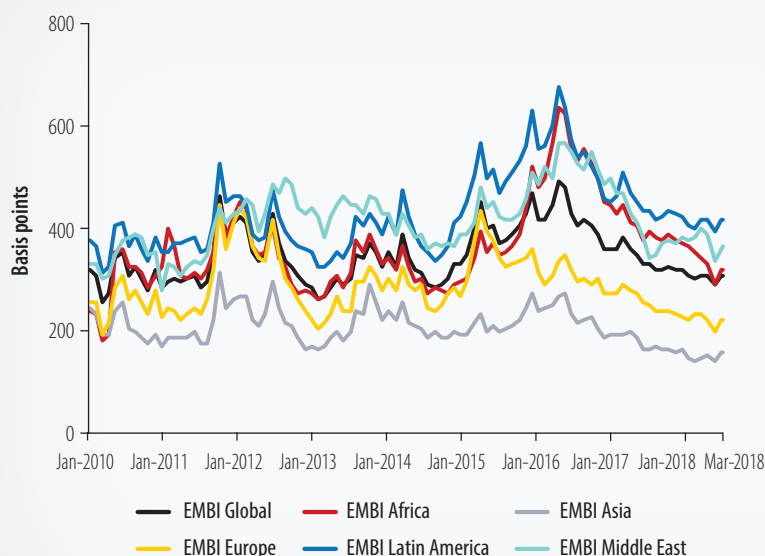
FIGURE 2.18: Selected International Bond Issuances of LICs and MICs in Sub-Saharan Africa



Sources: World Bank; Bloomberg.

Since 2013, countries, mostly LMICs, have been tapping international markets increasingly

FIGURE 2.19: EMBI Bond Spreads

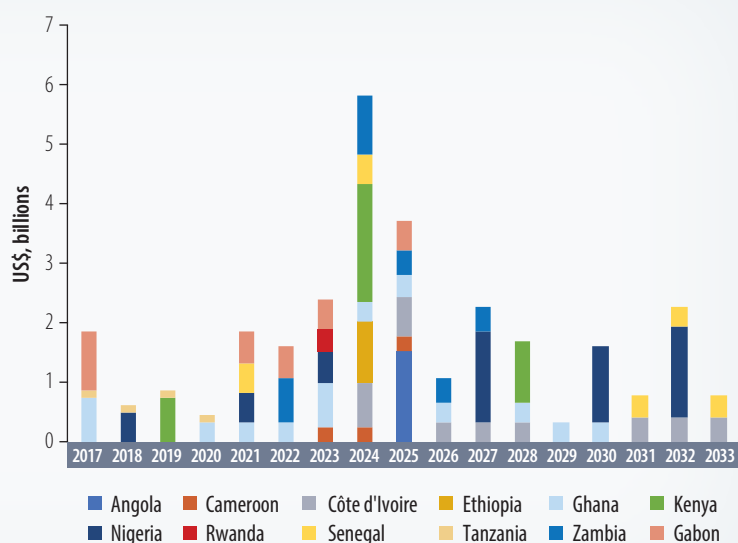


Source: World Bank; Bloomberg.

Between mid-2015 and 2018, Sub-Saharan African countries issued at spreads above their global peers. The spread in early 2018 points toward the closing of this gap

Sub-Saharan African issuers will be facing large repayments on international bonds starting in 2021, constituting considerable refinancing risk

FIGURE 2.20: Maturing International Bonds in Sub-Saharan Africa (US\$, billions)



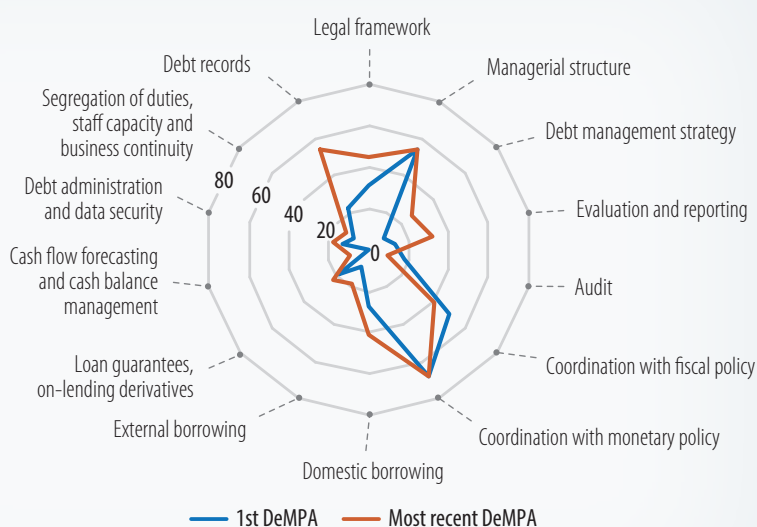
Sources: World Bank; Bloomberg.

Improved debt management frameworks and capacity in LMICs could help countries address some of these emerging risks. The World Bank's Debt Management Performance Assessment evaluated debt management institutions and capacity in 22 African countries on more than one occasion (figure 2.21).¹⁹ The analysis found that less than 50 percent of countries fulfill the minimum requirements for sound international standards in the legal framework for debt management. For domestic borrowing, only 40 percent of

the 22 Sub-Saharan African countries adhere to sound practice, and only 22 percent of the countries meet the minimum requirements for effectively managing loan guarantees, on-lending, and the issuance of derivatives.

Improvements have been made in many areas of debt management over the past years, but they started from a low base compared with sound international standards

FIGURE 2.21: DeMPA: Countries Meeting Minimum Requirements



Source: World Bank; based on DeMPAs in 22 countries.

Note: Debt Management Performance Assessment (DeMPA) tool used for assessing public debt management performance through a comprehensive set of indicators.

At the same time, debt management has been strengthened in several areas. The number of countries that have prepared and approved a formal debt management strategy, based on robust cost and risk analysis, has increased significantly. The percentage of countries following sound practice in debt recording increased from roughly 20 to nearly 60 percent. Further progress has been achieved in evaluation and debt reporting, domestic borrowing and the governance of guarantees, and debt administration and data security.

¹⁹ <http://documents.worldbank.org/curated/en/305821468190742099/Debt-management-performance-assessment-DeMPA-methodology>.

Conclusion

Two periods characterize the debt dynamics in Sub-Saharan Africa: a period of declining average debt levels until 2012, and accelerated growth of public debt from 2013 on. The main drivers of the recent increase in public debt were rising fiscal deficits and the depreciation of exchange rates, especially in commodity exporting countries. In addition, the slowdown in economic growth contributed to increases in public debt relative to GDP. Debt sustainability risks in the region increased significantly over the past few years, with 18 countries at high risk of debt distress at the end of the first quarter of 2018 compared with eight in 2013.

Debt levels remain substantially below pre-HIPC and MDRI levels, but the recent episode of fast borrowing gives rise to concern. The number of Sub-Saharan African countries in debt distress²⁰ doubled from four in 2013 to eight in 2018. In many countries that remain at low or moderate risk of debt distress, safety margins have declined. Stemming this tide will critically depend on the reduction of fiscal imbalances, maintenance of strong economic growth, and efficient and prudent public debt management.

²⁰ For the definition of countries "in debt stress," see the guidance note, paragraph 90, page 49: <http://documents.worldbank.org/curated/en/513741518471205237/pdf/LIC-DSF-SGN-2017-Clean-Feb0718-02082018.pdf>.

Section 3: Electricity Access and Economic Development: Options for Accelerating Progress in Sub-Saharan Africa¹

3.1 INTRODUCTION

Goal 7 of the Sustainable Development Goals aims to “Ensure access to affordable, reliable, sustainable and modern energy for all.”² Consistent with that goal, many developing countries in Sub-Saharan Africa have made investment in national electrification a key element of their national economic development strategies. They perceive improved household access to electricity as valuable for enhancing economic well-being and quality of life, and improved availability and reliability of electricity for businesses as necessary for increased productivity and economic growth (IEG 2015, xiv).

National electrification plans in Sub-Saharan Africa typically have focused predominantly on the expansion of the national electricity grid, with large-scale fossil fuel and hydroelectric generation facilities and, more recently, some investment in grid-scale wind and solar energy as well. Off-grid electricity supply historically has consisted mainly of small diesel-powered generators used to compensate for unreliable grid supplies, and to provide electricity for households and businesses not connected to the grid who can afford them.

All this has undergone considerable change over the past decade or so. During that time, there has been growing interest in solar-charged lanterns and small-scale solar photovoltaic (PV) home systems that can provide improved lighting, access to mass media, and battery charging to households in rural areas.³ This interest has been spurred by technological advances that have significantly reduced the cost of PV systems.⁴ These technological developments have led to great interest in the possibility that Sub-Saharan Africa could “leapfrog” over the traditional stages of national grid-based electrification that took place in today’s advanced economies.

There also has been a growing focus on what rural access to electricity service can do to improve livelihoods in rural areas, and how smaller-scale solar technologies could contribute to that. This contrasts with the more traditional view of some policy makers in Sub-Saharan Africa that any investments other than expansion and extension of the standard electricity grid are not providing “real” electricity access, of the type that is taken for granted in today’s advanced economies.⁵ This section looks at options for accelerating electrification in Sub-Saharan Africa, the role of innovation in facilitating such acceleration, and the implications of achieving accelerated electrification for inclusive economic growth and poverty reduction in the region. The examination of these issues is organized around three basic questions that need to be addressed in evaluating alternative electrification strategies:

- How might rapid recent innovation in renewable electricity generation technologies contribute to expanding access to and actual availability of power?

¹ This section was prepared by Michael Toman, Jevgenijs Steinbuks, Jörg Peters, Justice Mensah, Moussa Blimpo, and Govinda Timilsina.

² See <https://sustainabledevelopment.un.org/sdg7>. The Sustainable Energy for All (SE4ALL) program (<http://www.se4all.org/>) seeks to realize the aim of Sustainable Development Goal 7 through efforts to achieve universal access to modern energy, as well as major increases in energy efficiency and use of renewable energy, by 2030.

³ This interest is well illustrated by the World Bank Group program “Lighting Africa” (<https://www.lightingafrica.org/>). Somewhat larger installations for homes, schools, medical clinics, and community centers also can provide additional service, especially refrigeration. Even larger systems can provide electricity for mini-grids.

⁴ Improvement in the energy efficiency of electricity-using devices, such as domestic appliances and electric motors for operating machinery, also has made possible increased economic value with a given electricity supply.

⁵ Perhaps ironically, solar home systems often can provide higher-quality service than grid connections, given the unreliability of grid electricity pointed out in sub-section 3.3.

- How do different approaches for expanding access to electricity affect economic growth, employment opportunities, and poverty?
- How can innovative approaches to electricity sector governance in the region improve the prospects for effectively expanding national power systems and strengthening mutually beneficial regional interconnections among national systems?

In sorting through various possibilities for accelerated electrification, it is important to keep in mind that national electrification strategies generally seek to address several development objectives. These include facilitating accelerated income growth and job creation, and improving lives and livelihoods in more remote areas, as well as limiting environmental and health damages from providing electricity. On the one hand, to accomplish this range of objectives, given the changes in generation technology and the expectation of rapid future growth in electricity demand, the evolution of electricity systems in Sub-Saharan Africa will need to involve more than one national grid. The path to universal electrification also will incorporate interconnected or stand-alone “mini-grids” and “micro-grids” serving small concentrations of electricity users,⁶ and off-grid home-scale systems. On the other hand, as rural populations continue to migrate to rapidly growing urban areas in Sub-Saharan Africa, economies of scale and density will lower the costs of grid-supplied power in urban and peri-urban areas.⁷

The key conclusions reached in this section are as follows:

- i. There is much concern expressed about deficits stemming from difficulties in setting power tariffs to cover costs in Sub-Saharan Africa. However, the challenges are much broader and require a more diverse set of metrics. The benefits provided by different electrification strategies also are of critical importance, as well as the possibility that similar benefits could be provided at lower cost with different electrification strategies. In terms of performance metrics, the issue is not just connections but rather the actual quantity of electricity used, the reliability of service, and what can be done with the electricity available to further economic development. Several countries in Sub-Saharan Africa provide electricity access to less than 20 percent of their total population, with far higher percentages going unserved in rural areas. The cost for customers tends to be high, while reliability is low.
- ii. Substantial cost reductions from rapid technological improvements from innovations in home-scale solar power production provide opportunities to improve the quality of life of people without access to electricity in more lightly populated rural and remote areas of Sub-Saharan Africa. However, while home systems can provide more and better lighting and other basic household conveniences, they cannot do that much to increase incomes and employment and reduce poverty in those areas, given the limited quantities of electricity they provide compared with the electricity needed for most productive uses.
- iii. Extension of the national power grid to those lightly populated rural and remote areas is usually costly, and often it has little impact on economic development because of the limited amounts that people can afford to pay for electricity. Much may be gained by initially targeting grid extension to

⁶ Although definitions vary, micro-grids may supply as little as 1 kilowatt (kW) up to several hundred kW. Mini-grids might range from 1 megawatt (MW) to 10 MW. IFC (2017, 16) distinguishes between small/mid-size and large grids and uses the SE4All Tier system for benchmarking; see http://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/IFC_Minigrids_Benchmarking_Report_Single_Pages_January_2017.pdf.

⁷ In rural areas, a continued decline in unit costs for more decentralized systems, including larger-scale storage, may favor continued reliance on off-grid resources in some places. However, where grid-supplied electricity has the edge in terms of cost, a greatly expanded use of intermittent wind and solar resources to reduce greenhouse gases favors more widespread interconnection of generation sources to improve reliability.

areas with higher potential for significant expansion of productive uses, while pursuing the provision of smaller-scale alternatives in other areas.

- iv. Mini-grids using solar power also have benefited from the rapid and substantial advances in solar power technology. Accordingly, mini-grids are a very interesting possibility for scaling up electricity availability in areas where grid extension is costly or can only be accomplished some ways into the future. Although there has been limited investment in mini-grids so far in Sub-Saharan Africa outside Tanzania, several other countries, including Nigeria and Rwanda, have been undertaking significant regulatory reforms to lower barriers to mini-grid investment. A major challenge for inducing private sector mini-grid investment is confidence with respect to cost recovery, and what happens to mini-grid assets when the grid begins to penetrate its service territory. Additional mini-grid investments in the region would be quite valuable for better understanding their economics and how best to manage them.
- v. Sub-Saharan Africa also can benefit from using innovations in power sector regulation and corporate management from other areas of the world over the last roughly three decades. There is continued urgent need for improved sector regulation and management to increase economic efficiency, strengthen public confidence in sector management and regulation, and improve the investment climate, especially for the private sector. In addition to strengthening policies toward investment in mini-grids, a key step is putting in place electricity prices that better reflect the cost of service and do not distort the incentives of different electricity purchasers. Without this, it will be impossible to raise sufficient capital and attract new customers. Also needed are more transparent and less politicized operations of utility companies, and stronger and more independent regulatory bodies. Although reforms are difficult, without such steps, there are doubts about how much can be gained from investment programs for accelerating national electrification.

The rest of this section is organized as follows. First, several aspects of the current state of electrification in Sub-Saharan Africa are reviewed. Second, some historical aspects of electrification in Sub-Saharan Africa and elsewhere are examined, to provide further context for understanding and responding to current challenges for expanding electricity access and power availability in the region. Third, evidence on the potential gains in economic output and employment from scaling up electrification in the region are discussed. Fourth, the need to address several weaknesses in sector governance to increase the benefits the sector can deliver is highlighted. Finally, the various strands are drawn together to put forward an overall framework and some key actions for moving forward.

3.2 CURRENT STATE OF ELECTRIFICATION IN SUB-SAHARAN AFRICA

Electricity Access and Utilization

Figure 3.1 presents information on changes over time in household electrification in Sub-Saharan Africa. In some countries, such as Gabon, Swaziland, and Kenya, the pace of electrification has been rapid, with access rates increasing by more than 50 percent between 2000 and 2016. In contrast, electrification has lagged population growth in Zimbabwe, so that electrification rates declined.

Overall, the household electrification rate in Sub-Saharan Africa is the lowest in the world, averaging 42 percent in 2016. There are also huge gaps in electricity access between rural and urban households in Sub-Saharan Africa. Access rates among urban households are about 71 percent, compared with 22

Access to electricity
is still low in
Sub-Saharan Africa

FIGURE 3.1: Electricity Access in Sub-Saharan Africa



Source: IEA, Energy Access Outlook 2017.

percent among rural households (and even lower if a few countries with more significant rural electrification are excluded) (IEA 2014). These gaps mirror income and wealth inequalities in the region (World Bank 2016).

Electricity consumption in the region is low compared with other parts of the world (World Bank 2016) (box 3.1). Over 2010–14, the average annual consumption per capita in Sub-Saharan Africa was equivalent to just 4 percent of consumption per capita in the United States, and 15 and 21 percent of that in China and Brazil, respectively. Except for South Africa, industrial consumption across Sub-Saharan Africa is low, reflecting the low level of industrialization in the region. Utilization of electricity in the agriculture sector also is low, accounting for just 2 percent of total electricity consumption. Low levels of electricity consumption are relevant not just in and of themselves, but also because they hint at challenges in measuring actual versus nominal electricity access. Protocols differ in defining access, but in some cases, the

BOX 3.1:
Examples
of Limited
Electricity
Access and
Availability in
Sub-Saharan
Africa

In South Sudan, the Central African Republic, Chad, and Sierra Leone, less than 10 percent of the population has access to electricity. Ghana, Swaziland, South Africa, Gabon, Cabo Verde, Seychelles, and Mauritius have access rates of more than 80 percent (IEA 2017).

In Sierra Leone, the Comoros, Guinea-Bissau, and Benin, less than 20 percent of installed generation capacity is utilized (United Nations 2015).

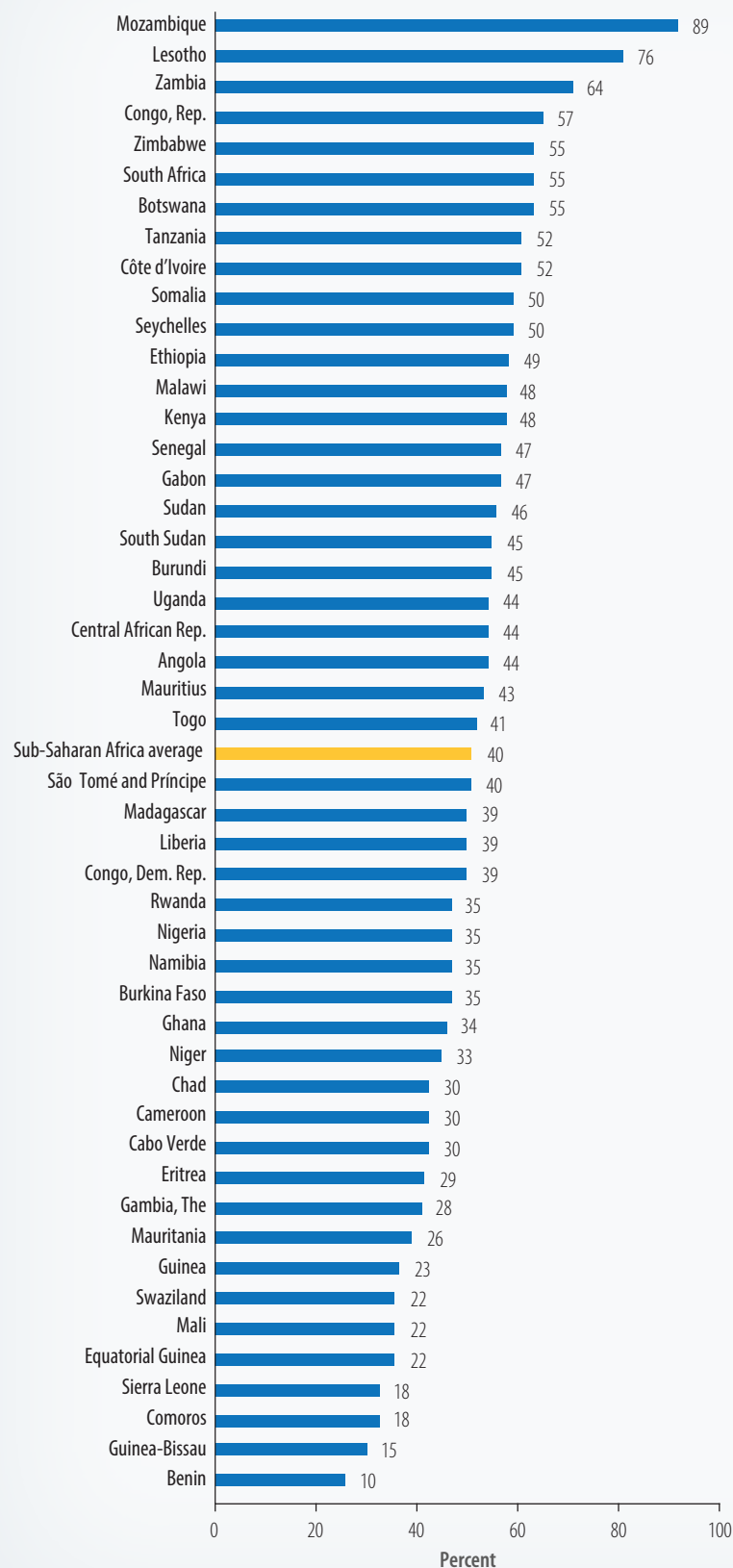
Ethiopia, with a population of about 94 million, consumes just about a third of the total electricity consumption of Washington, DC, which has a population of about 700,000 (World Bank 2016).

existence of one grid-connected household in a village is sufficient to establish that the whole village is electrified. In other cases, access is identified by the existence of physical connections, even if no electricity is actually flowing.

Utilization of installed generation capacity is low in a number of Sub-Saharan African countries, as shown in figure 3.2. On average, electricity generation in Sub-Saharan Africa was only 40 percent of the potential output given the installed capacity (United Nations 2015). The low capacity utilization rates are an additional indication of the inefficiencies in the electricity sector that have resulted in undermaintained and often inoperable generation capacity.

Aside from low access rates, the electricity sector in Sub-Saharan Africa is beset with huge problems of reliability. Households and firms often endure several hours of the day (night) without power. In some cases, outages are unscheduled, thereby constraining the utilization of electricity for productive purposes. Map 3.1 shows the shares of firms and households in Sub-Saharan Africa with access to reliable electricity, using indicators constructed from the latest round of data from the Enterprise and Afrobarometer Surveys (Blimpo and Cosgrove-Davies 2018).

FIGURE 3.2: Capacity Utilization in Electricity Generation in Sub-Saharan Africa

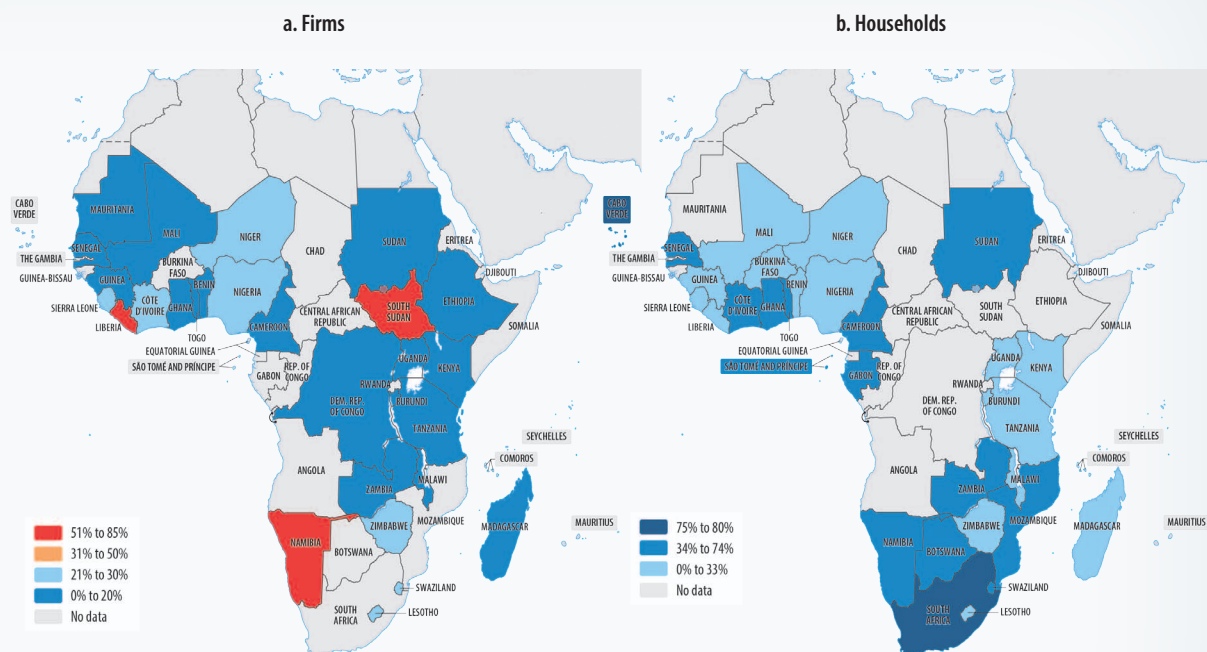


Generation capacity in Sub-Saharan Africa is underutilized. Electricity generation was only 40 percent of the potential output

Source: United Nations 2015.

Shares of firms and households with access to reliable electricity are very low in Sub-Saharan Africa

MAP 3.1: Indicators of Electricity Reliability for Firms and Households in Sub-Saharan Africa



Source: Blimpo and Cosgrove-Davies 2018.

Note: Panel a (firms) is derived from the World Bank Enterprise Data portal, which reports the share of responding firms reporting electricity outages. The map represents the complementary percentage (100% minus the percentage from the portal). Panel b (households) shows the share of households that receive electricity supply most of the time. These calculations are made using recent data from the Afrobarometer data set.

Electricity Generation Capacity

Total installed capacity of electricity in Sub-Saharan Africa was about 96 gigawatts (GW) in 2015, compared with 325 GW in India and 1,519 GW in China (EIA 2017). South Africa accounts for nearly half of the region's generation capacity. Installed generation capacity in Sub-Saharan Africa excluding South Africa is approximately one-third of the installed generation capacity in Brazil. Indeed, in many countries in Sub-Saharan Africa, installed generation capacity is less than 1 GW (IEA 2014; Castellano et al. 2015; Avila et al. 2017). Despite having the highest population in Sub-Saharan Africa, Nigeria has just about a quarter of the total installed generation capacity in South Africa.

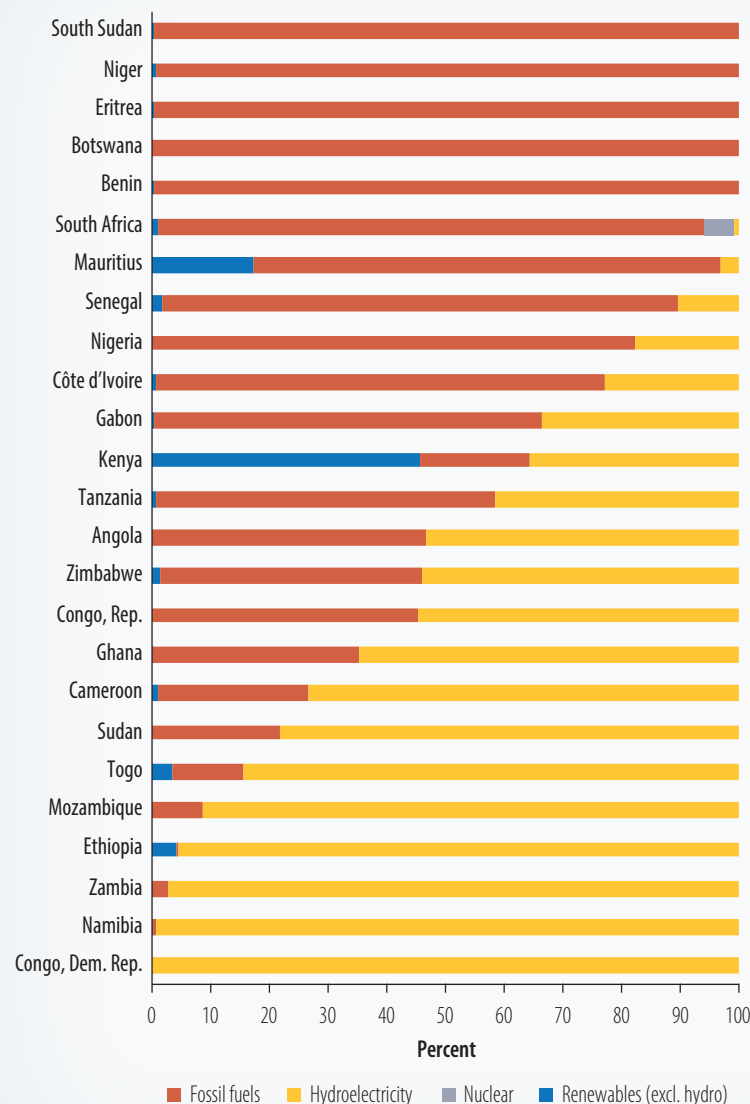
As shown in figure 3.3, fossil fuels are the main source of electricity generation throughout Sub-Saharan Africa, accounting for 64 percent of total electricity output in 2014; renewables (including hydro) accounted for the remaining 36 percent. Hydroelectricity is dominant in some countries, such as the Democratic Republic of Congo, Namibia, Zambia, and Ethiopia. In South Africa, 82 percent of generation capacity is coal based (Trimble et al. 2016). For other countries shown in figure 3.3, the shares of hydroelectricity and fossil fuel generation (gas, diesel, and heavy fuel oil) are about 47 and 48 percent, respectively. The heavy reliance on fossil fuels implies that the electricity sector is susceptible to fluctuations in international fuel prices. Last, but not least, non-hydro renewables constitute just 5 percent of installed capacity (EIA 2017).

Tariffs and Cost Recovery

Recently, attempts to reform the energy sector (including electricity) have increased electricity tariffs in most countries. The average electricity tariff in Sub-Saharan Africa is US\$0.17 per kilowatt hour (kWh), although there is a wide range of national averages, from US\$0.04 per kWh in Ethiopia to US\$0.50 per kWh in Liberia. These figures do not include value-added taxes and other taxes (Trimble et al. 2016).

Industrial and commercial tariffs in Sub-Saharan Africa are among the highest in the world. In many countries, industrial tariffs are high to hold down household electricity tariffs, while higher-consumption households and firms subsidize minimum consumption by low-income lifeline consumers (RISE 2014). Nevertheless, the prevailing tariff structures do not cover costs in most countries, as shown in figure 3.4. Analysis based on the Africa Infrastructure Country Diagnostic Power Tariff Database (27 countries, 2004–08), cited in Huenteler et al. (2017), indicates that less than a third of the sample countries had tariffs sufficient to recover the full cost of service, and cost recovery levels had declined over the observation period. In a recent World Bank survey of 39 Sub-Saharan African countries, Trimble et al. (2016) conclude that only two countries' utilities (Uganda and the Seychelles) have fully covered their operational and capital expenditures. Cost recovery is especially difficult in countries with high generation cost due to reliance on costly oil-based energy sources (heavy fuel oil and diesel).

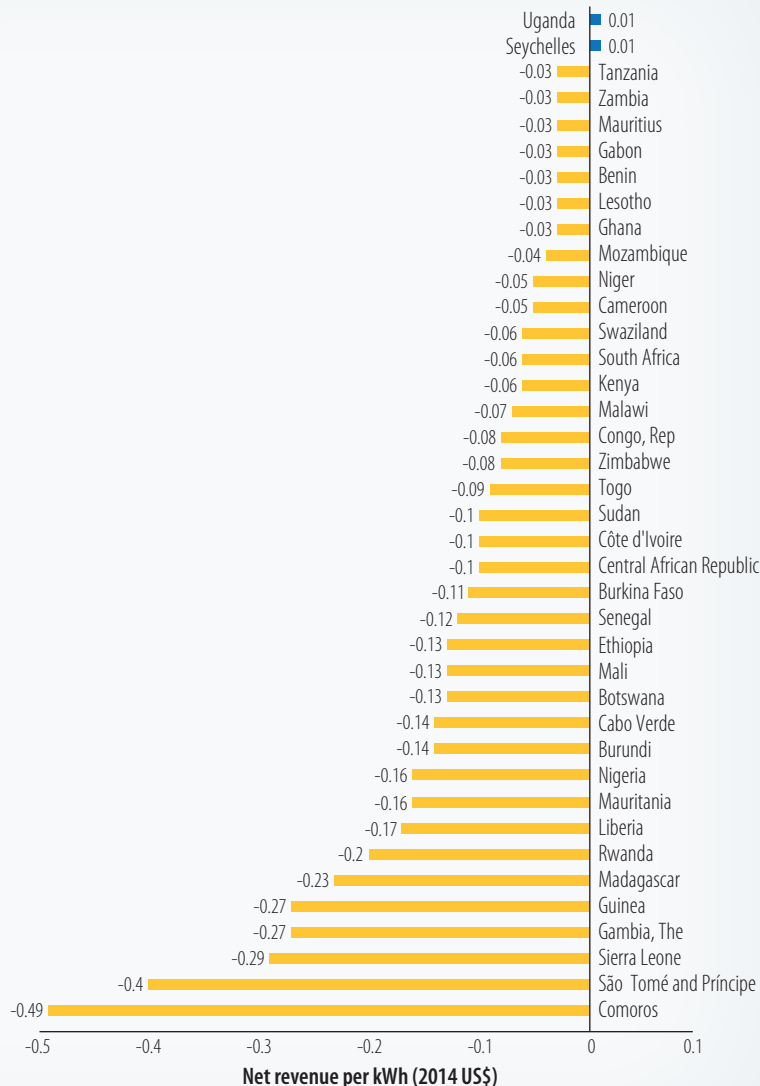
FIGURE 3.3: Sources of Electricity Generation in Sub-Saharan Africa



Source: World Bank 2016.

The prevailing tariff structure does not cover costs in most countries in Sub-Saharan Africa

FIGURE 3.4: Net Revenue per Unit (2014 US\$ per kWh billed)



Source: Trimble et al. 2016.
Note: kWh = kilowatt hours.

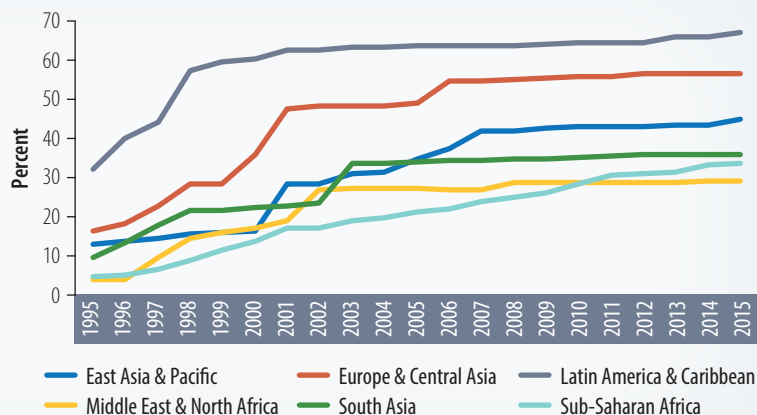
Metrics of Regulatory Reform

Achieving sound electricity sector governance is critical for effective and economically sound improvements in electricity access through a mix of larger scale and smaller scale generation sources, some interconnected while others operate as stand-alone mini-grids. Sound governance in turn requires multiple and coordinated changes in the national power sector, including improved regulation, restructuring of incumbent utilities, strengthened competition where feasible, and increased private sector participation.

Figure 3.5 shows a power sector regulatory reform index incorporating these essential components of power sector reform. The index was produced as part of ongoing research in the World Bank Energy Practice, on impacts of and impediments to such reform (Foster et al. 2017). Sub-Saharan Africa lags other regions according to this reform indicator.

Sub-Saharan Africa lags other regions in regulatory reform of the power sector

FIGURE 3.5: Power Sector Reform Index over Time and by Region



Source: Foster et al. 2017.

3.3 HISTORICAL PERSPECTIVES ON ELECTRIFICATION

Experiences in Sub-Saharan African Electricity System Development

Large-scale electrification efforts in Sub-Saharan Africa during the post-independence era were seen by governments as a key ingredient for industrialization that would sustain economic and political independence. In Ghana, for instance, the construction of its first hydropower dam, the Akosombo Dam, in 1965 was a game changer in expanding electricity access to the general population (NRECA 1981). However, it was not until the late 1980s that rural electrification gained significant attention among policy makers. In 1989, the National Electrification Scheme was established to spearhead a massive electrification agenda through programs such as the Self-Help Electrification Program. The scheme has been successful in increasing the access rate from less than 20 percent in 1989 to 82.5 percent in 2016 (Kumi 2017). Box 3.2 presents initiatives in Ghana to extend electricity access and spur uptake.

In South Africa, although most households and commercial buildings were electrified by 1990, the legacy of apartheid was that many households were denied access to basic services, including electricity (Dinkelman 2011; Gaunt 2003). The National Electrification Program was established after the end of apartheid in 1994, to expand electricity services to households in African homelands. Between 1993 and 2003, more than 470,000 households were connected to electricity (Dinkelman 2011).

The Government of Kenya implemented a grid densification program, the Last Mile Connectivity Program, with an overarching target of ensuring grid connection to every household within a 600-meter radius from a transformer. To reduce affordability constraints and increase uptake, connection fees were subsidized, with households paying between K Sh 35,000 (\$343) and K Sh 15,000 (\$147), compared with the

Ghana's experience demonstrates the impacts of efforts on the demand side in addition to addressing the supply dimension. Ghana undertook a comprehensive National Electrification Planning Study between 1989 and 1991, taking into consideration all the possible options for electrification, including grid and off-grid extensions as well as renewable energy-based solutions (biomass, solar, wind, and small hydro). This led to a master plan, which outlined six five-year implementation phases over 30 years (1990–2020). The National Electrification Scheme aimed at connecting all communities with a population greater than 500 to the national grid as part of the overall goal of universal access to electricity by 2020. At the time, there were 4,221 communities in Ghana with a population over 500, of which only 478 had access to electricity.

Several demand-side initiatives were launched to spur uptake. Connection fees were lowered, and the government launched a complementary program called the Self-Help Electrification Program (SHEP) to speed up the process by electrifying towns and villages which were prepared to help themselves. SHEP is a rolling, three-to-five-year electrification program, targeting communities that are not scheduled for immediate connection to the national grid, but located within 20 kilometers of an existing medium-tension electricity line (11 or 33 kilovolt network suitable for further extension). Under this scheme, communities help the electricity operator lower its cost by erecting low-voltage distribution poles, thereby ensuring at least 30 percent of the households in the community are wired and ready to be served as soon as the electricity supply becomes available. Communities accomplish this work through a village electrification committee, which is responsible for mobilizing funds, establishing rights-of-way, and helping people wire their homes.

In 2000, an additional component for credit provision for income-generating uses of electricity was incorporated, to increase

BOX 3.2: How Has Ghana Achieved High Uptake?

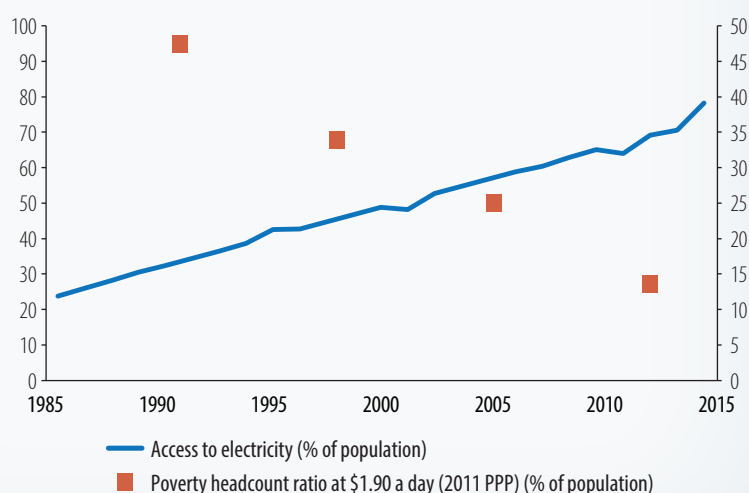
BOX 3.2:
Continued

consumption and ensure the viability of the utilities. Recently, the same credit facility has been used to assist households in paying for their wiring. To assist with affordability for residential consumers, a lifeline tariff was set for people who use up to 50 kilowatt hours/month.

By 2005, the access rate reached 54 percent, and 3,026 towns and communities were electrified. Moreover, Ghana's rapid progress in poverty reduction seems to have been correlated with progress in access to electricity across the country, potentially alleviating affordability issues along the way. Per the World Bank's World Development Indicators data, Ghana experienced a sharp decline in the poverty rate, from close to 50 percent in the 1990s to 14 percent in 2012 (Figure B3.2.1). Of course, other factors besides electrification likely contributed as well.

Source: Blimpo and Cosgrove-Davies 2018.

FIGURE B3.2.1: Ghana: Access to Electricity and Evolution of the Poverty Rate, 1990–2014



Source: World Development Indicators.

real connection cost of roughly US\$1,000 (World Bank 2017b). As a result, the electricity access rate in Kenya increased from 23 to 50 percent between 2009 and 2016 (World Bank 2017b).

Rwanda implemented its ambitious Electricity Access Rollout Program (EARP) in 2009 (box 3.3). Initially, the goal was to increase access to electricity from 6 to 16 percent of the population over a five-year period. The project far surpassed expectations, meeting that target within three years while lowering the cost of connection. The next goal was to reach 70 percent of households by the end of 2017. This has required going into more remote areas, thereby raising connection costs.

Although broadly similar approaches to electrification have been implemented in other countries across the region, the degree of engagement and accomplishment has varied. In

BOX 3.3: Key Determinants of Success in Rwanda's Grid Electrification Program

According to Baringanire, Malik, and Banerjee (2014), Rwanda's EARP benefited from several factors:

"Strong government ownership and the capacity to harmonize efforts of line ministries and other stakeholders in the sector [as well as utilization of evidence-based planning].

Very low initial electrification rate that suggests opportunities to pick low-hanging fruit and achieve rapid growth in access.

Multiple donors with mutually agreed goals.

Geographical attributes that support rapid scale-up. Although coordination and evidence-based planning should improve implementation in every setting, Rwanda's rapid successes were helped by its small size and high population density."

Even with these attributes, the project has faced challenges. These include lower than anticipated demand and shaky utility finances.

Angola, the Republic of Congo, and The Gambia, the access rate in rural communities has declined over the same period. Overall, there has been a marginal improvement (8 percent) in the share of people in rural areas in Sub-Saharan Africa with electricity access. Nonetheless, in absolute terms, the number of people without access to electricity has increased, because population growth has outstripped growth in electricity provision (Lucas, Dagnachew, and Hof 2017).

A common thread in most of the electrification programs in the 1990s and 2000s in Sub-Saharan Africa was the emphasis on connection to centralized grid electricity with large-scale hydro and/or thermal powered generation plants. Electrification programs were hinged on expectations of high generation from the region's large-scale hydro dams, due to the relatively low average cost and large production potential. Large-scale hydropower is still prominent, with the Grand Renaissance Dam in Ethiopia and the controversial proposed Grand Inga Dam in the Democratic Republic of Congo providing notable examples of large hydropower projects.

Nontechnical challenges in electricity sector development in many Sub-Saharan African countries have included excessive political interference in the sector, suboptimal planning and project execution, and mismanagement, which has contributed to operational inefficiencies of the utilities (Trimble et al. 2016). As a result, the quality of electricity provision often has been poor. For example, governments wield significant influence in setting electricity tariffs because of their political sensitivity. One result is that many utilities are unable to recover their costs and have blunted incentives to connect additional customers (Blimpo, McRae, and Steinbuks 2018). In addition, state-owned electricity distribution companies often are burdened with additional objectives, such as the provision of social services outside the core business of the company or overstaffing to increase job creation (Trimble et al. 2016). Private-sector participation in building or building and operation of new generation capacity has expanded somewhat in many countries, but it remains limited due to several regulatory barriers.

Factors Contributing to More Successful Implementation Elsewhere⁸

Since the advent of electricity provision in the second half of the 19th century, the process of electrification has evolved in diverse ways in different countries. In many countries, electricity was first provided in areas with robust socioeconomic development. Electricity thus was perceived in many urban communities and industrial centers to be a disruptive innovation that could drive productivity improvements. However, other strategies emerged in the spread of electricity to more rural and less commercially active areas.

Reliance on cost-effective mini-grids. In many currently industrialized countries, like the United States, Sweden, and later China, electricity initially was generated via small hydro and coal-fired thermal plants to serve local industries that had high demand for the service and could guarantee the financial viability of such investments. Excess supply of electricity provided nearby households (typically the most affluent ones, initially) the opportunity to be connected (Enflo, Kander, and Schön 2009). In Sweden, for example, seasonal variation in hydropower led many industries to sell excess power to neighboring communities to maximize the net returns from investment in generation.

⁸ Except where otherwise indicated, this section is drawn from ESMAP (2017).

In addition to the availability of an “anchor load,” reliance on mini-grids was influenced by resource availability (for example, usable hydropower or nearby coal), geography (distance to demand centers), sociodemographic factors (for example, population size and income), and sector governance, in addition to technological advances. Given the high economic cost of electricity transmission over long distances, given the technologies then available, mini-grids provided a viable alternative to a centralized grid. Mini-grids could be sized to utilize smaller-scale resources like small rivers for mini hydro-dams at reasonably low capital investments. In the United States, for example, the rapid development of mini-grids and expansion of the power sector became a profitable business in many cases—although the same businesses had to cope with later encroachment by the grid, which eventually swallowed up stand-alone systems. To illustrate the impact of policy support, local power companies in Sweden were given monopoly franchises over the areas served by their lines. The construction of the distribution lines was based on an agreement between the company and its customers that provided the incentive(s) for private sector participation.

Local participation. Local participation and ownership was a key feature of rural electrification in most countries. China adopted a bottom-up approach whereby local authorities and communities oversaw the development of off-grid generation based on resource availability and local demand. This provided a sense of ownership and technological flexibility in electricity infrastructure, as well as capacity building in construction, maintenance, and operation of the infrastructure (ESMAP 2017). Similarly, in the United States, rural communities were keen on obtaining electricity services and thus pooled financial and human resources together to ensure the expansion of grid supply to their communities.

Political commitment and public investment. Strong political will and commitment toward electrification is fundamental. Although private sector participation is important, public financing and/or regulatory support also are extremely relevant. In China, the central government built many small and isolated hydropower plants to provide electricity to neighboring communities. However, the operation and management of these power projects were given to local governments (ESMAP 2017).

In the 1920s, power companies in the United States were unwilling to extend grid services to rural communities, due to the relatively high cost of grid expansion per customer (Lewis and Severnini 2017). To address the incentive mismatch, the federal government, through the Rural Electrification Administration, offered financial incentives in the form of long-term, low-interest loans for the construction of transmission and distribution lines to rural communities and farms. In addition, several federal projects, such as the Bonneville Dam power plant, were established to provide power to rural communities. These efforts, coupled with other programs, resulted in rapid expansion of electrification in the United States between 1930 and 1955 (Lewis and Severnini 2017). This contrasts with the emphasis placed on private investment in today’s discussions of electrification in Sub-Saharan Africa.

David (1990) notes that in 1900, some 20 years after the first-generation stations were installed in London and New York, electricity was still hardly seen in homes or factories. Moreover, even when factories in today’s industrialized countries adopted electric machinery, their productivity did not increase for another 10 or 20 years—a phenomenon known as the productivity paradox. A related issue is the extent to which impacts from increased access to and availability of electricity depend on other factors, such as the availability of other infrastructure (water or roads) or access to finance for business development.

3.4 ASSESSING THE POTENTIAL DEVELOPMENT BENEFITS OF INCREASED ELECTRICITY ACCESS AND AVAILABILITY

A significant amount of money has been invested toward achieving national electrification ambitions. According to IEG (2015, xv), low-access countries across the world received about US\$3.6 billion per year for the electricity sector from all sources over 2000–14 (including about US\$1.5 billion per year from the World Bank Group). The bulk of these funds went into extension of the traditional electricity grid. The IEG report also states that to achieve universal grid access in current low-access countries by 2030 will require more than US\$17 billion per year, including about US\$12 billion per year for new transmission and distribution capacity. An additional US\$20 billion per year will be needed to address current supply inadequacies and expand generation capacity to meet growing demand. The International Energy Agency (IEA) projects that investments of around US\$52 billion per year until 2030 would be needed to achieve electricity access for all (IEA 2017, 13). These are very large quantities of investment in absolute terms and relative to past amounts. Under business as usual, according to the IEA, more than 670 million people would still lack electricity access in 2030 (IEA 2017, 11).

The ambition to improve electricity access is especially high in Sub-Saharan Africa, where almost 600 million of the 1.1 billion people currently without such access are located. About 95 percent of the US\$52 billion in needed investment mentioned above would be in Sub-Saharan Africa (IEA 2017, 13). This reflects the size of the population without access in the region, and the challenges of making effective infrastructure investments there (Foster and Briceño-Garmendia 2010). Without such a major initiative, the number of people lacking access in the region would be about 600 million of the 670 million people without access in 2030 (IEA 2017, 12).

In this sub-section, four topics are addressed. The first topic is the potential benefit for rural households (and microenterprises) from the sharp drop in cost and increase in performance of small-scale solar energy options. These can include individual solar-power devices, especially for lighting, and small-scale home systems providing electricity from having one or a few PV panels on or near the home. The second topic is the evidence available on the development benefits in Sub-Saharan Africa from access to electricity from the grid. That evidence comes from national-scale studies and experimental studies to evaluate the impact of electricity access in particular rural areas. The third topic is the potential opportunity from expanding investment in mini-grids in rural parts of Sub-Saharan Africa, and the challenges that need to be addressed for expanding such investment, especially on the part of the private sector. The fourth topic is the potential impact from improving electricity service reliability, an issue in urban and rural areas.

In the first and third topics, innovation in solar energy generation is a key element. In the second and fourth topics, provision of adequate and well-performing capacity for transmitting and distributing electricity is important, in addition to provision of adequate generation capacity. There have been important advances in the technology of the electricity grid as well as the previously noted advances in generation technology. Notable among these is development and initial implementation of “smart grid” technology, through which more dispersed and intermittent sources of electricity can be integrated, and price signals can be sent between users and the grid to reflect changes across the day in generation cost and the existence of bottlenecks in transmission capacity.

While such advanced grid management capacities are important from the perspective of overall development of the electricity grid, they are outside the scope of this report. Those capacities are important for larger-scale intermittent renewable generation sources into the national grid, and serving larger-load urban areas. However, a key focus in this report is the degree to which electricity access and availability (grid or non-grid) can reduce poverty and stimulate rural development, given there is a larger proportion of poor people in rural compared with urban areas and electricity service is much lower there. In addition, while the real-time communications capacity of a state-of-the-art grid can be useful for setting up more sophisticated electricity markets in more developed economies, much more basic reforms in sector management in Sub-Saharan Africa are needed before such sophisticated markets can develop.

Potential Impacts of Advances in Small-Scale Solar Power Generation on Rural Electrification in Sub-Saharan Africa

Advances in solar power generation have given rise to questions about the extent to which smaller-scale PV facilities can accelerate economic development in relatively sparsely populated rural areas in Sub-Saharan Africa. In those areas, capital-intensive extension of the central grid and provision of connections to individual households and businesses is costly compared with more densely populated areas, so generation technologies that can be deployed effectively at a smaller scale and in a more decentralized way may be useful.

The costs for smaller-scale PV systems strongly depend on the specific configurations of the technologies and scale of use. The cost of intermittent solar power also needs to include the cost of backup power or battery storage when solar generation is not available. Declining costs for panels and batteries have resulted in falling unit costs for smaller-scale solar systems. IRENA (2016) provides a wide-ranging and useful account of the spreads and trends in costs for various home-scale solar systems, and installed costs for various mini-grid configurations in Sub-Saharan Africa.⁹

A more basic issue is the sort of electricity services that smaller-scale sources can provide. A “pico-scale” solar home system (SHS) with a capacity of 10 watts can charge a battery during the day, which can then be used during the night for lighting with LED bulbs and charging phones. This basic lighting service can be valuable as well for small-scale retailers and service providers interested in extending their hours of business into the evening. Beyond that very basic level of service, the SHS capacity needed will depend on the electric appliances households want to use. To operate one table lamp, a refrigerator, a desktop computer, and a color TV at the same time, as would be expected in a middle-income household, would require a larger and costlier SHS than a pico-scale lighting system, including the capacity to recharge its battery storage for nighttime use.¹⁰

However, even larger-scale SHS cannot economically supply the electricity needed for many productive uses involving materials processing, such as driving electric motors in rice mills and saw mills or metalworking, or larger-scale refrigeration. A small-scale rice mill needs an electric motor with a capacity

⁹ IRENA (2016) and IFC (2017b) provide information on the expansion of markets for solar generation over time. Hermann, Miketa, and Fichaux (2014) provide some estimates of the technical potential (without consideration of economic feasibility) of different renewable energy resources.

¹⁰ We are grateful to Chris Greacen for advice on understanding system capacity requirements. Examples of systems with different capacities can be found on https://www.lightingglobal.org/products/?fwp_system_size=shs-products-10w-350w.

of more than 2 kilowatts (kW), which is equivalent to what 200 households would use with pico-SHS. Similarly, a small saw mill needs more than 5 kW of electricity capacity.

Thus, technological innovation resulting in dramatic cost reductions in off-grid, home-scale solar-powered devices and systems offers substantial opportunities for households to improve their well-being, and for small, service-based enterprises to operate in the evening. With individual solar home systems, households can obtain service for basic lighting, charging, and media use that provides higher-quality lighting, with less inconvenience or health risk than relying on candles, traditional battery-operated lights, or kerosene. However, small-scale solar home systems can provide few opportunities for improving incomes and employment, given the very limited amounts of electricity they can supply. Even these small-scale ways to increase electricity access may well require some form of subsidies to reach the lowest-income households.¹¹

The decline in the cost of solar power generation due to technical innovation also improves the economics of investing in solar mini-grids or micro-grids. A larger array of solar panels than home systems, with battery storage or back-up power sources, can supply enough electricity for a small manufacturing or repair facility, an agro-processing facility, or a refrigerated warehouse for a community to use for storing harvests. Such facilities can be “anchor customers” in a mini-grid that has sufficient scale also to serve households, at a lower cost than an SHS. However, economic, policy, and institutional challenges need to be addressed to determine the scope of what can be accomplished with mini-grids.

Mixed Evidence on the Economic Development Impacts of Access to Grid Electricity in Sub-Saharan Africa

There are several interdependencies between electricity access and use, and economic development. Increased access and use may stimulate jobs and income growth; but growth in personal and business incomes due to other causes also will stimulate increases in electricity demand that will show up as increased access and use if investments in expanding availability are undertaken. Another possibility is that another factor may influence both economic development and expansion in electricity access and use, for example increased availability of financing or improvement in investment climate. This will give the appearance of a direct positive relationship between electricity access and use, and economic development, that may not actually be present.

A key challenge in evaluating the economic development impacts of increased electricity access and use (from the grid or otherwise) thus is to “identify” how access to and use of electricity affect economic outcomes, separate from other confounding influences. Two types of approaches can be distinguished, each of which has strengths and weaknesses. Some studies use “experimental” approaches, which tend to rely upon more limited sample sizes but allow researchers to directly observe how changes in incentives to obtain electricity affect choices, other things equal. An experimental approach is used in impact evaluations in which, for example, a study team arranges for one randomly selected group of households to get electricity access, and this group is compared with another randomly selected group of households without access.

¹¹ Grimm and Peters (2016) find that in several Sub-Saharan African countries, the level of expense that households would be willing to incur for off-grid solar tends to be less than the cost of the technology for households in lower income strata.

The second category of approaches includes studies that use particular statistical techniques to infer causality in the absence of experimental data. These types of studies tend to have larger sample sizes than in controlled experiments. For example, researchers can make use of “natural experiments” in which an electricity access program is rolled out sequentially over time, and comparisons are made between groups receiving it initially, later, or not at all during the period of observation.¹² The nature of the sample allows researchers to focus on, for example, the impacts of electrification in rural areas versus electrification at a state or provincial level including urban as well as rural areas. Other studies in this category that do not attempt to separate out influences can show a correlation between economic development and electrification, but cannot establish what if any causal relationship is at work. Most studies in this category rely on micro data for household- and firm-level characteristics and choices. A few such studies use aggregated data from national accounts to make comparisons across countries in the observed relationships between electricity (and other) infrastructure and economic performance.

Calderón and Servén (2010) use cross-country aggregate data on how changes over time in various measures of infrastructure, including electrification, affect gross domestic product (GDP) vis-à-vis changes in other influences.¹³ Their analysis addresses causality and finds that greater infrastructure in Sub-Saharan Africa enhances GDP growth. However, the mechanisms through which the increased availability of infrastructure services enhances growth cannot be elucidated with this approach.

Micro-data studies of impacts of electrification outside Sub-Saharan Africa by van de Walle et al. (2017) in India and Khandker, Barnes, and Samad (2013) in Vietnam are good examples of the approach taken by many others in this literature. These authors compare the impacts over time of changing access to electricity in many rural areas with differing patterns of electrification. The substantial positive effects on household income, expenditure, and employment found in these studies stem directly from gaining access, as well as indirectly from having neighbors gain access, as brought out by van de Walle et al. (2017). Similarly, positive effects are observed for last-mile grid connections in the Philippines (Chakravorty, Emerick, and Ravago 2016). Rud (2012) finds a positive effect of electrification on industrial development in India. Burlig and Preonas (2016), in contrast, do not find positive effects on economic development in India.

So far, Akpandjar and Kitchens (2017) is one of the only nonexperimental studies on this topic for Sub-Saharan Africa with a reasonably large sample size. They find considerable effects of electrification measures in Ghana between 2000 and 2010, especially in raising non-agricultural employment.

Experimental studies in Africa also have been undertaken only fairly recently. They indicate a much more limited development impact from expansion of grid electrification in rural areas than the research from other regions. A study in rural Kenya by Lee, Miguel, and Wolfram (2018) assigned to different (randomly selected) unconnected villages not far from the grid a range of different upfront connection fees for household access to the grid. They use the differences in connections undertaken at different fee levels to estimate the “willingness to pay” of households for connection. It turns out that when the assigned

12 For this procedure to identify successfully the economic impacts of electricity access and use requires showing that the timing of the rollout was not based on different types of recipients, for example, it was not directed to more affluent (or more impoverished) households first.

13 See also Calderón, Moral-Benito, and Servén (2015). A major challenge in many studies that try to untangle the economic effects of electrification or other improvements in infrastructure services (although not in the work of Calderón and Servén) is that economic growth raises the demand for electricity; this complicates the identification of effects that increases in electricity supply (or improvements in quality) have on economic performance. Many studies have sought to address these relationships using statistical tests of causality with time-series data on energy use and growth. However, in reviewing this large body of literature, Ozturk (2010) finds no consensus on the existence or direction of causality between energy use and economic growth. Bruns, Gross, and Stern (2014) carry out a meta-analysis that reveals a statistically robust effect of economic growth on energy consumption, but not vice versa.

connection fee rises above roughly 50 percent of the actual cost, households' demand for connection goes to zero. The authors also evaluate the effects of electrification on different measures of economic activity and find no or negligible impacts.

In rural Rwanda, Lenz et al. (2017) evaluate the effects of the Rwandan EARP on households, enterprises, health centers, and schools. They find that 60 percent of households with the opportunity to access the grid in fact got connected, as did several small enterprises. Households as well as health centers and schools were very happy with having a connection, by and large, but they used electricity mostly for lighting and small entertainment appliances. Electricity consumption levels in connected households and enterprises remained very modest, even four years after connection. There was no indication of economic multiplier effects from increased productive uses of electricity at a scale beyond a few small shops and service businesses. The reliability of the grid was high during the period studied, so this was not a significant impediment to electricity usage. The effects of grid access on health centers could not be assessed, because virtually all the health centers in the country already had been provided with off-grid solar devices by the government.

A fairly large-scale experimental evaluation of a rural electrification program in Tanzania (Chaplin et al. 2017) confirms the general findings of the Rwanda study. Even in rural areas with grid access, many households and micro-enterprises in both countries use electricity quite sparingly, mostly for lighting, phone charging, and entertainment. The authors observe a reduction in the use of some traditional energy sources as well as positive effects on lighting usage and land prices as proxies for well-being. However, there is no indication of impacts on income generation and productivity, firm creation, or non-agricultural employment.¹⁴

Studies focusing mainly on households and small enterprises in rural areas do not address, for example, the potential impacts of extending service in peri-urban areas or to areas ripe for new industrial development. These various channels need further consideration in research on the economic impacts of electrification. Moreover, household access to electricity—grid-based or off-grid—may have indirect development benefits, such as improved educational outcomes due to a better study environment and access to information media, although the limited evidence so far available on this is not conclusive (Peters and Sievert 2016; Khandker, Barnes, and Samad 2013; Kudo, Shonchoy, and Takahashi 2017).

There is also a need to investigate potential synergies of increased electrification with improved availability of other economic benefits, to evaluate different portfolios of development measures that include electrification. In a forthcoming study, Blimpo and Cosgrove-Davies (2018) find that in Rwanda, there is a positive association between the impacts of electrification and several other factors, including greater access to local and regional markets, greater access to credit, workers' skill levels, and access to other public services. These correlations suggest useful avenues for additional research to unravel how electrification can enhance economic development.

¹⁴ Similar findings emerged from earlier, smaller-scale studies in Benin (Peters, Vance, and Harsdoff 2011) and Uganda (Neelsen and Peters 2011). The Benin study finds that grid access does not improve the performance of micro-enterprises in a grid-connected area compared with a nonconnected area, except for a small subset of firms whose production processes rely heavily on electricity. Comparing other types of micro-enterprises with matched enterprises in the nonconnected area indicates no statistically significant advantage from electricity access. The Uganda study finds no significant evidence of an expansionary effect of electrification on firm profits or worker remuneration, although a positive indirect impact is induced by the overall expansion on local demand from individuals moving into the electrified area. A cross-country analysis by Peters and Sievert (2016) draws together several of these findings. Dinkelman's (2011) frequently-cited study set in KwaZulu Natal finds little positive effect. Female labor supply increases with improved energy access; however, there is no effect on total labor demand, and female wages fall.

Potential Opportunities in Sub-Saharan Africa from Increasing Investment in Rural Electricity Mini-Grids¹⁵

Because of their size, cost, and relative speed of construction, mini-grids (or micro-grids) may be able to make a significant contribution to expanding electricity access and availability in more remote or lightly populated areas.¹⁶ Across the world, mini-grids and micro-grids have taken a variety of forms and performed a range of functions (Tenenbaum et al. 2014). These systems can range from small solar PV systems with batteries that provide enough electricity for basic lighting and other household needs in a small settlement, to larger-scale electricity service able to power a number of commercial and small industrial applications, with quality comparable to the national grid (IFC 2017a). They can utilize a variety of energy sources, including wind, solar, very small hydro (in hilly terrain and close to rivers), diesel, and biomass (in solid or gasified form). Continuity of service can be provided by using diesel in combination with intermittent sources like solar, or by connecting the intermittent source to batteries. Mini-grids can be stand-alone systems supplying lower voltage than the main grid, or they can be connected to the main grid and supply power into the main grid, as well as to the direct customers of the mini-grid. Grid-connected mini-grids also may decide to shut down any generation capacity they have once the grid becomes available, and serve only to distribute power from the main grid to connected customers. Mini-grids can be owned and managed by a local community, but increasingly they are owned and operated by a private company. They also could be owned and managed as a subsidiary of the utility operating the main grid.

The dramatic recent declines in PV costs from technical innovation that have benefitted the economics of solar home systems also represent a very important opportunity for more rapid scale-up of mini-grids. In addition, there are signs of growing interest of large multinational companies (for example, GE, Siemens, ABB, Eon, and Tesla) in making investments in mini-grids in rural areas (Tenenbaum, Greacen, and Vaghela 2018), and expectations of continued improvements in battery technologies. Another important but sometimes controversial technological development has been the emergence of lower-cost “pre-paid smart meters,” with which customers pay in advance for a certain amount of electricity use through a payment card that can be recharged as needed. If payment is not made, access to electricity can be cut off. These devices can simplify the challenge of revenue collection and non-payment of bills for mini-grid operators.¹⁷

There have been several examples of successful mini-grids of different types in South and East Asia, as well as some not-so-successful examples (Tenenbaum, Greacen, and Vaghela 2018; USAID 2018). However, the penetration of mini-grids is still relatively low in most of Sub-Saharan Africa, outside some model village-level installations.¹⁸ So far, Tanzania is one of the few Sub-Saharan African countries to implement a larger micro-grid electrification program, with 16 small (< 100 kW) solar PV or solar-diesel

¹⁵ We are grateful to Bernie Tenenbaum, Subodh Mathur, and Jon Exel for advice on this sub-section.

¹⁶ An additional argument for expanding mini-grids is that it may be easier to expand electricity access and availability that way than to struggle with overcoming institutional and regulatory weaknesses that hamper grid expansion. However, that is definitely a second-best alternative to addressing core sectoral governance problems so that economically sound investments in grid and mini-grid capacity are possible. Moreover, as noted below, regulatory and management issues also can be serious impediments to expanding mini-grid capacity in a financially sustainable way.

¹⁷ See <https://www.gogla.org/resources/2018-off-grid-solar-market-trends-report>. However, pre-paid meters have been met by strong community opposition in some places, notably in parts of South Africa. This indicates the political economy challenges to be overcome in trying to use improved metering and business technologies.

¹⁸ Tenenbaum et al. (2014, 25) observe that “It is always possible for donors to provide the outside know-how to build an SPP in the occasional ‘pilot’ village. When the project is inaugurated, it provides a good photo opportunity for an ambassador from a developed country or for a country’s president before an election. But in the words of one observer, this is nothing more than ‘boutique electrification.’”

hybrid micro-grids deployed since 2009 (Reber et al. 2018).¹⁹ The average system size of the micro-grids is just over 25 kW. However, several other Sub-Saharan African countries, including Nigeria, Rwanda, Tanzania, Uganda, and Kenya have been taking steps to improve their regulatory frameworks to support mini-grids (Banerjee et al. 2017, Tenenbaum, Greacen, and Vaghela 2018) (box 3.4).

The Nigerian Electricity Regulatory Commission (NERC) regulates tariffs for mini-grids developed by independent companies with distribution capacity of more than 100 kilowatts (kW). The goal is to establish cost-based tariffs, given targets for technical and commercial losses. For mini-grids with distribution capacity of less than 100 kW, NERC will accept tariffs that have been negotiated with the community.

Like Nigeria, Rwanda requires cost-reflective mini-grid tariffs. However, a mini-grid developer need not obtain the regulator's approval of its cost calculations before its retail tariffs go into effect. The regulations indicate what is to be included in calculating allowed costs. The regulator reserves the right to review the developer's cost calculations at any time.

Sources: Tenenbaum, Greacen, and Vaghela (2018).

BOX 3.4:
Policies for
Regulating
Mini-Grid Retail
Tariffs in Nigeria
and Rwanda

To be successful, mini-grids need to overcome several challenges. Above all, mini-grids need clear legal frameworks *before* making investments, implemented through local contracts with direct customers, national rules, and standardized regulatory contracts between purchasers and project developers (Tenenbaum et al. 2014; Tenenbaum, Greacen, and Vaghela 2018). Mini-grid companies need to have confidence in the quantity of power they will be able to sell, whether it is only to their direct customers or to the main grid as well, and in the prices that they will be paid. They also need to have a clear understanding of what may befall them once the main grid arrives and can compete with them. For example, will the utility operating the main grid be able to undercut the mini-grid with artificially low electricity prices made possible through government subsidies? Will there be a requirement that a utility taking over a service area of a mini-grid pays some compensation to the mini-grid for idling its assets, as well as possibly contracting with it for continued provision of local power distribution? Without clear specification of the mini-grids' rights and avenues of recourse, investment will be excessively risky.

Ultimately, the economic pros and cons of mini-grid investment can be summarized in a few major considerations. Although mini-grids may be more cost-effective than grid extension for supplying electricity for a range of productive uses in more remote or lightly populated areas, the prices that electricity users in those areas are willing and able to pay still may not be high enough to cover the capital and operating costs, even if the increased access to and availability of electricity could bring economic gains (D'Agostino, Lund, and Urpelainen 2016). However, while unit costs for full extension of grid-provided electricity may be lower than for mini-grid power, because of economies of scale and density, a long wait for grid power to arrive implies a potential cost in terms of foregone development opportunities relative to what might be possible with a mini-grid. Nevertheless, this argument for a proactive strategy to invest in mini-grids depends on the extent to which having

¹⁹ While our emphasis here is on solar, renewable mini-grid capacity in Tanzania is mostly small hydro, while solar has a quite small capacity share.

the electricity available is a key ingredient for increasing economic development in the areas to be served. As noted above, the evidence on this for rural areas remains mixed.

In part because the importance of electricity access vis-à-vis other factors remains poorly understood, RMI (2017) calls for experimental trials to generate systematic knowledge on proof of concepts that can be used to answer those “questions that are keeping many governments and investors on the sidelines.” However, care is needed in evaluating the case for subsidizing mini-grid installations, especially in the context of private owner-operators. Some more remote and lightly populated areas may never be economic for mini-grid service; but it is also important to assess how much economic development benefit can be engendered by the increased access to and availability of electricity. Meanwhile, subsidization of mini-grid installation can give rise to a number of problems, including provision of subsidies that are not actually needed and the possibility that subsidies will encourage weaker companies to enter the field. Mechanisms that use auctions in which companies bid on service quality and on *less* need for a subsidy can help ameliorate these problems to some extent, but only if markets become large enough to attract a number of competitors.

The observations in this subsection highlight the need for well-designed and accessible planning tools to formulate electrification strategies. For example, such tools can help identify what areas are better candidates for grid connection vis-à-vis the establishment of a mini-grid or reliance on off-grid solar home systems. This is another topic area in which Sub-Saharan Africa can take advantage of innovation that has greatly improved the usefulness of the available tools. A spatial electrification tool (see Mentis et al. 2017) and a Network Planner tool (see Kemausuor et al. 2014) provide information on the distance to the already existing grid, topography, population density and growth, solar irradiance, cost of diesel provision, electricity demand, and anticipated connection rates after electrification for evaluating different electrification options.²⁰ Expanded use of satellite imagery for geospatial mapping adds considerably to the ability to locate local clusters of power demand in currently underserved areas. A cautionary note is provided by Kemausuor et al. (2014), which reveals the heavy dependence of model-based planning tools on demand assumptions: as connection rates and average demand projections decrease, least cost strategies shift massively from on-grid to mini-grids and off-grid solar.

Potential Impacts of Improving Electricity Service Reliability

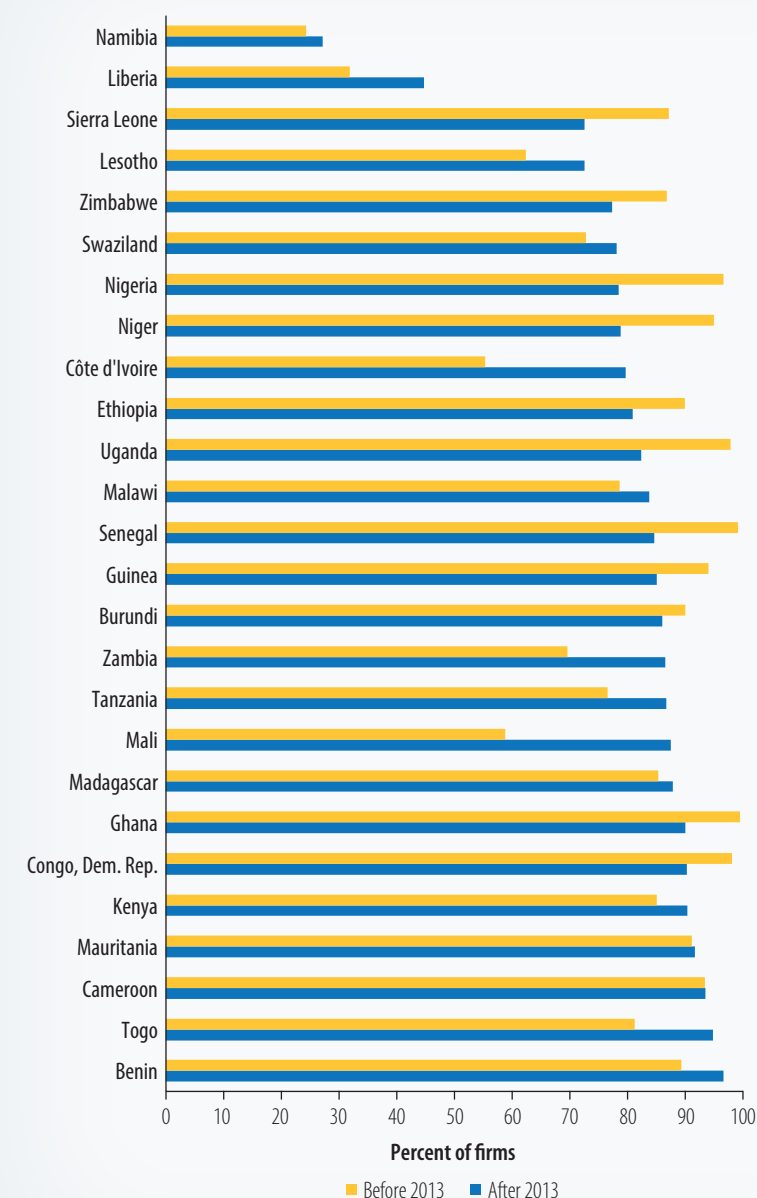
In grid-connected areas in Sub-Saharan Africa, electricity service quality is often low, with frequent and sometimes long-lasting outages, planned and unplanned. Figure 3.6 illustrates the situation in the context of reliability of service for businesses. This raises a question on the extent to which the findings from the experimental types of studies showing limited economic development benefits from grid electrification might be due in part to reliability problems.

20 The “Multi-Tier Framework” for assessing energy access under the United Nations/World Bank Sustainable Energy for All (SE4ALL) initiative (ESMAP 2015) is itself a useful planning tool, since it can account for different quantities and quality of access.

It is important to understand the options that firms have when facing an unreliable grid. The most obvious adaptation strategies are to reschedule production processes that rely on electricity; invest in self-generation capacities, mostly generators, if they have the capacity to do so; or move to areas with more reliable service (Steinbuks and Foster 2010; Steinbuks 2012; Allcott, Collard-Wexler, and O'Connell 2016). Firms that are integrated into more sophisticated division-of-labor value chains might also outsource more electricity-intensive production processes. These potential adaptive responses to low reliability create methodological challenges in that comparisons of the impacts of unreliability among firms with more or fewer outages or generators, for example, do not in themselves show cause-and-effect (see, for example, Grainger and Zhang 2017). They may instead be reflecting differences in adaptive capacity.

Several nonexperimental studies, using information on frequency and duration of outages, as well as backup generation capacities, find a negative relationship between outages and firm performance, and a positive relationship between generator usage and firm performance (see, for example, Grainger and Zhang 2017 for Pakistan, and Oseni and Pollitt 2015 for several African countries). Focusing on small and medium-size enterprises (SMEs) in Bangladesh, Nepal, Nigeria, Pakistan, Tanzania, and Uganda, Scott et al. (2014) relate differences

FIGURE 3.6: Percentage of Business Reporting Electricity Outages in Sub-Saharan Africa, before and after 2013



Reliability of electricity service quality remains a major issue

Source: Enterprise Surveys Data 2018, from <http://www.enterprisesurveys.org/data>.

Notes: Data from Enterprise Surveys on the percentage of firms experiencing electricity outages.

in reliability to differences in productivity, cost-competitiveness, and investment decisions. They conclude that although unreliability tends to have a negative effect on the productivity of SMEs in manufacturing, this is not always the case, and the results depend on how unreliability is measured. Furthermore, “SMEs experiencing electricity insecurity do not have higher unit costs of production than other SMEs and do not experience a competitive disadvantage in this way.” For investment decisions, Scott et al. (2014) state that reliability does have an influence, but it is “not the most significant factor.” In practice, this depends on which sectors are exposed to lower levels of reliability.

Using African firm-level data from the World Bank Enterprise Survey, recent not yet published work by Mensah (2018a) compares electricity outages with firm revenue and total factor productivity. In contrast to the findings of Scott et al. (2014), Mensah’s results indicate a strong negative relationship. The data indicate that firms facing more outages tend to rely on electricity self-generation, which increases the overall cost of production. Mensah (2018b) combines household and firm data to show a negative relationship between outages and employment. The data suggest that outages result in job losses through negative impacts on entrepreneurship, firm performance, and trade competitiveness. These observations indicate the usefulness of deeper causal investigation of the business impacts of unreliable electricity.

Experimental-type evaluations of service-improving interventions that reduce the frequency or intensity of outages do not (yet) exist for Sub-Saharan Africa. However, reliability in Rwanda was fairly high during the EARP evaluation documented in Lenz et al. (2017), with only short outages occurring every couple of days. In Kenya and Tanzania, in contrast, reliability was more of an issue. Lee, Miguel, and Wolfram (2018) report that around one-fifth of the sample in their Kenya study suffers from severe blackouts (some of the transformers were completely out of order). Chaplin et al. (2017) report that connected households in their study have grid electricity for fewer than 16 hours per day and experience around 1.7 episodes of brownouts per week (in their sample of more than 300 rural and peri-urban communities). Hence, reliability was apparently quite low. Yet, according to qualitative interviews done in a subset of eight of these communities, Miller et al. (2017) report few concerns expressed by households about the quality of electricity service.

Several studies have noted that less reliable electricity can have consequences like an input tax on energy (Allcott, Collard-Wexler, and O’Connell 2016; Abeberese 2017; Fisher-Vanden, Mansur, and Wang 2015; Chakravorty, Pelli, and Marchand 2014). Specifically, firms will choose less electricity-intensive input mixes, which means less intensive use of modern electricity-powered machinery. These choices reduce overall productivity and forgo opportunities to benefit from technical advance in machinery-intensive sectors. Moreover, since smaller firms face more difficulties in smoothing production through generator usage, unreliable electricity affects the size distribution of firms. These impacts could hold back industrial advances in or near urban areas. It is difficult to tell how substantial the impacts might be in the context of small enterprise development in rural areas.

Box 3.5 highlights the need for reliable supply of electricity to power the digital economy.

Many countries in Sub-Saharan Africa seek to diversify their economies with information and communications technologies (ICT), including expanding ICT as a sector and increasing its use in enterprises. One of the core ICT infrastructure elements is data centers. These facilities are a vital engine of the digital economy, storing data, hosting websites, and enabling cloud-based applications. Data centers are virtual data factories that make productive use of electricity, with measurable economic impact on gross domestic product, employment, and government tax revenue (Dutch Datacenter Association 2017).

Data centers consume lots of electricity to power computer equipment and keep it cool. In 2011, Google reported that it used 260 megawatts of electric power for its data centers (Glanz 2011), which is greater than the 2014 installed capacity in 19 Sub-Saharan African countries (Trimble et al. 2016). Data centers require high levels of reliability to ensure a seamless, nonstop flow of data. Reliability is defined by industry standards, ranging from 99.67 percent availability with no more than 29 hours of interruption per year for tier 1 data centers, to 99.995 percent reliability with just 0.8 hour of interruption per year for the highest tier 4 centers. Most Sub-Saharan African nations would find it difficult to meet even tier 1 reliability. The standards also call for a guaranteed source of electrical backup that can power the center for at least half a day (Uptime Institute 2012).

Lack of enterprise-grade reliability requirements for industry certification generally rules out the feasibility of large data centers in many Sub-Saharan African countries. Although virtually every country in the region has a data center, the centers are small, serving a narrow set of business and government users. Due to the region's challenging environment for reliable and inexpensive electricity, most businesses host their data outside the region. This results in a large volume of data transmitted to overseas data centers, requiring significant amounts of international Internet bandwidth. Along with connectivity and storage costs, it takes a longer time to access overseas data centers, raising latency. Security is an issue, as increasing amounts of government, business, and personal information are transmitted abroad, with vague data protection.

To build up its national data center industry and improve latency, Rwanda launched an initiative to repatriate 1,000 websites hosted abroad (RICTA 2015). An analysis of the program found that quality was improved for domestic users due to faster access to the sites (Internet Society 2017). Visitor engagement was high, with more page views and return visits due to the enhanced performance. The skills of web-hosting employees increased, due to technical requirements to manage additional websites. Although latency improved, it is still difficult to convince local businesses to place their websites in Rwanda, due to the lower price of hosting overseas. This is primarily because of the high cost of electricity for data centers in Rwanda. The government is contemplating subsidizing the cost of electricity for local data centers, to make local hosting more attractive, improve latency, and strengthen data sovereignty (Minges 2017).

Despite concerns about reliability, there is growing interest in installing large data centers in the region to achieve better latency and reduce the cost of international bandwidth. In 2017, Microsoft, one of the world's largest owners of data centers, announced it would build two data centers in South Africa, to support its cloud-based services. Notably, South Africa's electricity supply is considered the second most reliable in the region after Mauritius (Afrobarometer 2016). The new data centers will have faster speeds compared with accessing cloud services in Europe or the United States; international connectivity costs will be reduced; and trust will be increased, as the centers will have to comply with South Africa's data protection law (Marston 2017). Electricity reliability is critical for other countries in the region that want to develop their digital economies.

Source: Blimpo and Cosgrove-Davies 2018.

3.5 CHALLENGES IN IMPROVING ELECTRICITY SECTOR GOVERNANCE

Necessity of Improved Power Sector Governance

Improved electricity sector governance is a top priority for effectively expanding electricity access in Sub-Saharan Africa. Expanding grid electricity access and power availability requires a significant amount of capital for adding new generation capacity, transmission lines, and distribution substations. The capacity of utility companies to raise capital internally with their own cash flows requires a sound balance sheet, and this is not possible if tariffs are distorted, bill collection and theft prevention are difficult at best, and uncompensated costs are imposed on the companies to satisfy other social mandates.²¹ Direct government financing is uncertain and increasingly scarce, given limits on the fiscal capabilities of many countries.

Financing from sources outside the utility also is critical to success in enhancing electricity access and power availability, given the limited internal resources of utilities and national governments. However, equity financing is impossible without clear delineation of the role for private investment in the sector. Equity and debt financing are costly if net revenues are inadequate and uncertain for the reasons noted above.

Barriers to private sector equity participation in power generation through independent power providers (IPPs) not only reduce the availability of financing, but also stymie opportunities for improving the efficiency of electricity production and thus lowering its cost, including through utilization of improved technologies. They also obstruct possibilities for improving efficiency and lowering prices through increasing competition in the provision of electricity. These considerations are especially important in the context of state-owned utilities that are not accountable to shareholders and often have weak corporate governance, with the result that they are particularly inefficient.

Expanding electricity access through increased production from IPPs with smaller-scale generation, incorporation of renewable energy sources, and construction of distributed mini-grids require even more effort to establish a sound regulatory environment (Tenenbaum et al. 2014; Tenenbaum, Greacen, and Vaghela 2018). One of the most important considerations for creating a positive environment for mini-grid investment is spelling out the rules and procedures governing the relationship between a mini-grid and the main central grid. What are the rights and obligations of these two parties with respect to the mini-grid interconnecting with the main grid, to sell surplus power or purchase backup power with intermittent primary generation sources? If the mini-grid is farther from the main grid, what happens as the grid expands into the area served by the mini-grid? For example, can the grid compel interconnection? How does one mitigate the risk that the main grid could drive the mini-grid out of business unfairly and inefficiently, by offering lower, typically government subsidized prices without compensation for stranded investments? If this risk is not mitigated, mini-grid investment by IPPs will be stunted.

Another important consideration is spelling out the rights and obligations of the mini-grid and its customers. How does the mini-grid curtail service to avoid an outage from demand exceeding power availability? How does it set prices to recover investment as well as operating costs and compel payments?

²¹ Newbery (1998, 2) argues that the “central problem of regulation is to agree [on] a regulatory compact which assures investors that their sunk capital will be adequately rewarded, and that they will be protected from populist pressure to reduce prices.”

Cross-border power trade in Sub-Saharan Africa is quite limited, despite the existence of three regional power pools whose ostensible purpose is to facilitate such trade and help to coordinate regional expansion. However, expansion of cross-border electricity trade may be able to yield significant benefits by avoiding duplicative investment in new generation capacity, and improving returns to larger-scale generation investments by increasing the scale of demand, as well as expanding transmission infrastructure. Even if there is limited scope for new regional-scale generation projects, expanded cross-border power trading can yield benefits if it is undertaken in a way that fosters more competition in electricity generation and increased incentives for improving firm performance and accelerating the penetration of technology improvements. Sound governance of national electricity systems is needed to reduce obstacles to successful cross-border electricity trade, such as lack of payment discipline, lack of security of supply, lack of the trust needed to engender credible commitments to electricity trade, and inadequate investment in cross-border transmission capacity.

Improved sector governance is yet another area in which Sub-Saharan Africa can benefit from taking advantage of innovative efforts elsewhere. Faster and more effective electrification can be accomplished by adapting and utilizing lessons from other experiences in what has and has not worked. Research on organizational behavior also provides new insights into why companies and regulatory bodies can have persistent roadblocks to improved performance.

There is an extensive and thoughtful literature on the general theory of power sector regulatory reform and improved governance and ways that the theory needs to be adapted in practice to fit the circumstances faced on the ground.²² What follows here are observations on the need for improved sector governance and opportunities for making such improvements in the context of Sub-Saharan Africa, but firmly grounded in theory and experience in other areas as well as in Sub-Saharan Africa.

Impediments to Successful Improvement of Power Sector Governance in Sub-Saharan Africa

Eberhard's (2007)'s discussion of several impediments to successful improvement of power sector governance remains highly relevant today for many countries in Sub-Saharan Africa. These obstacles include the following:

Lack of commitment to advance electricity sector restructuring. Over the past couple of decades, Sub-Saharan Africa has made some progress in improving the governance of its power sector, as suggested by figure 3.5. Many countries have introduced some form of competition, reducing the prevalence of fully monopolized, vertically integrated power sectors. However, most countries have only made some regulatory reforms to open the generation subsector to IPPs, without much progress in improving the performance of the existing integrated utilities. Foster et al. (2017) observe that vertically integrated natural monopolies remain the norm in over 80 percent of the countries in Sub-Saharan Africa. Moreover, even where IPPs can enter on paper, other barriers, such as lack of assured access to transmission facilities, limit their scale and impact.

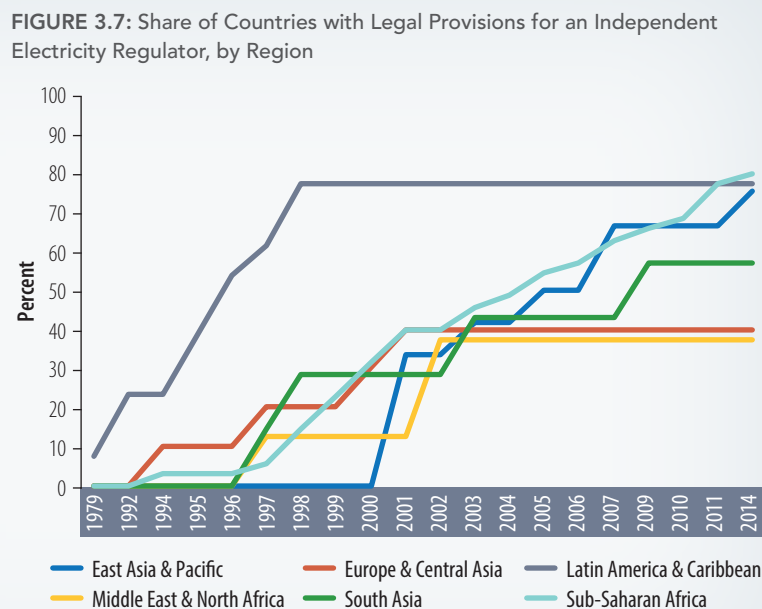
22 Joskow and Schmalensee (1983) remains a landmark in this literature. More recent contributions addressing lessons learned and adaptation of regulatory reform concepts to developing countries include Sorenstein and Bushnell (2015) and Strbac and Wolak (2017).

A key concern with not restructuring traditional state-owned utilities is that there are no financial penalties for poor performance. This can undermine incentives to expand the customer base or lower costs by reducing technical and commercial losses. In the context of water utilities, Berg (2013) argues that strengthening managerial performance incentives, with targets based on well-designed performance benchmarking, is central to improving the performance of state-owned and municipal utilities. Where social objectives are undertaken by state-owned utilities (such as ensuring electricity access for lower-income citizens), transparent and realistic business plans are needed in addition to input from civil society.

Institutional and political weaknesses. Conceptually, one of the most important elements for improving power sector governance is the establishment of organizationally separate and functionally independent regulatory agencies. Such bodies play a vital role in helping to depoliticize and thereby improve the performance of the sector, for example, by setting tariffs transparently and in accordance with specified rules and limiting predatory conduct by existing utilities through ensuring market access to IPPs via access to transmission. Most of the countries in Sub-Saharan Africa have legislation establishing separate regulatory authorities, even surpassing that of other developing country regions (see figure 3.7). However, many of these regulators are not genuinely independent. Some do not have the authority to set tariffs; for example, they can only recommend tariffs for approval by the minister. Even where the national regulators have more independence legally, they come under significant political pressure not to set tariffs according to transparent processes and objective economic principles. In a study commissioned by the World Bank and African Forum for Utility Regulators to assess the performance of regulators in Africa, Gboney (2010, 7) finds that “No regulatory agency has been able to achieve [the desired outcomes indicated by] the standard Independent Regulatory Model.” Implementation of power sector regulatory reform is particularly challenging in the

environment characterized by political instability and conflict that is encountered in Sub-Saharan Africa. Foster et al. (2017) note that among the countries in their study that have not taken any measures toward power sector regulatory reform, most tend to be conflict-affected states in Sub-Saharan Africa, such as Eritrea, Guinea, Liberia, and South Sudan.

Lack of transparency, credibility, and accountability. The counterpart to the frequent absence of genuinely



Most regulatory agencies in Africa are still developing their capacity due to nonavailability of skills and experience

independent regulatory bodies is that the regulatory environment in many Sub-Saharan African countries is opaque. Concession agreements and power purchase agreements rarely are subject to independent scrutiny. Eberhard (2007) observes that government officials and collaborating private operators often justify such secrecy “on the grounds of commercial necessity or competition.” However, competition in the power sector is absent or very limited in most Sub-Saharan African countries. In Namibia, unlike in many other countries in Sub-Saharan Africa, the meetings of the regulatory board are open to the public, and its minutes are published.

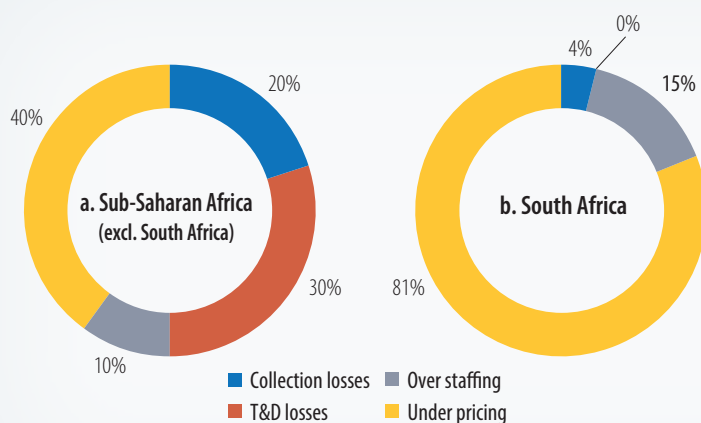
Lack of regulatory capacity and competency. Building the professional capacity of new regulators is one of the biggest challenges facing the infrastructure sector in Africa. Lack of institutional strength makes national regulators particularly vulnerable to external political pressures, as many regulatory institutions in Sub-Saharan Africa are no more than 10 years old (figure 3.8). It takes time to strengthen national regulators and establish better management

and organizational systems and practices. Most regulatory agencies in Africa are still developing their capacity and competency, due to nonavailability of key skills and experience. African Development Bank (2013) describes the experience of Ethiopia, where the existing regulator, the Ethiopian Electricity Agency, was delegated to perform a dispute resolution function. However, the regulator could not perform these duties satisfactorily, as it had no experience in dispute resolution and needed training in the field. Angola provides another example, where the limited availability of human resources skills in the national regulatory authority has increased the risks of delay and redundant investments in the national power sector.

Inadequate coordination among government agencies and weak sector planning. Eberhard and Gratwick (2011) observe that the majority of Sub-Saharan African countries have inadequate planning capacity and end up contracting out this function to consultants. Nevertheless, many countries in the region do not have least cost power development plans, and in those that do, the plans often are seriously outdated (Eberhard et al. 2017).

Even where the national electricity development plan is more up-to-date and robust, implementation can be highly problematic, due to lack of integration between the planning and implementation authorities. Vagliasindi and Besant-Jones (2013) observe that in South Africa, Eskom’s operating cost recovery ratio declined over 2005–08, despite a doubling in average revenue yield (in nominal price terms) over the same period. They argue that this outcome can be traced to a significant extent to costly investments in extending power supply access to customers whose businesses were unprofitable for Eskom. Nyoike (2002) shows

FIGURE 3.8: Composition of “Hidden” Utility Costs in Sub-Saharan Africa



Source: Trimble et al. 2016.

Note: T&D = transmission and distribution.

Underpricing is the largest component of the utilities’ quasi-fiscal deficits across Sub-Saharan Africa, followed by transmission and distribution losses

that Kenya's 328 megawatt (MW) planned capacity expansion over 1996–2000 saw only 205 MW actually installed, leaving a significant shortfall. Kapika and Eberhard (2013) find that in more recent years, power sector regulatory reforms in Kenya have led to greater coordination between planning and implementation, and hence an increasing number of IPPs and public sector–funded capacity-expansion projects.

Sound energy planning also is important for electricity access off the main grid. The commercial viability of mini-grids depends critically on the time horizons for cost recovery and the size of the prospective customer base. In turn, these are affected by the credibility of national grid electrification plans (Tenenbaum et al. 2014).

Problematic tariff structures, leading to poor financial viability of electric utilities. In the 1980s, the region's tariffs were greater than long-run marginal cost and achieved higher cost recovery levels than other regions (Huenteler et al. 2017). However, evidence from more recent studies has shown that underpricing of electricity is prevalent today in many countries in Sub-Saharan Africa, as reflected in figure 3.4.

Trimble et al. (2016) conclude that underpricing is the largest component of the utilities' quasi-fiscal deficits in the region, accounting for 40 percent, followed by transmission and distribution losses (30 percent), commercial losses (20 percent), and overstaffing (10 percent) (see figure 3.8). The problem of underpricing is even more drastic in South Africa, the continent's largest economy, where underpricing accounts for 81 percent of the total deficit, followed by overstaffing (15 percent) and commercial losses (4 percent). Trend data were available for a limited number of countries; these showed that quasi-fiscal deficits in the power sector improved or remained stable in some cases and deteriorated in others.

One reason for the underpricing, particularly in the residential sector, is households' low willingness to pay for electricity services because of limited incomes, especially in rural areas. Briceño-Garmendia and Shkaratan (2011) find that many poor households in Sub-Saharan Africa without access to electricity would have problems affording even the variable cost of electricity at current rates, let alone the full cost of service. This is consistent with the findings noted in the previous section from the impact evaluation of Rwandan rural electrification: many households there who did have connections consumed no more electricity than could have been provided by a moderate-scale solar home system. Yet, once the grid has been extended, there is strong political pressure to set prices low enough to increase its utilization.

Once underpricing becomes the norm, it is difficult for governments to undo it (Huenteler et al. 2017). Tariffs in many Sub-Saharan African countries are among the highest in the developing world. Raising the tariffs is politically unpopular, even where more households have a willingness to pay for electricity services with improved quality. For example, Twerefou (2014) finds that households were prepared to pay on average about US\$0.27 per kWh for improved quality of electricity service in Ghana, or about 150 percent of the tariffs at the time of the study. Similarly, Oseni (2017) finds that Nigerian households would be willing to pay up to 86 percent above the current tariff for improved service quality. Yet, underpricing persists in both countries.

Moreover, raising tariffs alone may not be sufficient for the utilities to achieve full cost recovery. Trimble et al. (2016) argue for the need to lower the cost of supply to come closer to cost recovery, and that potentially large cost savings exist for many countries in Sub-Saharan Africa. Other policy recommendations

to improve the financial viability of electric utilities include pre-paid electricity meters that can effectively reduce commercial losses, if political economy challenges can be overcome, and reducing corruption, such as, for example, demands from utility staff for bribes in some countries (Kojima et al. 2016).

Implications of Barriers to Improving Electricity Sector Governance

The consequences of difficulty in overcoming barriers to improving electricity sector governance include inadequate total investment in the sector and lack of private sector participation (box 3.6). The major implication of excessively low prices is that they make it unaffordable for the public utilities to finance national power sector expansion to meet rapid demand growth (Kessides 2012). The utilities may also choose to increase electricity connection charges, to generate additional revenues and prevent unprofitable customers from accessing the electricity grid (Blimpo, McRae, and Steinbuks 2018). Because of the high connection charges, electricity access is greatly diminished (Golumbeanu and Barnes 2013). Huenteler et al. (2017) describe the example of Zambia, where inflation and insufficient adjustments of the historically low electricity tariff resulted in deteriorating financial performance of the national utility, ZESCO. The company's cost recovery dropped from about 1.3 in 2003 to about 1.0 in 2006–07. This left the company without sufficient financial resources for major expansion of access to electricity or system supply capacity. Another example is Senegal, where in the 2000s the electricity sector's deepening financial crisis led to rapidly growing electricity shortages. Between 2004 and 2010, the financial losses of the national utility (SENELEC) increased 14-fold, and the undelivered energy jumped 12.5-fold during the same period.

Engaging the private sector is important for advancing electricity access in developing countries, where the public sector lacks sufficient resources to undertake costly investment in electricity generation and

transmission, and international donor sources are very limited. Although private sector participation has grown in much of the world, in Sub-Saharan Africa, 50 percent of the countries have not engaged the private sector in generation or distribution. Foster et al. (2017) show that, in most developing countries, private sector participation is particularly low in the transmission and distribution sectors. More than any other reform, private sector participation has proved to be subject to significant reversals.

Private sector investment by IPPs engaged in grid and off-grid electricity provision has been adversely affected by regulatory policy uncertainty. Given the small size of many IPPs, they are electricity price takers selling to the integrated national utility (typically, a single buyer) and competing with other supply options. In many instances, the national utility prefers not to buy power from IPPs and cancels the contract, even if the IPP sells at lower prices than other generation sources. This may happen because the administrative costs of buying power from multiple small producers can be too high. Moreover, if electricity tariffs are high enough, the utility may want to remain the sole supplier of electricity, so that it

- Lack of commitment to move forward on electricity sector restructuring
- Lack of transparency, credibility, and accountability in the regulatory environment
- Lack of professional capacity
- Weak sector planning and inadequate coordination among government agencies
- Tariffs that do not cover costs and distort incentives, leading to poor financial viability of electric utilities.

Source: Eberhard 2007.

BOX 3.6:
Summary of
Cross-Cutting
Challenges
to Improve
Power Sector
Regulation and
Management
in Sub-Saharan
Africa

can exercise market power in the absence of sufficient regulatory oversight. Cancellations and reversals for IPPs exceed 30 percent in Sub-Saharan Africa, which is twice the rate in other developing regions. In the distribution segment, private sector participants face high risks of divestitures (private acquisition of formerly publicly-owned assets) and concessions (service contracts engaging private sector participants). These arrangements face a 50 percent failure rate in Sub-Saharan Africa, compared with 15-20 percent elsewhere. Many of the early private sector participation arrangements saw contracts cancelled (the Comoros, The Gambia, Guinea, Mali, and Togo) and divestitures renationalized (Cabo Verde and Senegal).

One way to reduce cancellations and reversals for IPPs is to have an independent national regulator that is more involved in the purchase contracts of the national utility vis-à-vis its traditional responsibility of regulating the seller (the IPP). For example, one of the important decisions the national regulator must make is how to split the costs of the interconnection between the IPP and the national grid operator (which is typically part of the national utility). Another important decision concerns the price (or the feed-in tariff) that a grid-connected small power producer receives for the power that it sells to the national or regional utility. Setting the correct price for such transactions is particularly important for IPPs selling renewable electricity, as the price should account for the social benefit of avoided pollutants and, within the context of a country's commitments to reduce greenhouse gas emissions, the value of reducing such emissions through expanded deployment of renewable energy. Tenenbaum et al. (2014) note that in practice, an appropriate price is rarely implemented because the social cost of environmental damage is difficult to estimate in a way that convinces the affected parties, and it is often politically difficult to get someone to pay for it. However, this rationale does not justify setting an implicit default price of zero for environmental damages.

One barrier to mini-grid development is that regulators in many countries require mini-grid operators to charge the same tariff as the state-owned utility does, which may not even cover the operating costs of the central grid, given government subsidies (Trimble et al. 2016). However, electricity regulatory commissions and rural electrification entities in several African countries—including Nigeria, Tanzania, and Rwanda—have specified that mini-grid retail tariffs need not be the same as the retail tariffs charged by the state-owned national utility (Tenenbaum, Greacen, and Vaghela 2018). In addition, if no legal framework exists that stipulates what is to take place when the central grid is extended to an area with a mini-grid, entrepreneurs will abstain from investing for fear of losing the value of their assets (IFC 2017a; Comello et al. 2017; Tenenbaum et al. 2014). Electricity regulators in Tanzania, Rwanda, and Nigeria have issued legal rules specifying post-interconnection business models and forms of compensation for developers whose isolated mini-grids become connected to the main grid.

Tanzania is one of the few countries in Sub-Saharan Africa that has undertaken regulatory reforms and implemented a national-scale micro-grid electrification program. The relative success of the program is at least partially attributable to a sound regulatory framework. The tariff methodology for small power projects is technology neutral and based on avoided generation costs (Moner-Girona et al. 2016). For grid-connected systems, the feed-in tariffs are derived from an assumed seasonal mix of hydro and thermal generation, whereas those for isolated systems reflect “islanded” diesel generation costs. Under the Standardized Power Purchase rules issued by the national regulator, projects in Tanzania under 1 MW do not require a license but need to register with the regulator. Projects under 100 kW are also exempt from tariff approval. Freedom to set their tariffs reassures mini- and micro-grid companies that they will be able to recoup costs.

Beyond just limiting investment and reducing incentives for private sector participation, weak and opaque governance—for example, when other external parties have no access to regulatory contracts—elevates public concerns over corruption or the exercise of market power. That in turn leads to a lack of trust in the entire system. This is extremely problematic, given the often highly politicized nature of decision making in the sector and the need for careful deployment of limited investment resources for good results.

Engaging the wider community in making the regulatory system accountable, including having a genuinely independent regulator, is critical for raising the credibility and legitimacy of the governance system. Kapika and Eberhard (2013) describe the case of Tanzania as an example for successful stakeholder engagement. Tanzania has established the Government Consultative Council (GCC), a formal structure through which the public can engage with the regulator. GCC recommendations are not binding, and in many cases real decisions end up being made with only limited engagement by the GCC. Nevertheless, there is at least a forum where public concerns can be clearly communicated to the regulator, especially on licensing and tariff-related matters. Even if such consultative councils are not used, regulators should at the very least disclose justifications for their decisions in a timely and regular manner, to avoid perceptions that they serve only “to ‘rubber-stamp’ tariff decisions agreed upon elsewhere” (Kapika and Eberhard 2013).

Expanding Cross-Border Electricity Trade

Expanding cross-border power trade also can contribute to improving power sector governance and performance. Cross-border trade can create additional competition for national power sector monopolies and additional pressure to reduce operational inefficiencies from organizational or political decisions. In turn, this increases the incentives to reduce rent-seeking behavior within national electricity sectors. The management of increased cross-border trade also supports increased transparency and helps to encourage regulatory consistency among national systems. However, reaping these benefits requires strong national-level sector improvements as well as cross-border coordination mechanisms for facilitating payments and synchronizing grid frequencies.

Underpricing electricity in domestic markets also adversely affects cross-border electricity trade. It leads to increased depreciation of generation, transmission, and distribution systems, which makes interconnections costlier to operate. It damages the financial viability of utilities, deterring private sector investment in generation and thus limiting the capacity available for cross-border trade, including investment in new generation projects in electricity exporter countries. The poor financial health of electricity importers increases the risks associated with contracting, security of demand, and nonpayment.²³

Effective implementation of regional-scale sector planning (not just development of plans that are not followed) allows participating countries to lower generation and transmission costs by avoiding duplicative investments and taking advantage of economies of scale in large-scale project development. For example, some large-scale hydroelectric projects may have great potential to generate cheaper power, but the economically effective development of such resources requires coordination, given that much of the production would be exported.²⁴

²³ These issues are discussed in the South Asia context in Singh et al. (2018).

²⁴ Timilsina and Toman (2016) provide an analogous demonstration of this point for South Asia.

3.6 IMPLICATIONS FOR ELECTRIFICATION STRATEGIES IN SUB-SAHARAN AFRICA

This section has argued that technological innovation in the form of dramatic improvements in solar power offers substantial opportunities for households to improve their well-being through expanded use of home-scale solar power systems and devices, but these in themselves offer few opportunities for improving incomes and employment because of the limited amounts of electricity they can provide. Even these small-scale ways to increase electricity access may well require some form of subsidies to reach the lowest-income households. However, grid extension in rural areas may not have much economic impact either, at least in the nearer term, given its cost and the limited ability to pay and willingness to pay of lower-income potential users. One priority going forward is more analysis to improve understanding of the roles played by increased electricity access and availability, and improved service reliability, in spurring economic development, increased employment, and reduced poverty.

Micro-grids or mini-grids for rural power provision represent a very interesting middle ground between home-scale systems and extension of the national grid. Solar mini-grids with battery storage are particularly of interest given the sharp declines in PV cost triggered by rapid technological advances. At this stage, experience with mini-grids in Sub-Saharan Africa is limited, although they seem to have worked well in several cases in South and East Asia. Several countries in Sub-Saharan Africa have been revising their power-sector regulations to reduce barriers to mini-grid development.

The economic trade-offs between mini-grids and extension of grid service will depend on the cost of mini-grids, which do not have the economies of scale and density found on the main grid; the potential scale of customer demand given the cost; and the length of time required for extension of the grid into more lightly populated and remote areas, compared with mini-grid service availability. The nature of these trade-offs ultimately will determine the extent to which solar mini-grids (as well as small-scale hydro) will facilitate economic development with substantially less reliance on the traditional power grid than in the past. In the face of limited willingness to pay for electricity in more remote and less densely populated areas due to low incomes, neither grid extension nor investment in mini-grids can have that much impact on income growth and poverty reduction.

One way to accelerate access would be to subsidize mini-grids. However, the benefit of doing so depends on the extent to which limited electricity access and availability for productive uses have been a severe constraint on economic development in the areas where mini-grids would be installed. Subsidies also are difficult to target in terms of identifying the types of mini-grid systems that are better suited than others to the areas where investments are being made, and the degree to which subsidies are needed. Support from the World Bank and other development partners for increasing the number of well-designed and soundly operated private mini-grid investments in Sub-Saharan Africa would be very valuable in shedding light on the benefits they can provide and the costs incurred. Ultimately, policy makers need to weigh the case for subsidizing increased electricity access versus support for other basic needs (Grimm et al. 2018).

A well-thought-out, evidence-based plan for national electrification is crucial. Such a plan should include staged rollouts for grid extension and targeted investments in mini-grid development to expand electricity access for productive uses. In areas with high potential for expanding energy-intensive productive uses, new industrial zones could be grid-connected sooner to foster economic development, while other areas with lower potential demands for productive uses could be served by mini-grids. Over time, as incomes rise and populations agglomerate in higher-productivity locations, the national grid can spread out. In the meantime, household and community quality of life in off-grid areas can be substantially improved at relatively low cost through the provision of basic electricity services using solar home systems. It needs to be strongly emphasized that the benefits provided by these systems are especially significant for improving the lives and livelihoods of women.

Finally, it is crucial to consider carefully what is needed to improve the governance of countries' electricity systems and how to accomplish that, and then take the necessary steps to make those improvements, even though some will be politically difficult. Especially important are steps to rationalize electricity pricing, reduce regulatory barriers that limit private sector investment in grid or off-grid power production, make utility operations more efficient and transparent, and foster more independent sector regulation. These steps are essential to raise economic efficiency, provide a more positive investment environment, expand private sector participation, and increase public confidence that the public interest is being served. Taking advantage of past and ongoing innovation to improve governance systems and enhance understanding of organizational behavior may offer even greater opportunities than the increased uptake of technical innovations. Changing longstanding institutional forms, regulatory norms, and management practices is always challenging. Without such steps, however, there are doubts about how much can be gained from investment programs for accelerating national electrification.

Appendix

I. Country Classification by Resource Abundance in Sub-Saharan Africa

Resource-rich countries		Non-resource-rich countries		
Oil	Metals & minerals			
Angola	Botswana	Benin	Ghana	Senegal
Chad	Congo, Dem. Rep.	Burkina Faso	Guinea-Bissau	Seychelles
Congo, Rep.	Guinea	Burundi	Kenya	Somalia
Equatorial Guinea	Liberia	Cabo Verde	Lesotho	South Africa
Gabon	Mauritania	Cameroon	Madagascar	Sudan
Nigeria	Namibia	Central African Republic	Malawi	Swaziland
South Sudan	Niger	Comoros	Mali	Tanzania
	Sierra Leone	Côte d'Ivoire	Mauritius	Togo
	Zambia	Eritrea	Mozambique	Uganda
		Ethiopia	Rwanda	Zimbabwe
		Gambia, The	São Tomé and Príncipe	

Note: Resource-rich countries are those with rents from natural resources (excluding forests) that exceed 10 percent of GDP.

II. Country Classification by Income in Sub-Saharan Africa

Low-income countries		Lower-middle-income countries	Upper-middle-income countries
Benin	Malawi	Angola	Botswana
Burkina Faso	Mali	Cabo Verde	Equatorial Guinea
Burundi	Mozambique	Cameroon	Gabon
Central African Republic	Niger	Congo, Rep.	Mauritius
Chad	Rwanda	Côte d'Ivoire	Namibia
Comoros	Senegal	Ghana	South Africa
Congo, Dem. Rep.	Sierra Leone	Kenya	
Eritrea	Somalia	Lesotho	
Ethiopia	South Sudan	Mauritania	
Gambia, The	Tanzania	Nigeria	
Guinea	Togo	São Tomé and Príncipe	
Guinea-Bissau	Uganda	Sudan	
Liberia	Zimbabwe	Swaziland	
Madagascar		Zambia	

Note: The list is from the World Bank list of economies, June 2017(FY2018).

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