Africa's Pulse

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AN ANALYSIS OF ISSUES SHAPING AFRICA'S ECONOMIC FUTURE

CLIMATE CHANGE ADAPTATION AND ECONOMIC TRANSFORMATION IN SUB-SAHARAN AFRICA

WORLD BANK GROUP

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Executive Summary

- **While the global economy continues its rapid recovery from the global recession of 2020, inequities in vaccine supply and access to external finance are leading to a two-track recovery.** Advanced economies are fast rebounding amid unprecedented fiscal support coupled with vaccine rollout, while the developing world is struggling with a slow pace of vaccinations and little fiscal support. In advanced economies, there has been a sustained increase in trade and consumption. Inflationary pressures have increased alongside the recovery in activity, pointing to continued strong rises in global input prices. Financial conditions remain broadly accommodative.

Sub-Saharan Africa exits recession in 2021, but recovery is still timid and fragile.

- **In Sub-Saharan Africa, the economy is set to expand by 3.3 percent in 2021, one percentage point higher than the forecast of the April 2021 *Africa's Pulse,* with projections for 2022 and 2023 just below 4 percent.** This rebound was fueled by elevated commodity prices, relaxation of stringent measures, and recovery in global trade. Commodity prices remain well above their pre-pandemic levels, with several reaching all-time highs. Oil prices rose above their pre-pandemic levels in the first half of 2021 but have plateaued more recently due to demand concerns and the gradual reversal of previous production cuts by the OPEC+ alliance. Metal prices remain generally stable on aggregate. The surge in commodity prices combined with rapid growth in China in the first half of the year boost African exports. The rise in imports (2.17 percent) however outpaced that of exports (1.67 percent), generating a current account deficit comparable to pre-pandemic levels (-0.50 percent). On the supply side, available data for the first two quarters suggest that the recovery was supported primarily by a rebound in the service and industry sectors, and to a lesser extent agriculture.

- **Economic recovery in Sub-Saharan Africa remains timid and fragile as the slow pace of vaccination continues to expose the region to emerging strains of coronavirus, holding back economic performance.** While our growth forecast is on the upper bound of the interval projected in the April 2021 *Africa's Pulse,* the rebound remains weaker than growth in advanced economies and emerging markets, reflecting subdued investment in Sub-Saharan Africa. The rebound in private consumption observed in the first half of 2021 is likely to be subdued in the second half of the year due the third wave of COVID-19 in large economies. In South Africa, for example, the economy was on a faster-than-expected recovery trajectory until it was derailed by the Delta variant, causing officials to raise lockdown measures to level 4. These measures, which lasted four weeks, sapped business confidence and slowed the pace of recovery, severely affecting many sectors of the economy. In addition, most countries in the region have failed to meet the vaccination goals of 10 percent coverage by September and will miss the target of 40 percent by end-2021. At the current pace, it will take some time for many countries in Sub-Saharan Africa to regain their pre-COVID-19 levels of activity. And a return to pre-pandemic output trends may take longer. The economic damage from the pandemic is expected to be protracted.

- **Growth in economic activity for the region is projected at 3.5 percent in 2022 and 3.8 percent in 2023. However, these projections are subject to substantial uncertainty around the pace of vaccination.** Faster vaccine deployment would accelerate growth to 5.1 percent in 2022 and 5.4 percent in 2023 in Sub-Saharan Africa—as containment measures are lifted faster than in the baseline and spending increases. In contrast, slower vaccine delivery and coverage would impede the relaxation of COVID-19 disruptions in economic activity and project growth to slow down to 2.4 percent in 2023.

- **Within Africa, recovery is also multi-speed.** Angola, Nigeria, and South Africa, the largest economies in the region, are expected to emerge from the 2020 recession, yet at different paces. Angola is expected to grow by 0.4 percent in 2021, after five consecutive years of recession. The country is still battling to gain momentum, with elevated debt levels and weak performance of the oil industry. Nigeria is expected to grow by 2.4 percent in 2021, supported by the service sector. South Africa is projected to grow by 4.6 percent in 2021, reflecting better performance in services, industry, and somewhat agriculture. The country provided stimulus to support businesses and households that were affected by the pandemic as well as by riots and lootings that mostly affected the Kwazulu-Natal and Gauteng provinces. In addition to rising public debt, the unemployment rate rose to record high levels, from 32.6 percent in 2021Q1 to 34.4 percent in 2021Q2.

- **Excluding South Africa and Nigeria, the rest of Sub-Saharan Africa is rebounding faster, with a growth rate of 3.6 percent in 2021.** Non-resource-rich countries, such as Côte d'Ivoire and Kenya, are expected to recover strongly at 6.2 and 5.0 percent, respectively. Similarly, Mauritius and the Seychelles are projected to grow by 5.1 and 6.9 percent, respectively, underpinned by a successful vaccination rollout that helped boost mobility, which is key for the tourism industry in these island nations. The Republic of Congo is expected to continue a prolonged recession path at -1.2 percent in 2021, and it will eventually emerge from recession in 2022 amid increased revenues reflecting higher oil prices.

- **Public debt levels across Sub-Saharan African countries experienced a steep increase, a trend that predated the COVID-19 crisis.** On average, the general government gross debt is projected at 71 percent of gross domestic product (GDP) for 2021, an increase of 30 percentage points of GDP since 2013. Increased funding on commercial terms, partially reflecting the recent surge in Eurobond issuances, has raised the exposure of Sub-Saharan African countries to interest rate, exchange rate, and rollover risks. Rising fiscal burdens are expected to cause significant debt sustainability concerns. After reaching record levels, sovereign spreads declined notably, particularly in countries with high debt-to-GDP ratios, such as Zambia, Angola, and Ghana. Improving debt transparency remains critical. In particular, African countries need to collect and publish more and better debt data and improve contingent liability reporting. And it is imperative to continue building government staff capacity for improved debt management, including for audits and internal controls.

- **Inflation picked up on the back of rising food and fuel prices.** Inflation rose in most countries in the region, reflecting elevated food price inflation, and it is projected to increase to 4.3 percent in 2021. However, inflation remains within central bank objectives in many countries, except in Nigeria where it is outside the target band although on a downward trend. Different inflation patterns have emerged in oil-exporting countries where deflationary dynamics are expected, and inflation is projected to decline from 5.8 percent in 2020 to 3.5 percent in 2021.

- **The risk on the outlook is tilted to the downside.** The outbreak of the Delta variant and its impact on economic activity have shown that the region remains vulnerable to the emergence of new variants. Incoming data in many countries provide evidence that the recovery that was underway in the first half of the year was derailed by the reimposition of containment measures. Nearly 20 percent of the countries in the region were in (nationally or targeted) lockdown or elevated COVID-19-related restrictions during the third quarter of 2021. These countries, located in the East and Southern Africa subregion, accounted for 37 percent of the regional GDP. As of mid-September, only 3.3 percent of Africa's population had been fully vaccinated—as opposed to more than half the population in advanced countries. Empowering the African Vaccine Acquisition Trust (AVAT) and the COVID-19 Vaccines Global Access (COVAX) facility to deliver greater supplies of the vaccine to the region will require the cooperation of vaccine manufacturers, vaccine-producing countries, and those that have already achieved high vaccination rates. Vaccinating the world against COVID-19 is a global good.

Sub-Saharan Africa is reforming; what is most needed to boost and sustain economic recovery is financing.

- **African countries have seized the opportunity of the crisis to foster structural and macroeconomic reforms.** Countries have been relatively disciplined on monetary and fiscal policies. Fiscal deficits have remained under control and are expected to narrow in 2021 and beyond. The median fiscal deficit in Sub-Saharan Africa expanded by only 2.9 percentage points of GDP in 2020, as opposed to an expansion of 7.6 percentage points of GDP in advanced countries. Nearly half of the countries in the region had an overall budget deficit below 5 percent of GDP in 2020, while that proportion was about 25 percent among advanced economies. From 5.4 percent of GDP in 2021, the fiscal deficit is expected to narrow to 4.5 percent of GDP in 2022 and to 3 percent of GDP in 2023. Oil-rich countries in Sub-Saharan Africa will see a narrowing fiscal deficit from 2.1 percent of GDP in 2020 to 1.2 percent of GDP in 2021. The improved fiscal balance for this group of countries reflects not only higher international prices for their commodities, but also fiscal consolidation efforts by governments.

- **Inflation rates have remained relatively under control across countries in the region.** For instance, about three-quarters of the countries with available data (35 of 47) had single-digit average rates of consumer price inflation in 2020, and the number of countries is estimated to increase to 38 in 2021. At the same time, the expectation of low interest rates for a longer period in advanced economies is enabling African central banks to keep an accommodative monetary policy. On the fiscal front, public sector deficits have not expanded at a faster pace than in advanced economies.

- **A number of countries have embarked on "hard to do" and "hard to sell" structural reforms.** Examples include exchange rate unification in Sudan, fuel subsidy reform in Nigeria, and opening of the telecommunications sector to the private sector in Ethiopia, among others.

- **Because of limited fiscal space but also fiscal discipline, African countries have not been able to inject the level of resources required to launch a vigorous policy response to COVID-19.** The amount of fiscal stimulus deployed by African governments has not only been insufficient, but also significantly small compared with that of advanced countries. Since January 2020, budget support to people and firms in the region has amounted to 2.8 percent of GDP, compared with 17 percent of GDP in advanced countries. Most countries in Sub-Saharan Africa provided limited support to firms and households amid fiscal sustainability concerns at a time when a countercyclical fiscal policy could have buffered the shock induced by the pandemic. Some countries, notably Angola and Zambia, have been compelled to apply austerity measures as debt became unsustainable. Growth across countries in Sub-Saharan Africa therefore remains below trend and potential.

- **Accelerating the economic recovery in Sub-Saharan Africa requires significant additional financing.** The region needs more financing to counter the effects of the pandemic and sustain a robust and inclusive recovery. This is needed to narrow the unequal recovery path between rich and poor countries. In an environment of continued uncertainty around the coronavirus and its variants, an aggressive fiscal consolidation agenda is counterintuitive and might prove detrimental for long-term growth—particularly by exacerbating the long-lasting impacts of the pandemic on health and education.

- **The recent allocation of Special Drawing Rights (SDRs) to African countries is a good shot in the arm but it might not be sufficient.** Of the US$650 billion in SDRs issued by the International Monetary Fund (IMF), about 3.6 percent is allocated across Sub-Saharan African countries—that is, the equivalent of their IMF quota share. These additional resources are aimed at boosting liquidity and combatting the pandemic. SDR allocations are part of the solution, intended to complement rather than substitute other financing channels. The international community needs to continue exploring different options that would enable rich countries to share their surplus SDRs voluntarily with the poor countries in the region with the greatest financing needs. An extension of the Debt Service Suspension Initiative (DSSI) may help participating countries redirect their limited resources to the recovery effort. Tackling debt problems at their root would require accelerating the process of countries seeking relief from the Common Framework for Debt Treatments beyond the DSSI. Meeting the region's development goals will require contributions from all potential sources—including international financial institutions and the private sector.

Sub-Saharan Africa can seize the climate opportunity to adapt and transform its economy.

- **Confronted with mounting fiscal pressures, African countries still need long-term support to recover and address the key structural issues they face—with climate change adding to the region's already daunting challenges.** Recent evidence shows that 15 percent of global spending in response to COVID-19 was devoted to recovery spending—and the shares of green and brown recovery spending were comparable (19.4 and 20.4 percent, respectively). Additionally, an important share of recovery spending (47 percent) was invested in activities with zero climate impact.

- **Policies to foster sustainable and inclusive growth cannot be divorced from the climate crisis—for which Africa bears the least responsibility but the largest brunt.** Despite the region being the lowest contributor to global carbon emissions, Sub-Saharan African countries are disproportionately affected by climate change. From the Sahel to the Horn of Africa, and to the south of the continent—all are experiencing the devastating effects of slow onset changes in temperature and more natural hazards. The social and economic disruptions of singular and recurrent climate shocks are wide ranging and can multiply quickly with intergenerational consequences.

- **The costs of climate change can be significant.** Recent evidence shows that monthly economic activity in the region could contract by 1 percent when the average temperature is 0.5°C above that month's 30-year average—a growth impact that is 1.6 times as high as that of developing countries outside the region. The impact of a drought on medium-term growth in the region is about eight times as high as that in developing countries outside the region. Greater reliance on climate-sensitive activities as well as limited resilience and coping mechanisms explain the larger impact in the region.

- **And the cost of inaction is even higher.** Recent simulations suggest that a 3°C global warming by 2100 (the "business as usual" scenario without major changes in the world's social, economic, and technological trends) would entail estimated potential GDP losses of US$2.9 trillion in Sub-Saharan Africa. Implementing policies to reach the Paris Accord objectives (2°C global warming) would reduce the losses in economic activity by US$962 billion a year in terms of the 2100 GDP. Recent estimates suggest that adaptation to climate change will cost US$30 billion to US$50 billion (2-3 percent of regional GDP) each year over the next decade. Still, financing adaptation is more cost-effective than frequent disaster relief.

- **Climate change amplifies the frequency and impacts of shocks that disproportionately affect the poorest households, with long-term impact on human capital.** In response to shocks, the poor are often forced to resort to a wide array of damaging coping strategies that undermine human capital formation and thus perpetuate the cycle of poverty and vulnerability. This is illustrated by evidence from the Sahel where one in four households is vulnerable to repeated climate shocks. In the absence of effective social protection programs, extreme weather events (droughts and floods) can contribute to maternal and

child malnutrition by leading to reductions in food intake, trigger decisions to take children out of school, or lead poor households to sell productive assets, thereby perpetuating and deepening inequalities.

- **Climate impacts on the poor include loss of lives and livelihoods, damage to essential infrastructure and disruption of services, poor health and malnutrition, conflict, and an escalation of distress-driven migration.** The persistent food, water, and environmental crises amplified by climate impacts can lead to protracted fragility and conflict. "Business-as-usual" responses to climate change will not stop the increase in civil conflict and political instability relative to a world without climate change.

- **Social protection systems in Sub-Saharan Africa can be leveraged to become more adaptive, to enhance household resilience to climate shocks and stresses.** Enhancing the ability of "adaptive" social protection (ASP) systems to reach more poor and vulnerable households in the event of climate shocks depends on increasing the robustness of emerging ASP delivery systems around four key system building blocks: (i) institutional coordination for shock response between agencies in charge of social protection, disaster risk management, agriculture, and public finance; (ii) reinforcement of ASP programs, including women's empowerment to boost their role as drivers of household resilience; (iii) better leveraged ASP systems through good climate early warning system data and readily available information to update shock response programs; and (iv) reprioritization of social protection in the national budgets even in times of extremely tight budgets and development of diversified strategies for ASP financing.

- **Adverse climate shocks (rising temperatures and extreme weather events) have lowered agricultural incomes and productivity and can potentially lead to a sectoral reallocation process with limited growth gains.** Climate change adaptation policies need to consider climate change as a source of economic transformation. The pace of reallocation of workers from rural to urban areas and within local labor markets in urban areas is affected by rising temperatures through structural transformation and urbanization. Policies addressing climate change can improve the allocative efficiency of workers across sectors and space, thus accelerating structural transformation, boosting productivity, and enhancing economic development.

- **Addressing climate change requires bold actions and massive investments across key economic sectors**—such as creating the conditions for the transition out of coal and into scaling up renewables in the energy mix; investing in shared, low-carbon transport in cities; boosting sustainable food and land use systems; investing in resilient water infrastructure (including improved management); and reducing emissions from critical industrial value chains.

Climate change may be an opportunity for structural change and job creation.

- **Africa's unique context—of low baseline development, preexisting climate vulnerabilities, limited energy access, and high reliance on climate-sensitive sectors—poses challenges but also provides opportunities to build back better and greener.** Policy makers must harness these opportunities in the face of escalating climate impacts. They need to mobilize resources both domestically and internationally to deliver new jobs that are greener—and in the vicinity of existing products—and foster the manufacturing of more green products in the medium term.

- **Achieving universal access to energy is critical to attain the region's long-term sustainable development goals.** Nearly 600 million people have no access to energy in Sub-Saharan Africa, thus limiting their ability to start and run a business. Even megacities across the largest countries in the region have an inadequate and unreliable supply of energy. Increased adoption of renewable energy technologies (notably, solar and wind) along with an expansion of the national grid are critical to render universal access to energy a more attainable goal. Specifically, a plan that includes staged rollouts for grid extension and targeted investment in mini-grid development to expand electricity access for productive uses is essential. Improved governance in the electricity sector is key to support such expansion.

- **In a region where much of the infrastructure, cities, and transportation systems are yet to be built, investments in climate-smart infrastructure can help cities create jobs.** The business closures, job losses, and reduced revenues for local services induced by the pandemic have affected the majority of cities in Sub-Saharan Africa. Urban policies that are climate-sensitive can help local governments leverage their limited public finance with private sector investment while addressing problems such as pollution, floods, extreme heat, and energy access. For instance, energy-efficient retrofits of buildings, low-carbon municipal waste and water, and green urban transport can deliver benefits to cities in the short and medium term. Recent evidence suggests that African countries need investment in more compact, clean, and connected cities. South Africa will need US$215 billion in investment in its cities; Kenya, US$27 billion; and Ethiopia, US$42 billion. These investments, however, would deliver benefits in Ethiopia, Kenya, and South Africa of US$240 billion, US$140 billion, and US$700 billion, respectively. They will also support additional jobs—resulting in an average of 210,000 net new jobs in Ethiopia, 98,000 in Kenya, and 120,000 in South Africa to 2050.

- **Adopting technological advances, best practices, and new business models can help enhance the sustainability of agriculture.** Technological developments such as weather forecasts, soil sensors, and high-resolution aerial imagery are helping crop management in real time. Adoption of modern agricultural practices (for example, new seed varieties, fertilizers, irrigation, and machinery) contributes to strengthening the food production and

distribution system. Financial solutions are evolving (including mobile money and digital loan options) to connect smallholder farmers with financial institutions and provide greater market access. In this context, governments, investors, and international organizations are essential to establish localized agricultural planning and facilitate access to credit and digital tools.

- **Land policies are powerful levers for reducing greenhouse gas emissions and strengthening resilience to climate change.** The land use sector has potential to reduce emissions, sequester carbon, and increase human and biophysical resilience. Sustainable land management and restoration often provide positive and lasting contributions toward societal well-being and sustainability—including multiple benefits such as job creation, disaster risk reduction, climate change mitigation, and adaptation for current and future generations. Land issues and policies are key considerations for adaptation planning, to strengthen land tenure and management arrangements in at-risk environments. Secure land rights, provided on an individual or community basis, are likely to increase people's incentives to invest in and take advantage of adaptation strategies.

- **Countries with a high share of carbon and carbon-linked wealth are highly exposed to carbon risk and need to avoid policies and investments that might elevate their exposure.** As the world decarbonizes, the shift away from oil, gas, and coal will pose risk to the value of the wealth of countries that are already abundant in nonrenewable energy (for example, Nigeria and Angola), but also that of countries with recent oil and gas discoveries (Mozambique, Kenya, and Senegal). The risk of stranded assets in these countries highlights the need to accelerate the reduction of their wealth exposure to carbon risk.

- **Diversifying exports away from nonrenewable energy commodities has proven challenging for resource-abundant economies.** Policies should be designed to foster asset diversification by supporting the accumulation of human capital and renewable natural capital, as well as narrowing infrastructure gaps. Prudent management of commodity revenues is critical to finance these investments. Setting up a coherent fiscal framework that includes targeted fiscal incentives, reducing subsidies to fossil fuels, and instituting some form of carbon pricing are critical to foster private investment and innovation in clean energy and other green activities.

- **The transition to a low-carbon economy would lead to changes in the existing product space of countries across the world—including in Sub-Saharan Africa.** Identifying green diversification opportunities that are closely related to the countries' existing production capabilities (know-how, infrastructure, and skills) is critical. Evidence shows that the product space of African countries is characterized by few green exports that are not technologically sophisticated or complex. Still, young Africans have been launching startups that address climate change, protect the environment, and provide jobs. Some innovative businesses include ecology-friendly bamboo bikes, eco-fashion, plastic recycling, and screens and matting from vegetable materials, among others.

- **The transition to a low-carbon economy would lead to net job creation worldwide—and these green jobs will be characterized by higher levels of nonroutine cognitive skills and higher dependence on formal education, work experience, and on-the-job training.** Human capital investments and reskilling toward green jobs will need to be supported by education policies and learning-by-doing to shape the adaptation of workers' skills to the demands of a changing product space.
- **In Sub-Saharan Africa, creating jobs for more than 12 million people entering the job market every year will require not only green jobs, but also brown jobs.** The most important concern on the top of the agenda for African countries is job creation, not just green jobs. Policy makers will need to leverage climate technologies to boost agricultural productivity and increase industrialization as well as the non-agricultural labor force. Firms offering training for jobs in solar energy are emerging in Africa—for instance, Green Solar Academy (South Africa) and its partners throughout the continent are providing training and workshops that cover the basics of running a solar business and system design. Fostering extractive activities linked to sectors that will power the green economy (for example, cobalt, lithium, copper, manganese, nickel, and zinc) is another potential source of jobs—particularly as their prices increase with decarbonization.
- **Financing climate change adaptation in Sub-Saharan Africa is essential, and policies to mobilize resources are critical to create more, better, and sustainable jobs.** In the face of climate shocks, policy makers will need to harness (environmental) policy reforms and taxes. However, the reality of financing and technology gaps, which will rapidly escalate in the near to medium term, remains and will need innovative thinking and collective action. Linking climate-related finance with critical governance reforms and conservation of natural capital as foundational assets may serve as an entry point. Finally, the global energy transition must be inclusive and equitable. Given the different realities of economies and various pathways to net-zero by 2050, the development community needs to advocate for and support low-income countries without leaving anyone behind, especially with respect to universal electricity access, while advancing climate goals.

Section 1: Recent Trends and Developments

1.1 GLOBAL TRENDS

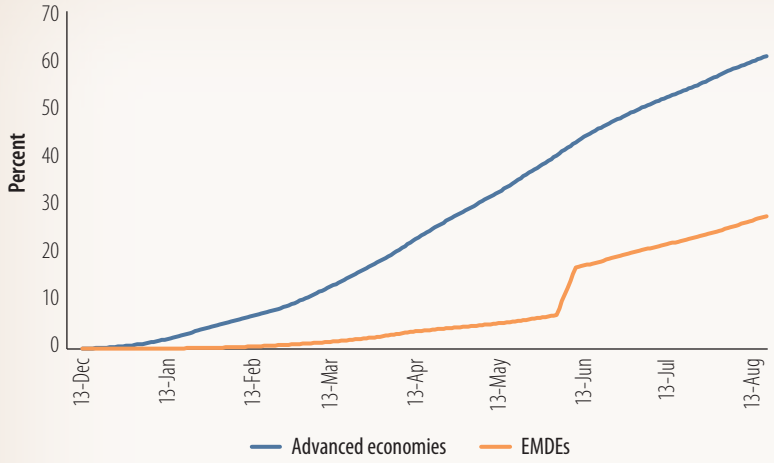
Global growth is estimated to have peaked in 2021 and is expected to slow steadily going forward amid the ongoing spread of the Delta variant of COVID-19, a rapid withdrawal of fiscal stimulus, supply bottlenecks, and lingering inflationary pressures. The global recovery has predominantly been driven by advanced economies, which have made more progress in vaccination and been able to provide greater fiscal support. Recovery in many emerging markets and developing economies (EMDEs) has been weak even as the economic impact of subsequent waves of COVID-19 has diminished (figures 1.1 and 1.2).

In its January 2021 Global Economic Prospects report, the World Bank Group forecast that the global economy would expand by 5.6 percent in 2021 and 4.3 percent in 2022. Incoming data point to robust but moderating global activity. The global composite Purchasing Managers' Index (PMI) has declined in recent months but remains elevated, with services activity outpacing manufacturing. The recovery in global activity has been accompanied by a sustained increase in global trade, with the volume of global goods trade well above its pre-crisis level despite supply bottlenecks, resulting in supplier delivery times falling to a survey record low (figure 1.3).

Tourism remains depressed, however, even in countries

FIGURE 1.1: Vaccine Rollout in Advanced Economies and EMDEs

Unequal pace of vaccination between advanced economies and EMDEs.

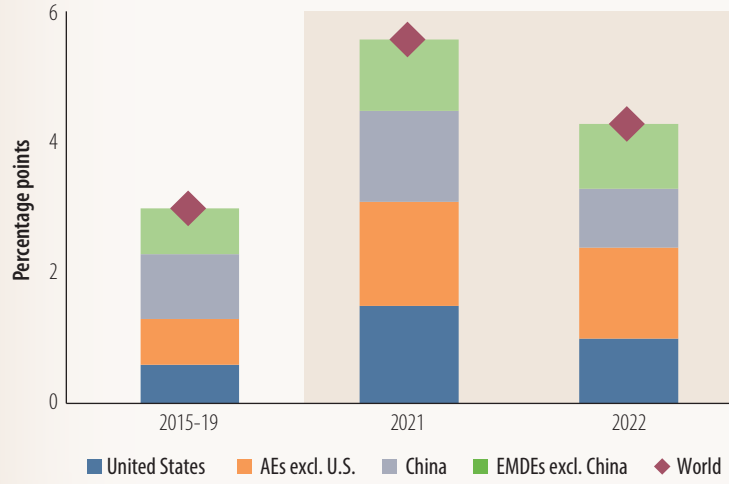


Source: Our World in Data, World Bank.

Note: The figure shows the share of people who have received at least one COVID-19 vaccination dose. The sample includes 36 advanced economies and 65 emerging markets and developing economies (EMDEs). The last observation is August 24, 2021.

FIGURE 1.2: Contributions to Global Growth

Strong global economic recovery driven by advanced economies and supported by fiscal stimulus and vaccination rollout.

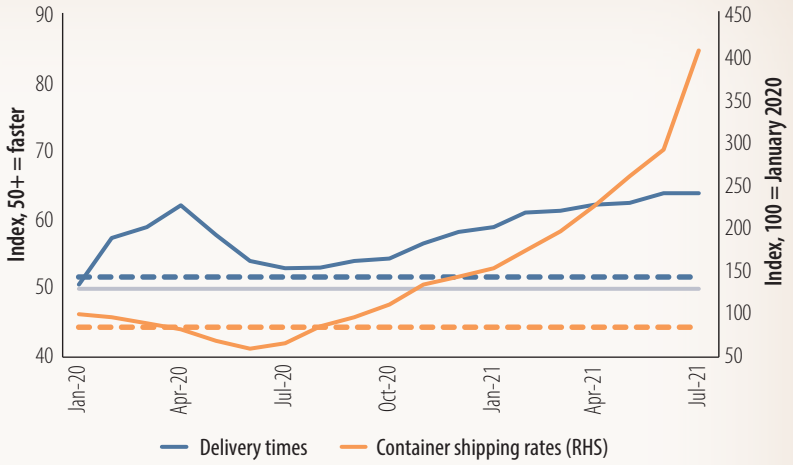


Source: World Bank.

Note: Aggregate growth rates are calculated using GDP weights at average 2010–19 prices and market exchange rates. The shaded area indicates forecasts from the June 2021 edition of the Global Economic Prospects report. The figure shows contributions to global growth forecast for 2021 and 2022 compared with average contributions to growth over 2015–19. AEs = advanced economies; EMDEs = emerging markets and developing economies; GDP = gross domestic product.

Logistics bottlenecks with delivery times stabilizing while costs jump.

FIGURE 1.3: Global Shipping and Costs



Sources: Harper Petersen & Co. (database); Haver Analytics; World Bank.

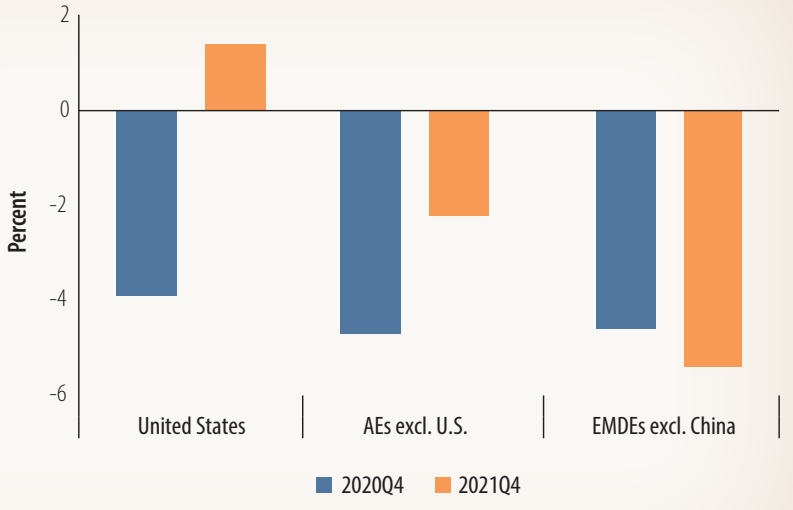
Note: The figure shows the global manufacturing suppliers' delivery times the Purchasing Managers' Index (PMI) and the Harper Petersen Charter Rates Index (HARPEX) for container shipping rates. PMI data are inverted by subtracting data from 100; therefore, increasing (decreasing) PMI data indicate faster (slower) delivery times. Container shipping rates are monthly averages of weekly data and reflect price developments on the charter market for container ships. Dashed lines indicate long-term averages over January 1998 to December 2019 for delivery times and February 2018 to December 2019 for container shipping rates. The last observation is May 2021 for delivery times and May 25, 2021 for container shipping rates.

that have not experienced major outbreaks of COVID-19, and international travel is expected to be constrained by lingering mobility restrictions and reluctance to travel while the virus is not completely under control. Inflationary pressures have increased alongside the recovery in activity, with survey data pointing to continued strong rises in global input prices.

U.S. output is rebounding sharply, fueled by substantial fiscal support, and has exceeded its pre-pandemic level in 2021Q2. Activity in the euro area has been slower to recover but has regained ground since the beginning of the year because of the relaxation of mobility restrictions and an accelerated vaccine rollout. The latest composite PMI indexes signaled accelerating growth for 80 percent of advanced economies in the second quarter, compared with only about 60 percent of EMDEs. In China, whose economy led the initial stages of the recovery last year, activity remains robust, but the pace of growth has moderated amid diminished policy support. Across most EMDEs, however, the ongoing recoveries will not be sufficient to erase the damage from the pandemic, whose legacies are expected to weigh on global activity for a protracted period (figure 1.4). Many countries will take a prolonged period to regain their pre-COVID-19 levels of activity, and a return to pre-pandemic output trends may become unattainable in the absence of major reform efforts.

Long-term effects of the COVID-19 crisis on economic activity in EMDEs.

FIGURE 1.4: GDP Gaps Relative to Pre-Pandemic Projections



Source: World Bank.

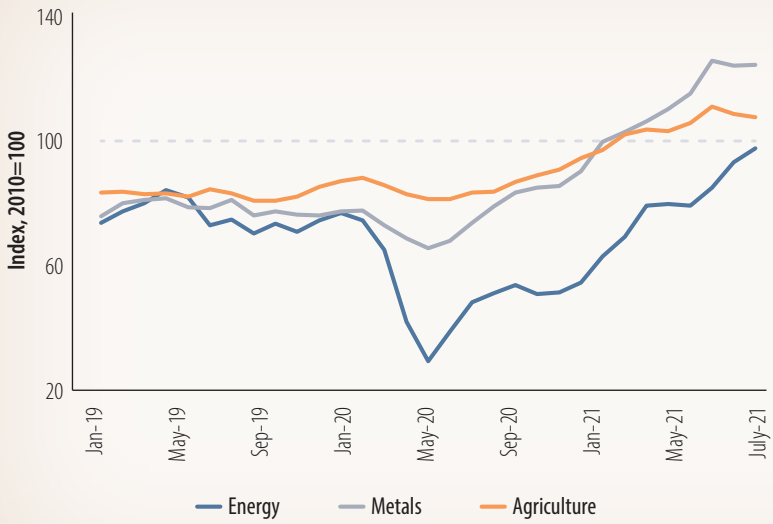
Note: The figure shows the gaps between the June 2021 and January 2020 editions of the Global Economic Prospects report. AEs = advanced economies; EMDEs = emerging markets and developing economies.

Global financing conditions are diverging across advanced economies and EMDEs. In advanced economies, financing

conditions remain broadly accommodative, with elevated equity valuations and subdued yields. In EMDEs, financing conditions have tightened in recent months because of policy rate hikes in some countries (Brazil, Mexico, and the Russian Federation), pandemic setbacks, and country-specific risks. Net portfolio inflows to EMDEs have been weak in anticipation of the eventual policy normalization by the Federal Reserve and a broader decline in risk sentiment.

Commodity prices remain well above their pre-pandemic level, with several of these international prices reaching all-time highs (figure 1.5). Elevated shipping costs have contributed to higher import prices for some commodities while the spread of the Delta variant of the coronavirus has contributed to increased uncertainty about demand. Energy prices have seen a particularly sharp increase in recent months, especially for natural gas and coal, which have risen by more than 50 percent since the start of the year. Oil prices rose above their pre-pandemic levels in the first half of 2021 but have plateaued more recently due to demand concerns and the gradual reversal of previous production cuts by the OPEC+ alliance. Metal prices remain generally stable on aggregate, with some outliers. Tin prices reached an all-time high amid supply disruptions and continued strong demand from the electronics sector, whereas copper prices declined slightly from recent all-time highs amid the spread of the Delta variant and a softening in economic indicators in China. Agricultural commodity prices have been volatile, with weather-induced supply concerns pushing up the prices of wheat, cocoa, and coffee.

FIGURE 1.5: Aggregate Commodity Prices



Sources: Bloomberg; World Bank.
Note: The last observation is July 2021.

Commodity prices remain elevated, with several stabilizing at record highs.

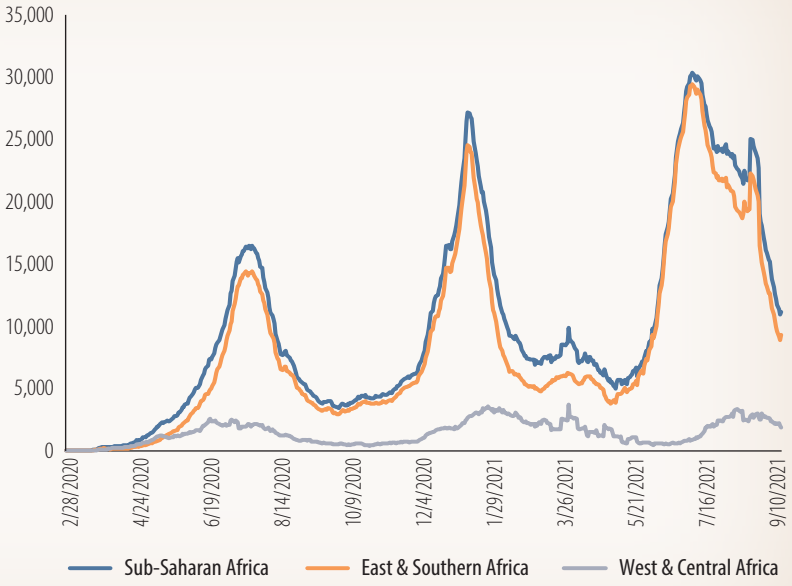
1.2 RECENT DEVELOPMENTS IN SUB-SAHARAN AFRICA

COVID-19 Pandemic Developments

Over the summer of 2021, Sub-Saharan African countries faced a third wave of COVID-19. This third wave stemmed mainly from the spread of the Delta variant which was first identified in India and grew to be more contagious than previous variants of the coronavirus. In terms of daily new cases of COVID-19, the peak of the third wave was higher than the second one[1]—at about 30,000 new cases per day in July 2021 compared with around 26,600 new cases per day in January 2021, respectively—while the second peak was higher than the first one, at 16,000 cases per day in July 2020 (see figure 1.6). Although the vaccine rollouts seemed to be effective at containing the number of COVID-19 cases in spring 2021, the third wave proliferated across the African continent as the rate of COVID-19 mutations surpassed the pace of vaccinations.

The surge in cases and most severe health impacts of the third wave has occurred in places where there are relatively lower vaccination rates.

FIGURE 1.6: Daily New Cases of COVID-19 in Sub-Saharan Africa and Subregions (smoothed, 7-day moving average)



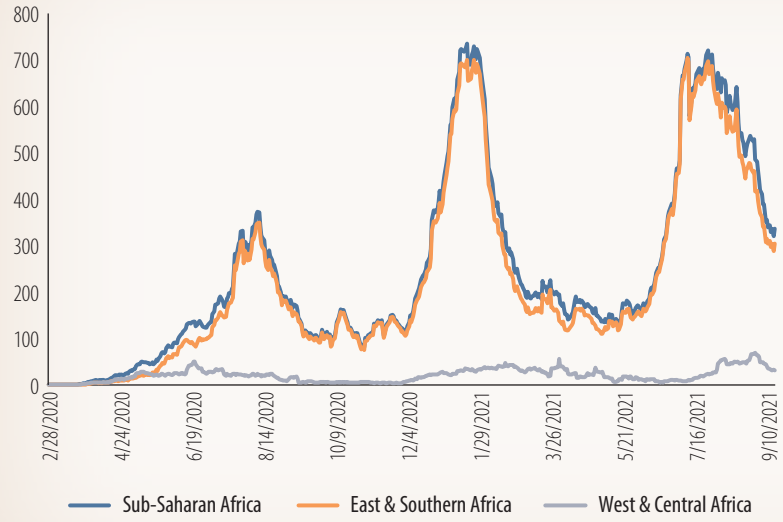
Source: Our World in Data, COVID-19 dataset.
Note: Cases as of September 16, 2021.

According to the Centers for Disease Control and Prevention (CDC), the fastest surge in cases and most severe health impacts has occurred in places where there are relatively lower vaccination rates. Consequently, those places have experienced more cases of hospitalizations and deaths than in places with higher shares of vaccinated people. Progress on vaccine rollouts remains slow in Sub-Saharan Africa. For example, few countries in the region have surpassed five percent of the population being fully vaccinated, according to the Africa CDC. In Madagascar, Tanzania, and Uganda, vaccination rates have reached less than one percent while Burundi and Eritrea have not even started their vaccine campaigns. Only two countries have exceeded more than 50 percent (i.e., 69.71 percent in the Seychelles and 54.21 percent in Mauritius).

1 The second wave stemmed largely from the spread of the alpha and beta variants, which have become more contagious than the initial strain of COVID-19.

Based on the latest dataset as vaccination rates climb, the economy will rebound, and death rates will fall. Consequently, it is important to accelerate the pace of worldwide vaccine rollouts to slow down, minimize and ultimately halt COVID-19 mutations, because variants of the virus are affecting the lives and livelihoods of people across the globe. The health and economic impacts not only affect the world economy, but also economies in Sub-Saharan Africa. Even though the vaccine does not provide full immunity against the coronavirus, it provides greater protection to people who are fully vaccinated against severe symptoms of COVID-19 infections, compared with those who are unvaccinated. The viral load tends to have a shorter life when vaccinated people are infected by COVID-19. Unvaccinated people are at high risk of infection from new variants because they lack the preventive barriers to repel infections from COVID-19. There is some evidence that daily new deaths from COVID-19 have not increased from the second wave to the third wave in Sub-Saharan Africa, as indicated in figure 1.7. While the daily cases have increased from the second wave to the third

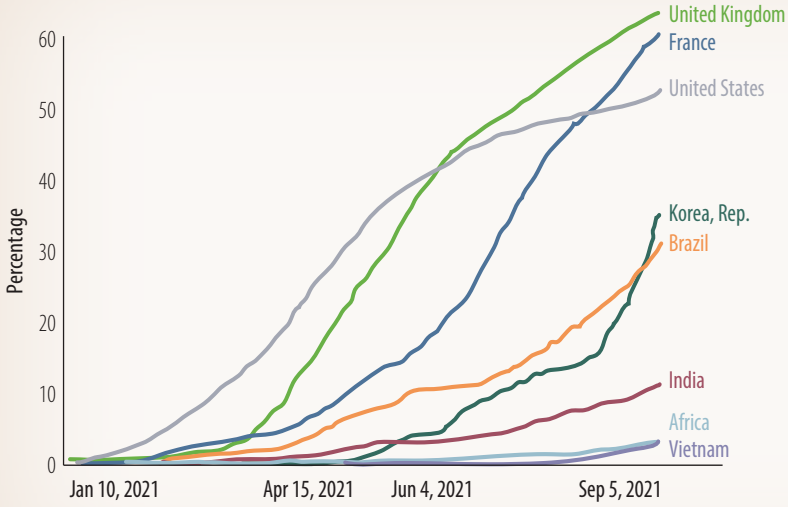
FIGURE 1.7: Daily New Deaths from COVID-19 in Sub-Saharan Africa and Subregions (smoothed, 7-day moving average)



Source: Our World in Data, COVID-19 dataset.
Note: Deaths as of September 16, 2021.

At their peak, death rates in the region during the third wave are comparable to those in the second wave.

FIGURE 1.8: Share of the Population Fully Vaccinated against COVID-19

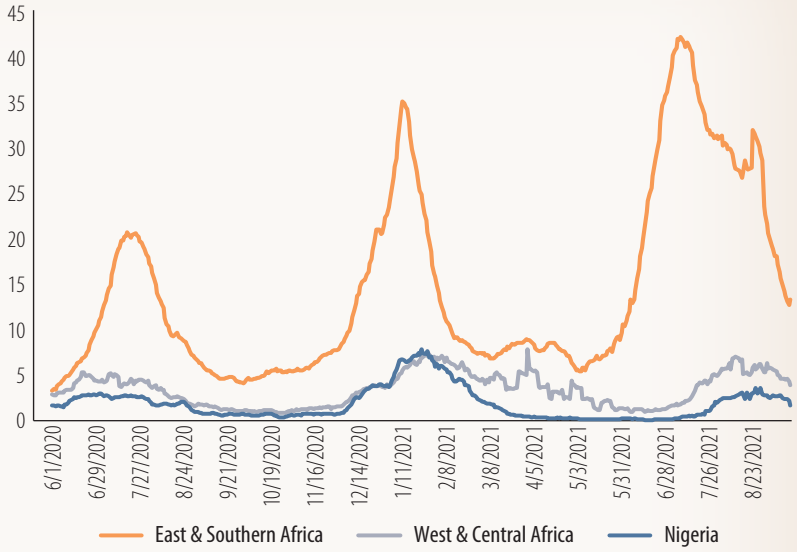


Source: Our World in Data, COVID-19 dataset.
Note. Vaccination figures as of September 16, 2021. Africa includes the entire continent.

The share of the population fully vaccinated against COVID-19 is low in Africa vis-à-vis the rest of the world.

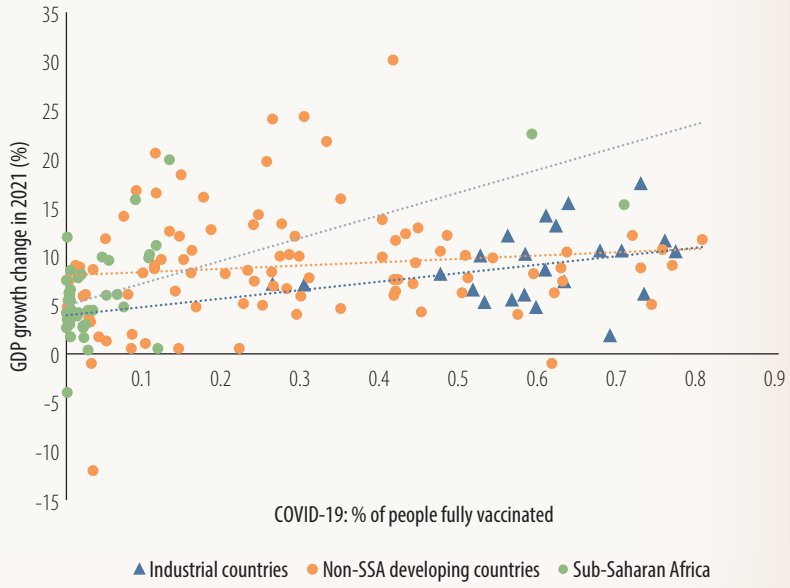
AFE has experienced a higher surge of infections than AFW in the third wave.

FIGURE 1.9: Within Africa, AFE Has Seen the Worst Surge So Far (7-day rolling averages of COVID-19 cases, per million people)



A better rate of vaccine penetration is associated with a higher economic rebound.

FIGURE 1.10: COVID-19 Vaccine Penetration and GDP Growth Rebound in 2021



Source: Our World in Data, Coronavirus Pandemic (COVID-19) Statistics.
Note: Smoothed=7-day moving average. Data as of September 16, 2021.

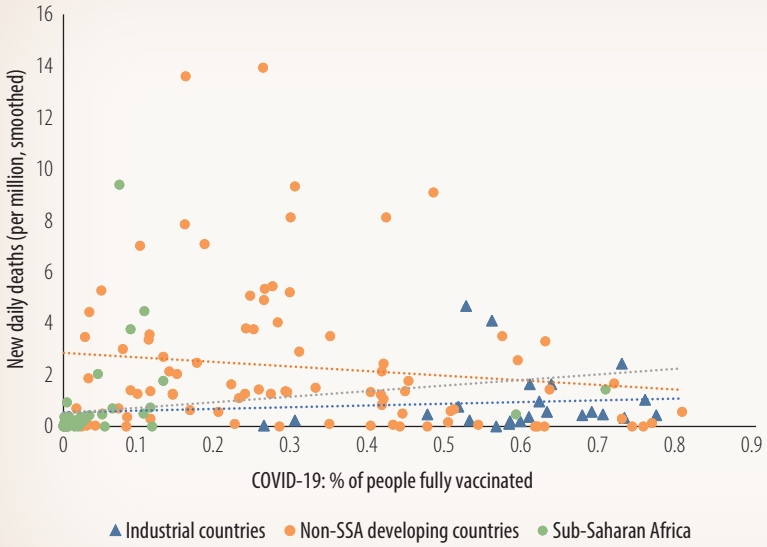
wave, the daily deaths have been contained. Despite the Delta variant being more contagious, vaccines are effectively reducing hospitalizations and deaths in advanced countries. Consequently, continuing to improve vaccine distribution in Sub-Saharan Africa is essential to prevent an increase in death rates.

One of the current priorities is hastening the distribution and uptake of vaccines in Sub-Saharan Africa, which is expected to provide a boost to the region's economy. Compared with other regions, Sub-Saharan Africa's vaccine distribution has progressed slowly (see Figure 1.8). Almost 90 percent of Sub-Saharan African countries are fully unvaccinated. These low vaccination rates could result in a slower pace of recovery from the third wave, especially as new variants (Delta) present additional challenges. Surges in daily new cases have accelerated in the Sub-Saharan African region during the summer of 2021—in the East and Southern Africa region (AFE) even more than in the West and Central Africa region (AFW) (see figure 1.9). Figures 1.10 and 1.11 show a relationship between vaccine

distribution and the economic rebound and daily deaths, respectively: the relationship between vaccine distribution and rebound in the economy is positive, whereas the relationship between vaccine distribution and daily deaths is negative. Therefore, accelerating vaccine distribution rates could help spur economic recovery while also enhancing protective measures against the most severe health impacts from the COVID-19 pandemic.[2]

FIGURE 1.11: COVID-19 Vaccine Penetration and Daily New Deaths

A higher rate of vaccine penetration is related to lower death rates.



Source: Our World in Data, COVID-19 dataset.
Note: Daily new deaths as of September 16, 2021.

BOX 1.1: Vaccine Hesitancy in Sub-Saharan Africa

The success of the COVID-19 vaccination rollout depends on a third factor—vaccine hesitancy. There is evidence that this attitude is prevalent not only in developed countries, but also in developing countries.[a] It is still essential, however, to boost African countries' access to COVID-19 vaccines and ensure that countries have the capacity to deploy their vaccine campaigns.

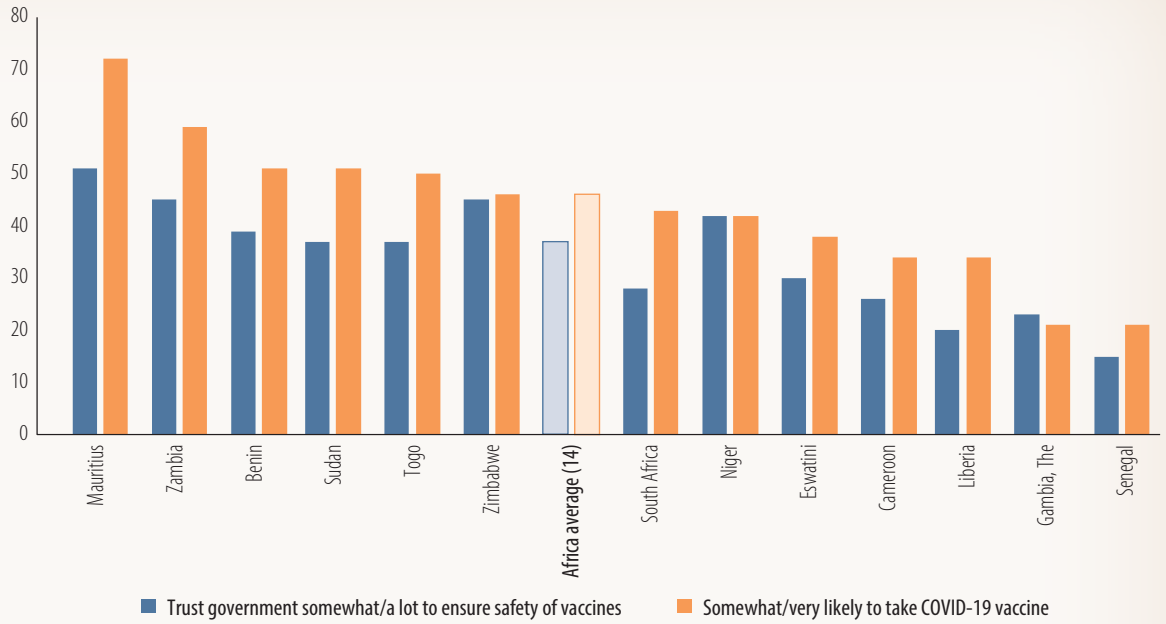
Between late 2020 and mid-2021, Afrobarometer conducted face-to-face interviews with 17,800 people in 13 Sub-Saharan African countries. According to the survey, although Africans broadly approve of strong government action to curb the spread of the coronavirus, they mistrust their governments when it comes to vaccines.[b] The Africa Centers for Disease Control and Prevention (CDC) is helping governments vaccinate 40 percent of Africans by the end of this year. As of mid-September, 3.3 percent of the population was fully vaccinated.[c] Despite the lower distribution rate, the supply of vaccines in African countries is improving.

The Afrobarometer survey finds that 43 percent of respondents across 13 Sub-Saharan African countries answered that they are "somewhat likely" or "very likely" to try to get vaccinated. Still, there is a wide degree of heterogeneity in the responses across the surveyed countries. In South Africa, the country with the highest number of coronavirus infections in the region, only 43 percent of its citizens would be likely to get the vaccine (figure B1.1.1). Broadly, more than half of the respondents are willing to get a vaccine in four of the surveyed countries (Mauritius, Zambia, Benin, and Sudan). By contrast, vaccine hesitancy is alarmingly high in Senegal and The Gambia. Finally, about a third of the respondents across the 13 countries believe these vaccines are safe either "somewhat" or "a lot." This is not necessarily a ringing endorsement because the low trust in the government's capacity is correlated with lower likelihood of getting the vaccine (figure B1.1.1).

2 A successful vaccination rollout implies not only alleviating the problem of vaccine inequity but also hesitancy. See Box 1.1 on vaccine hesitancy across selected Sub-Saharan African countries.

BOX 1.1
Continued

FIGURE B1.1.1: Do Africans Trust Their Government and COVID-19 Vaccines? Data from 13 Countries, 2020/21 (percent)



Source: Appiah-Nyamekye Sanny (2021) from Afrobarometer.

Vaccine hesitancy prevails in low-, medium-, and high-income countries, and skeptics are usually found in all socioeconomic, religious, and ethnic groups. Vaccine hesitancy is attributed to concerns due to[d]: (i) a shorter period of trials and relaxation of regulatory standards; (ii) the novel technology of mRNA vaccines, which had never been tried in humans; and (iii) conspiracy theories about the consequences of the vaccines posted on unregulated social media platforms.

How can vaccine hesitancy be reduced? The deployment of mass communication and community engagement are critical to increase vaccine knowledge and awareness. These tools have the potential to spread reliable information, creating and reinforcing confidence among the community. Designing tools that build on behavioral insight can also increase vaccine take-up. In this context, entertainment education (edutainment) and lotteries are scalable and cost-effective. Tested innovations can be considered in the vaccine campaign.[e] Vaccine hesitancy can be lowered if manufacturers obtain authorization from stringent regulatory bodies or the World Health Organization while communicating their decisions transparently.

a. Solís Arce et al. (2021).
b. Appiah-Nyamekye Sanny (2021).
c. Africa CDC Vaccine Dashboard (link: https://africacdc.org/covid-19-vaccination/).
d. Wouters et al. (2021).
e. De Walque and Orozco (2021).

1.3 ECONOMIC DEVELOPMENTS

Sub-Saharan Africa's recovery process from the 2020 recession has been affected by a third wave of the pandemic—led by the Delta variant, a more transmissible and virulent strain of the coronavirus. To curb the growth of infections in the region, which happened to be the fastest in the world and with more fatalities than the preceding two waves, countries were compelled to renew containment measures leading to lockdowns of some cities. Of 48 countries affected, nine were in (nationally or targeted) lockdown or elevated COVID-19-related restrictions during the third quarter of 2021. According to the World Health Organization (WHO), 33 countries in the continent experienced a resurgence in infections, with 95 percent of new cases being accounted for by the Delta variant. Of those affected, 79 percent were hit severely, forcing officials to apply stringent measures. Countries with the highest rate of infections in the region include Malawi, Mozambique, Namibia, Zambia, and Zimbabwe.

Recovery in the region is still hampered by the low vaccination rates and the limited resources to continue providing financial assistance to vulnerable households and firms. The rollout of vaccine campaigns in Africa is falling considerably shorter compared with other continents, as less than 3.3 percent of the population is inoculated compared with more than 50 percent in advanced economies. Hence, Sub-Saharan Africa remains vulnerable to new variants of coronavirus, which in turn will continue to hold back economic recovery. Unlike advanced economies, African countries failed to provide adequate fiscal stimulus to engineer a sustained recovery that delivers more and better jobs. This support falls short of the pressing health and economic needs that are required to respond to the numerous challenges brought about by the pandemic. The financing gap was estimated at US$290 billion in 2020.

The World Bank has been working with partners to help developing countries to finance the acquisition and distribution of COVID-19 vaccines. In October 2020, the World Bank approved additional financing of US$12 billion for vaccines and expanded the financing envelope to US$20 billion in June 2021. As of September 20, 2021, the World Bank has approved 31 operations to support vaccine rollout in 30 Sub-Saharan African countries, amounting to US$1.9 billion—of which US$674.9 million was allocated to AFW and US$1.23 billion was distributed across countries in AFE. Total vaccine support for the Africa region—including approved, negotiated, and under preparation projects—stands at US$2.8 billion.

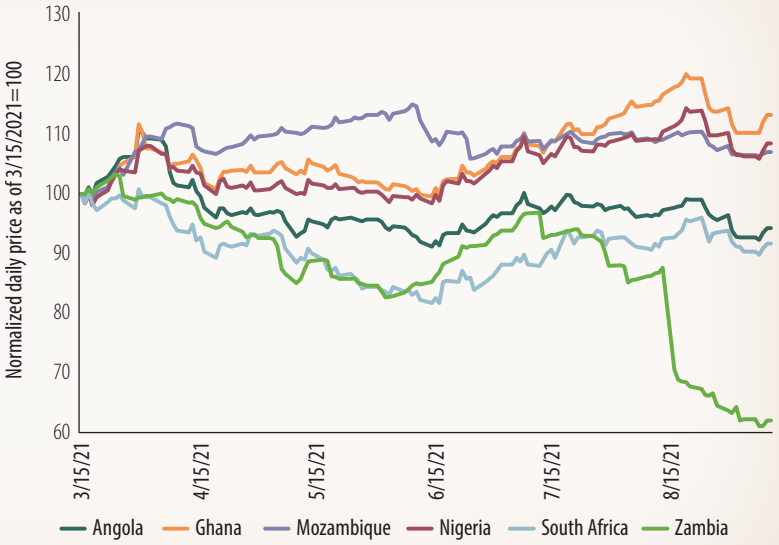
Debt levels were already elevated before the pandemic in some countries, and they were constrained to use austerity measures to reduce deficits.[3] One-third of Sub-Saharan African countries were in or at risk of debt distress before the COVID-19 crisis (IMF 2018). Some of them were in negotiations with multilateral partners to secure deals that would lead to structural reform programs to address debt issues. Consequently, sovereign bond spreads have been elevated in these countries (figure 1.12). Amid the pandemic, when financial support is imperative, these countries must cut spending to address public debt sustainability concerns. Efforts from donors through the G20 Debt Service Suspension Initiative (DSSI) for Sub-Saharan African borrowers have been insufficient—as the potential savings from this initiative were only estimated at 1 percent of gross domestic product (GDP) from January 2021. It has failed to reach the goal of reducing debt servicing costs, which have been rising.[4]

3 See for example Angola, the Republic of Congo, Tanzania, Mozambique, and South Africa.

4 Of the 38 eligible countries for debt relief in the region, only six did not participate for fear of losing the favorable rating score or facing high sovereign bond spreads.

Sovereign bond spreads surged amid elevated debts triggered by fiscal supports, while declining in Zambia in the post-election period.

FIGURE 1.12: Sovereign Bond Spreads in Selected Sub-Saharan African Countries (basis points)



Source: Bloomberg Analytics.

Many countries in the region followed procyclical policies to consolidate public finance. This hampered their ongoing recovery process. In contrast, more financial support is warranted to narrow the unequal recovery path between rich and poor countries. As argued in the April 2021 Africa's Pulse, speeding up vaccination rollout and fostering policies to increase investments would expedite the pace of recovery. It is uncertain that African countries will meet their vaccination target of 40 percent of the population by the end of the year. Mauritius and the Seychelles are the only countries in the continent that have attained herd immunity—with more than 60 percent of the population being fully vaccinated. South Africa follows far behind with 22 percent, while most countries have less than 5 percent of their population fully vaccinated.[5] Nevertheless, Mauritius and the Seychelles have since opened their borders to tourists and economic activities have resumed, putting the countries back on the growth trajectory of the pre-pandemic era.

The ongoing recovery is still weak and appears to be somewhat less sustainable since the outbreak of the third wave. It is supported by relatively weak private consumption, growing at 1.5 percent this year, amid containment measures that are still in place in many countries. Moreover, the estimated rise of 1.0 percent in gross fixed investment is insufficient to drive the region toward its full potential growth path. The recovery underway is primarily fueled by a surge in commodity prices, which is projected to plateau in 2022 and 2023.

In South Africa, for example, the economy was on a faster-than-expected recovery trajectory until it was derailed by the Delta variant, causing officials to raise lockdown measures to level 4. These measures, which lasted for four weeks, slowed the pace of recovery, severely affecting many sectors of the economy. In addition, the country was affected by unrest that led to riots and looting in some provinces, in particular Kwazulu-Natal and Gauteng, causing economic losses estimated at R50 billion. Moreover, the government is set to continue the Temporary Employee/Employer Relief Scheme. Finally, wage bills were negotiated at levels that were higher than those set in the budget for this year. Amid weak growth prospects, there is little expectation that the trajectory of government debt will abate in the short to medium term.

However, this is not an appropriate time to embark on a fiscal consolidation that may hinder the progress achieved so far by the country since the outbreak of the COVID-19 crisis in 2020. The

5 See Section 1.2.

country faces tremendous challenges, such as unemployment, high inequality, poor education, skill shortages, and relatively high poverty. The government should step in to provide assistance where needed. Failure to do this may lead to social unrest like that witnessed after the arrest of former president Jacob Zuma. Financial injection to support struggling small and medium-size enterprises will revive the dormant private sector and boost consumption in a country with a large informal sector.

Countries like Angola, Mozambique, and Zambia, which were already vulnerable before the pandemic, have seen further deteriorations in their public finance (figure 1.13). Oil wealth allowed Angola to engage in large-scale borrowing, but the debt burden rose sharply once oil prices and the currency declined, reaching a peak of 134 percent of GDP in 2020. Debt remains a concern over the medium term, despite a partial rescheduling of external debt service, including under the DSSI. Mozambique, the Republic of Congo, and Zambia have been negatively affected by opaque management of their debts during boom periods. With little access to financing, these countries will struggle to launch an effective recovery.

FIGURE 1.13: General Government Debt-to-GDP Ratio, 2020 (percent of GDP)

Elevated debts constrain Sub-Saharan African countries to consolidate public finance.

Source: World Bank staff estimates.

Even economies with broadly sound fiscal policies before the crisis such as Ghana and Rwanda, are not immune to the COVID-19 financing issue. These countries—known for their effective management of public finance—saw their public debts projected to soar, respectively, from 63 and 62 percent of GDP in 2019 to 81 and 71 percent of GDP in 2020. With a vaccination rate of closer to 5 percent of the population, Rwanda needs more government spending to accelerate the pace of immunization. Industrial production dropped by 14.2 percent month-over-month in June, reflecting the effects of the restriction measures imposed by the government to fight surging infection cases of the Delta variant. Similarly, the IHS Markit PMI in Ghana declined for two consecutive months, from 51 in June to 49.7 in July and 48.9 in August. This drop is partly attributed to a decrease in new orders amid COVID-19 restrictions.

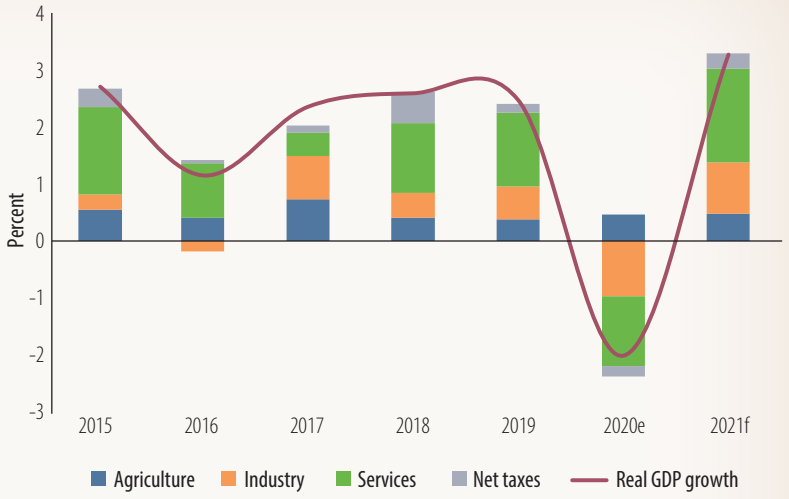
The limited external financing and slow pace of vaccination keep African economies vulnerable to future waves of new variants of COVID-19 and can have spillovers to the rest of the world. If concerted efforts are not made by the countries and the world community, it is likely that the least vaccinated parts of the region will remain sources of new, more transmissible, and virulent variants of coronavirus. Consequently, even countries that have been successful in containing the virus so far are still exposed to resurgence of new variants. This somber outcome should be regarded as a humanitarian crisis rather than an issue with which low-income countries must grapple alone.

Economic Developments

The Sub-Saharan African economy is set to emerge from the 2020 recession and grow at 3.3 percent in 2021—reflecting an expansion in industry and services on the production side (figure 1.14) and subdued growth in private consumption and gross fixed investment on the demand side (figure 1.15). The rebound of activity in the region is weak compared with growth in advanced economies and EMDEs, pointing to an uneven recovery between rich and poor countries. The strong growth in advanced economies is mainly attributed to the rapid pace of vaccination and remarkable fiscal stimulus, accompanied by unconventional monetary policies. The pace of vaccination is still lagging in Sub-Saharan African countries, with up to 3.3 percent of the population being inoculated and fiscal support of about 2.8 percent of GDP.[6] The slow pace of vaccination makes the region vulnerable to the Delta variant as well as the emergence

Economic activity in Sub-Saharan Africa is estimated to have expanded by 3.3 percent in 2021. On the supply side, expansion in industry and services supported the recovery.

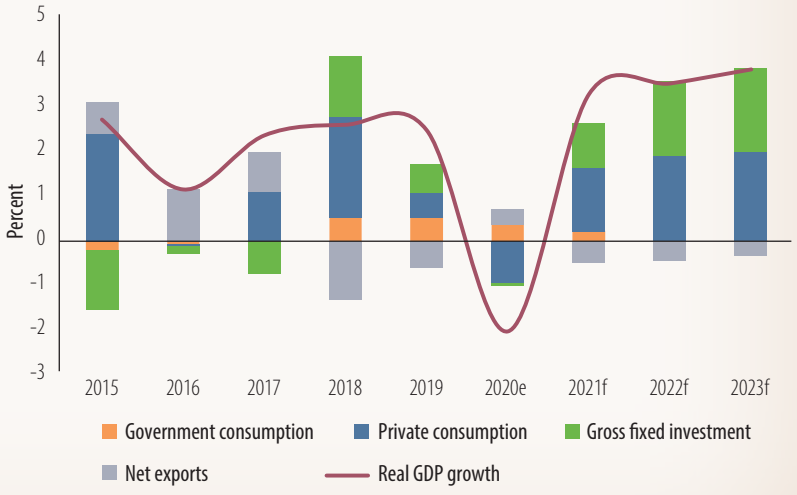
FIGURE 1.14: Contribution to GDP Growth, Supply Side (% points)



Source: World Bank staff estimates.

On the demand side, subdued increases in private consumption and investment were key drivers, while net exports and government consumption contracted.

FIGURE 1.15: Contribution to GDP Growth, Demand Side (% points)



Source: World Bank staff projections.

6 The fiscal stimulus is the budgetary support to people and firms measured by additional spending and forgone revenues (IMF 2021).

of new variants of interest in the future. This situation will continue to hold back the region's economic performance as countries will be forced to resort to stringent measures. The rebound in global trade after the reopening of many countries supported economic activity in the region. The regional recovery was particularly supported by the surge in commodity prices combined with rapid growth in China during the first half of the year—as reflected in higher exports. Nevertheless, the rise in imports (2.2 percent) outpaced the increase in exports (1.7 percent), thus leading to a current account deficit comparable with the pre-pandemic levels (-0.5 percent).[7] The speed of the recovery has been slowed by the more transmissible and virulent Delta variant since June. Countries responded with strict containment measures and imposed lockdowns in many cases. These measures particularly affected the industrial and service sectors.

East and Southern Africa

South Africa was hit hard by the third wave of coronavirus, recording the highest levels of infections and deaths in the continent. Officials decided to raise lockdown restrictions to level 4 in June for a month to contain the spread of the virus. This was followed by riots sparked by the arrest of former president Jacob Zuma for alleged corruption. Riots and lootings were concentrated mainly in Kwazulu-Natal and Gauteng provinces. The estimated cost of the unrest was R20 billion in Kwazulu-Natal alone and R50 billion for the entire country. The government announced an R38.8 billion relief package to support affected businesses. A large part of this package (R26.7 billion) was devoted to an R350 monthly payment in the form of social distress relief grants payable until the end of March 2022. Although GDP registered a substantial jump in the second quarter of 2021 (19.3 percent year-on-year),[8] high-frequency data suggest that the negative effects of the lockdown measures and unrest will be reflected in the second half of the year.

Angola still struggles to gain momentum, with elevated debt levels and a prolonged recession. Although experiencing a protracted decline, the oil sector had a small uptick in production to 1.10 million barrels per day in July, from 1.07 million of barrels per day in June—the lowest level since 2004 (IEA 2021). The economy continues to rely on the non-oil sector, which was held back by the third wave of coronavirus. The progress on vaccination has been slow, with only 3.2 percent of the population fully vaccinated. The oil sector was further affected by the pandemic, leading to delays in exploration of new fields and investment in new projects. The country's heavy reliance on the oil sector endangers the prospects of raising revenue and reducing debts. Ongoing restrictions and poor performance of the oil sector continue to hold back recovery (figure 1.16).

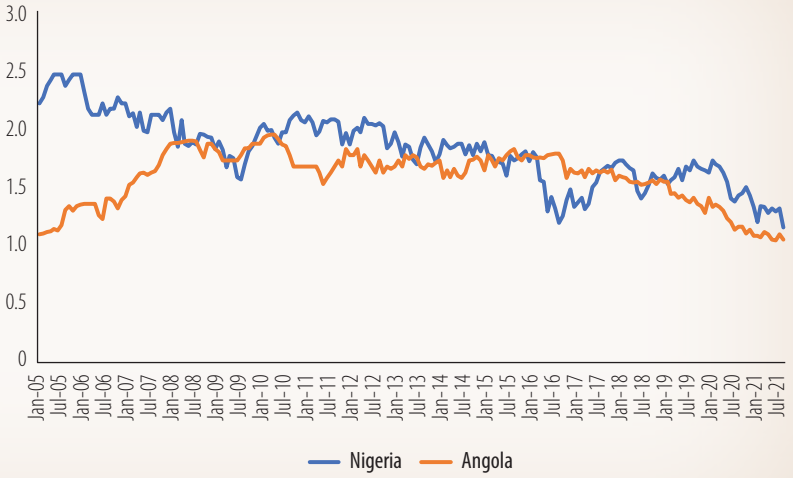
In Zambia, the election of Hakainde Hichilema to the presidency has increased confidence that the business-friendly president-elect will embark on reforms for fiscal consolidation and public finance transparency. The domestic currency appreciated 19 percent against the US dollar and sovereign bond yields retracted by 620 basis points. The new minister of finance announced that the country will engage in talks with the International Monetary Fund (IMF) to secure a deal that entails a commitment to fiscal discipline. The country wants to redirect public spending to

7 These projections are subject to uncertainties related to the resurgence of new variants, inadequate vaccination rollout, dynamics in commodity prices, and the pace of recovery in China.

8 Sectors that contributed to greater growth in the second quarter of 2020 were transport, storage and communication, personal services, and trade, catering, and accommodation, whereas manufacturing, finance, real estate and business services, and general government services pulled it down.

Continued decline in oil production dragged recovery in Angola and Nigeria.

FIGURE 1.16: Angola and Nigeria: Oil Production (million barrels per day)



Source: U.S. Energy Information Administration.

pro-poor expenditure in the form of subsidies and social support. These efforts come with higher mining tax collection driven by elevated metal prices. The rising infection cases of the Delta variant led the country to apply severe restrictions, which in turn exacerbated an already weak economic situation.

The Mozambican economy grew by 2 percent in the second quarter, the highest quarterly growth rate since the second quarter of 2019. The key drivers were the tertiary sector (namely, hotels and restaurants, transport, and communication), followed by the primary sector (mainly fishing and mining). In contrast, the secondary sector contracted by 1 percent, driven by the poor performance of the electricity and water subsector.

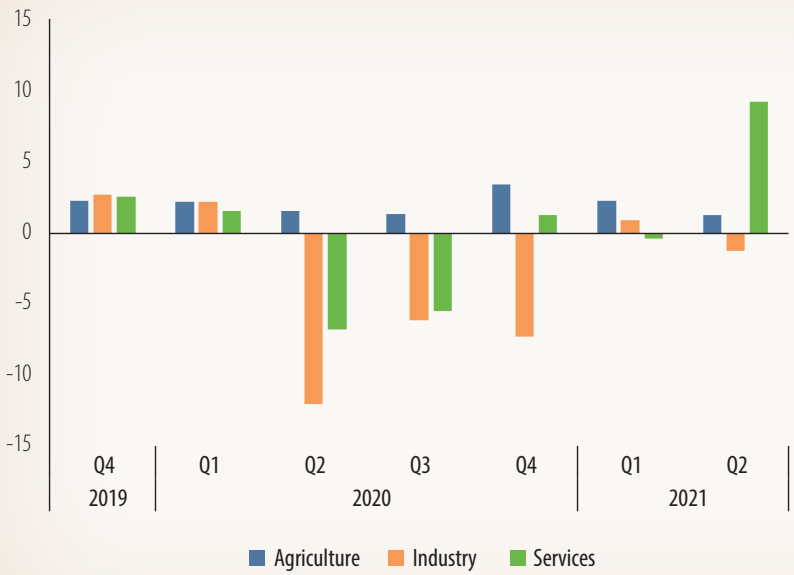
Among non-resource-intensive countries, the strong momentum of the economy in the first half of the year in Kenya was hampered by the third wave of coronavirus driven by the Delta variant. Mauritius and the Seychelles suffered from stringent measures that negatively affected the tourism industry. Activities in the sector have resumed as the government eased restrictions and increased the vaccination rollout. The Seychelles and Mauritius have recorded the highest vaccination rates in the continent, with 70 and 59 percent of the population being fully vaccinated, respectively. Governments decided to open their borders to tourists who have received at least one dose of the vaccine. Escalating political tensions are holding back momentum in the recovery process of Ethiopia.

West and Central Africa

Nigeria's economic growth shows little sign of speedy recovery from the 2020 recession. The economy grew 5 percent in the second quarter, from 0.5 percent growth in the first quarter. This was the third consecutive quarter of positive growth since the pandemic crisis. The main driver of the recovery is the non-oil sector, with a growth rate of 6.7 percent compared with 0.8 percent in the first quarter (figure 1.17). The service sector recovered strongly after a disappointing first quarter, rising from -0.39 percent to 9.27 percent in the second quarter, while agriculture contracted from 2.28 in the first quarter to 1.30 percent. Industrial activity also declined to -1.23 percent in 2021Q2, down from 0.94 percent in 2021Q1 (figure 1.15). Recent improvements in the labor markets have been largely attributed to workers turning to small-scale, nonfarm enterprise activities in retail and trade—although their incomes remain precarious. In the first half of 2021, the fiscal deficit widened at 4 percent of GDP, driven by an increase in debt servicing costs and capital expenditure.

Ghana was not immune to rising COVID-19 infections in July 2021. The measures used to contain the spread of the pandemic thwarted the recovery in mid-2021 as activity slowed in August. However, the country has managed to keep the virus from spreading and provided adequate support to affected households. The country benefited largely from good performance in the first half of the year on the back of higher demand for its exports—particularly in the agriculture and industrial sectors.

FIGURE 1.17: GDP Growth in Nigeria, by Sector (percent)



The recovery in Nigeria was primarily supported by the service sector, coupled with subdued expansion in agriculture, while industry offset the rebound.

Source: Nigeria National Bureau of Statistics.

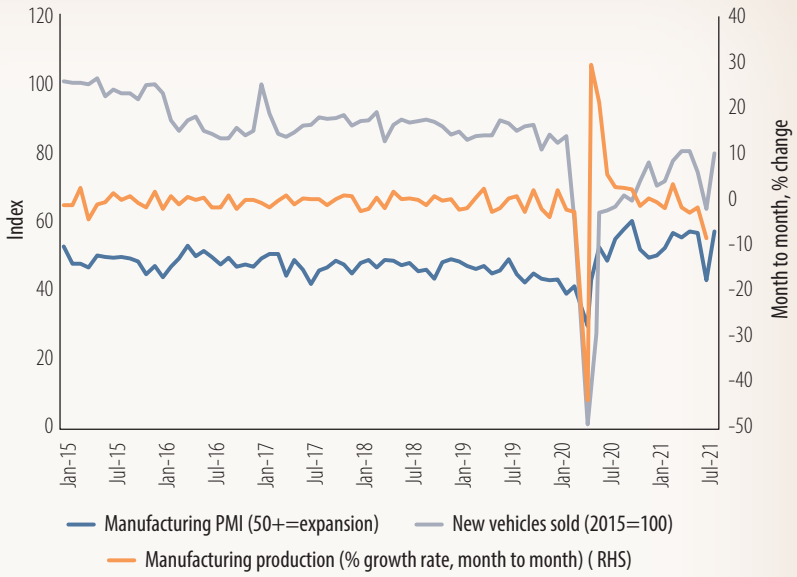
Oil-exporting members of the Economic and Monetary Community of Central Africa (CEMAC)—Cameroon, Chad, the Republic of Congo, Gabon, and Equatorial Guinea—have benefited from a rally in oil prices and emerged from the COVID-19-induced recession of 2020, except for the Republic of Congo, which is still struggling with a prolonged recession. However, these impacts have been offset by the spread of the Delta variant of COVID-19, lower oil production in the first half of the year in the case of Gabon and the Republic of Congo, and growing insecurity—specifically in the Central African Republic, Cameroon, and Chad. In Cameroon, the surge in oil prices coupled with the digitalization of tax and customs procedures generated more public revenues, while public spending was contained at 0.4 percent year-on-year in 2021Q1. Metal exporters in the subregion were set to gain on the back of higher terms of trade—however, the rally in metal prices has plateaued amid weak demand from China.

Survey data suggest that the Delta variant is holding back the strong economic recovery experienced during the first half of the year throughout the region. The very slow vaccination pace across countries in the region suggests that containment measures in many parts of the region will most likely remain in place for a while.

High-frequency indicators in the East and Southern Africa subregion are signaling a slowdown in economic activity in June and July. After plunging to 43.5 in July, the manufacturing PMI in South Africa recovered strongly to 57.9 in August (figure 1.18). Following the ease of restrictions and in the aftermath of the civil unrest, the PMI recovery also reflected a rebound in new vehicle sales (25.7 percent increase) after a sharp collapse in July. Similarly, consumer confidence remained weak but improved marginally (from -13 to -10), thus inching closer to the pre-pandemic level. This sentiment is consistent with the fiscal support to households through the reintroduction of the social distress relief grant and the once-off cash allowance to government employees under the 2021/22 wage agreement. Unsurprisingly, the RMB/BER business confidence index in South

The decline in manufacturing production, the PMI, and new car sales in July reveals the effects of the third wave of COVID-19 and political unrest.

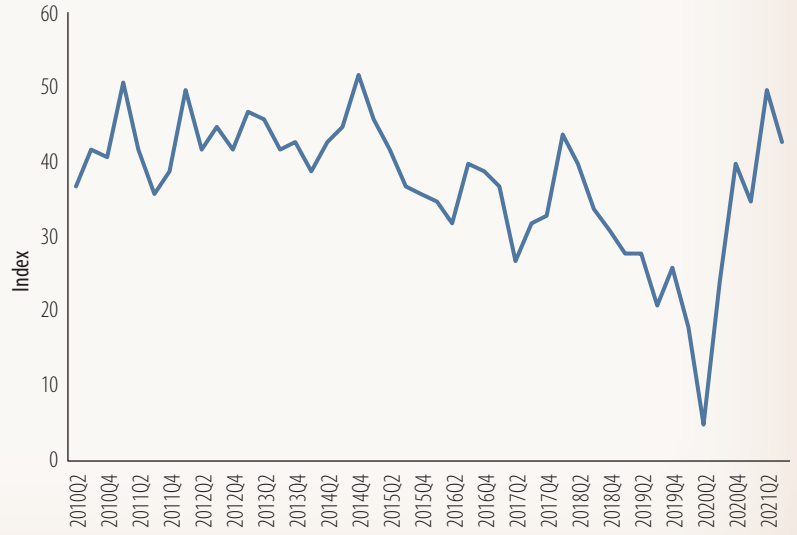
FIGURE 1.18: South African PMI, Manufacturing Production, and New Car Sales



Source: Haver Analytics, Statistics South Africa.

Concerns about the effects of the Delta variant combined with riots and looting in July weighed on business confidence.

FIGURE 1.19: South African RMB/BER Business Confidence Index



Source: Haver Analytics.

Africa fell to 43 in the third quarter, after touching the 50-point mark (figure 1.19). The effects of riots and looting were reflected in manufacturing production, which contracted by 8 percent in July from a 1.3 percent fall in June.

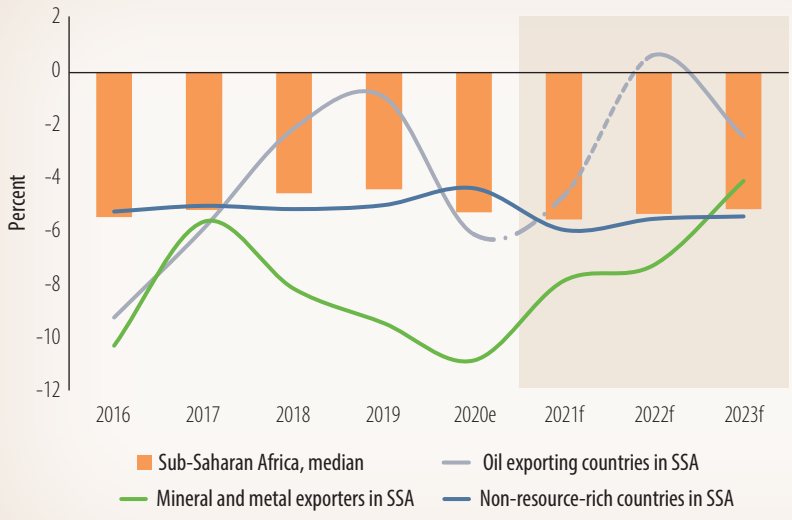
In Angola, oil production in July remained below last year's levels by 150,000 barrels per day; that is, 220,000 below its OPEC target. The sector was affected by the pandemic, leading to delays in exploration of new fields and investment in new projects. The restrictions that were imposed impacted particularly the external sector in Kenya, resulting in a decrease in exports of coffee and tea. Imports rose, which then exerted pressure on the current account, widening the deficit. As a result, the domestic currency depreciated by 3 percent against the US dollar. The PMI decreased marginally from 51 in June to 50.6 in July. In Rwanda, industrial production growth sharply decelerated from 25.1 percent year-on-year in June to 6.2 percent in July following the restrictions imposed by government officials to reduce the spread of the Delta virus. Manufacturing activity declined by 8.3 percent year-over-year (y-o-y) in July. The sectors dragging the recovery were mining and quarrying, furniture and other manufacturing, and chemicals, rubber, and plastic products. Similarly, Uganda's stringent measures to contain rising infections significantly slowed economic activity at the beginning of the third quarter. The PMI plummeted in June and registered a further decline in July—with the retail and recreation sectors being the most affected.

The West and Central Africa subregion presents a similar picture. Industrial activity in Nigeria was partly affected by the measures implemented to contain the spread of the Delta variant. The outbreak of the third wave of the virus weighed on activity more recently, but the economy emerged with a steady recovery in visits to retail and recreation outlets, and the PMI increased to 55.4 in July. The oil sector contracted by 12.7 percent as oil production declined from 1.81 million barrels per day in 2020Q2 to 1.61 million barrels per day in 2021Q2. Côte d'Ivoire faced new outbreaks of bird flu in addition to the spread of the Delta variant. Industrial production faded in 2021Q2, after strong activity in the first quarter. Despite the resurgence in cases, the retail sector continued its recovery, with visits to retail and recreation outlets continuing their upward trajectory. The government has also stepped up its vaccination plan, with nearly 2 million vaccinated of 2.6 million vaccine doses received as of September 25, 2021. High-frequency data from Ghana recorded a small drop in the PMI from 51 in June to 49.7 in July. Mobility figures suggest a further decline in economic activity in August.

External positions are expected to improve in resource-rich countries on the back of rising commodity prices, although commodity market volatility remains.

The current account deficit in the region is estimated to have slightly widened from 5.2 percent of GDP in 2020 to 5.5 percent of GDP in 2021, despite the increase in global commodity prices and the pickup in global trade (figure 1.20). The current account deficit is expected to decline to 5.3 and 5.1 percent of GDP in 2022 and 2023, respectively. However, the regional aggregate of the current account deficit masks considerable heterogeneity across country groups. The current account deficit in 2021 has widened among non-resource-rich countries while it has narrowed among resource-rich ones. The deficit in non-resource-rich countries has widened from 4.3 percent of GDP in 2020 to 5.9 percent of GDP in 2021, and it is expected to stabilize around 5.5 percent in 2022–23. Oil-exporting countries, however, experienced a narrowing of their current account deficit from 6.0 percent of GDP in 2020 to 4.6 percent of GDP in 2021. These countries are also expected to witness marked correction in the current account, turning to a surplus of 0.7 percent in 2022 before going back into deficit territory at -2.4 percent in 2023. This pattern is associated with the higher export proceeds thanks to elevated oil prices. Mineral and metal exporters registered a decline in the current account deficit of 3 percentage points of GDP. Given elevated metal prices that are expected to stabilize at a higher level, metal and mineral exporting countries are expected to reduce their deficit from 7.8 percent of GDP in 2021 to 4.1 percent in 2023.

FIGURE 1.20: Evolution of the Current Account (% of GDP)



The recovery in the current account deficit of oil exporters is offset by slow recovery of metal exporters and non-resource-rich countries.

Source: World Bank staff projections.

In South Africa, the (seasonally adjusted and annualized) current account surplus widened from R261 billion in 2021Q1 to R343 billion in 2021Q2—an increase of 1.3 percentage points in GDP to 5.6 percent of GDP in the second quarter. It is expected that the unrest and the cyberattack on Transnet's operations will likely affect exports in 2021Q3. The trade surplus accelerated to R614 billion in 2021Q2 thanks to a protracted upward trend in merchandise exports, which registered a quarterly increase of 13.2 percent to R1.83 trillion in 2021Q2. In turn, the rebound in exports was supported by favorable terms of trade, an increase in export volumes, and improvements in global demand. Imports increased by 3.4 percent on a quarterly basis to R1.31 trillion in 2021Q2. Hence, the trade surplus increased from 7.5 percent of GDP in 2021Q1 to 10 percent in 2021Q2.

Debt vulnerabilities continue increasing amid the pandemic.

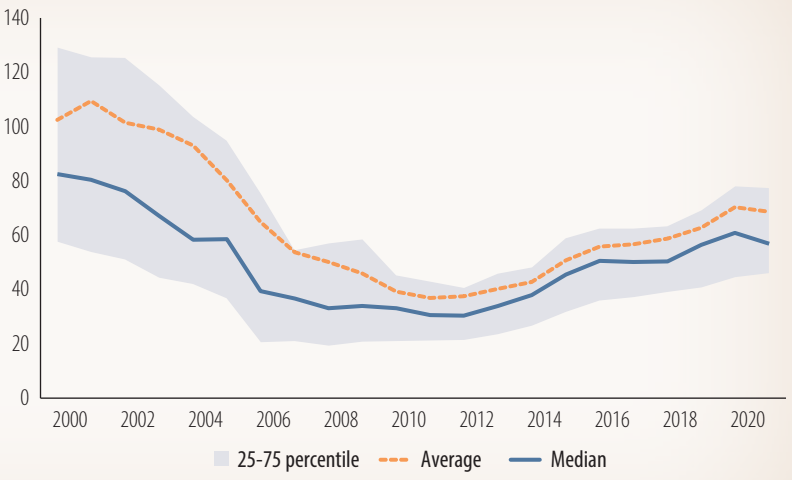
Public debt levels across Sub-Saharan African countries experienced a steep increase, which predated the COVID-19 crisis. On average, the general government gross debt is projected at 71 percent of GDP by 2021, an increase of 30 percentage points of GDP since 2013 (figure 1.21).[9] Higher debt ratios coupled with increased reliance on more expensive financing sources have pushed up interest payments for the region. Increasing reliance on funding on commercial terms, partially reflecting the recent surge in Eurobond issuances, has raised the exposure of Sub-Saharan African countries to interest rate, exchange rate, and rollover risks.

As of August 2021, Sub-Saharan African countries have raised US$9 billion in Eurobonds—an amount that is higher than the US$5.9 million raised throughout 2020 (figure 1.22). The largest issuer as of August 2021 was Ghana, with US$3 billion, the first Sub-Saharan African country to issue a Eurobond in dollars since the onset of the pandemic. This capital raising is part of the US$5 billion financing to support growth-oriented expenditures—as stipulated in the 2021 government budget. In September, Nigeria raised US$4 billion in Eurobonds in a sale that attracted offers of four times the amount that the government initially planned to raise. The country issued the debt in three tranches of three tenors. It raised US$1.25 billion for seven years at a yield of 6.125 percent and sold a 12-year bond at 7.375 percent to fetch US$1.5 billion. A 30-year tranche of US$1.25 billion was sold at 8.25 percent.

The COVID-19 pandemic has amplified debt vulnerabilities in the region.

Steep increases in public debt across Sub-Saharan African countries before the COVID-19 crisis.

FIGURE 1.21: Evolution of Public Debt in Sub-Saharan Africa (percent of GDP)

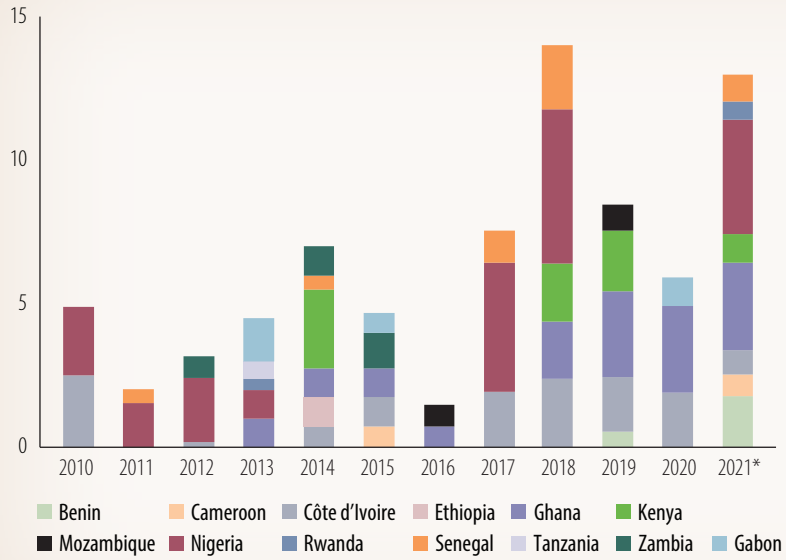


Sources: World Economic Outlook April 2021; World Bank staff estimates.

9 Around 95 percent of low-income developing countries in Sub-Saharan Africa experienced an increase in public debt stocks.

The share of Sub-Saharan African countries assessed in debt distress or at high risk of external debt distress increased to almost half before the crisis (figure 1.23). In 2021, two countries in the region experienced an increase in their risk of debt distress so far.[10] Rising fiscal burdens are expected to cause significant debt sustainability concerns.

FIGURE 1.22: Eurobond Issuances as of September 2021 (US$, billions)

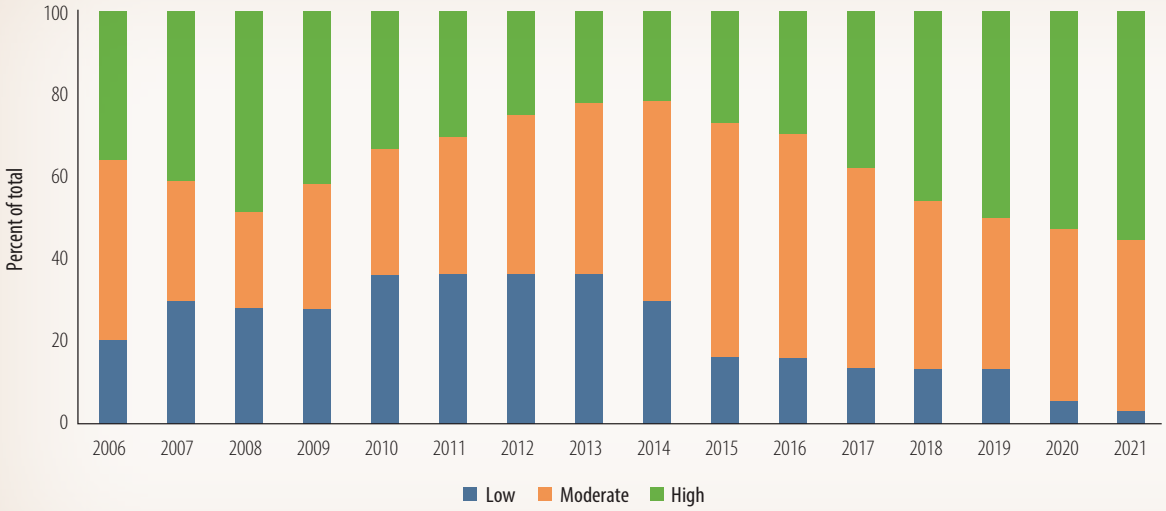


Sources: Bloomberg; World Bank staff estimates.
Note: Data as of end-September 2021.

The surge in Eurobond issuances has amplified debt vulnerabilities in Sub-Saharan Africa.

Improving debt transparency remains a critical challenge—in particular in closing gaps in data coverage and quality as well as contingent liability reporting. Evidence from the World Bank's Debt Management Performance Assessment shows significant gaps in cash flow forecasting and cash balance management, and loan guarantees and on lending derivatives (figure 1.24). Broader problems continue in debt management governance, weak legal frameworks, lack of audits, poor data administration and internal control, and low staff capacity with limited and uneven progress over time.[11]

FIGURE 1.23: Evolution of Risk of External Debt Distress (percent of total)



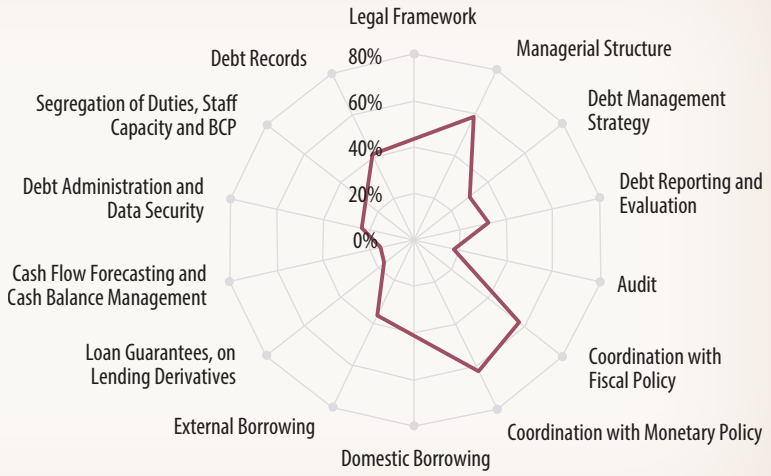
Source: World Bank staff estimates as of June 2021.
Note: The data cover joint World Bank–International Monetary Fund debt sustainability analyses for low-income countries in Sub-Saharan Africa. The number of countries varies by year.

The share of Sub-Saharan African countries assessed in debt distress or at high risk of external debt distress increased to almost half before the crisis.

10 The risk of debt distress was elevated from moderate to high in Guinea Bissau, and from low to moderate in Uganda.
11 See *Africa's Pulse* volumes 22 and 23 for more details on issues of availability and completeness in debt statistics and management.

Improving debt transparency remains a critical challenge. Significant gaps persist in cash flow forecasting and cash balance management, and loan guarantees and on-lending derivatives.

FIGURE 1.24: Debt Recording Dimensions and Share of Countries That Meet the Requirement



Source: World Bank.
Note: Share of Sub-Saharan African countries that meet the minimum requirement.

There has been some progress, although slow, in the process of debt relief through the Common Framework for Debt Treatments beyond the DSSI. Official bilateral creditors reached a preliminary agreement on Chad's debt restructuring in June. Acceptance of debt restructuring under the Common Framework terms and conditions is awaited from private creditors to allow the process to move to its conclusion. On September 16, 2021, Ethiopia's creditors' committee held its first meeting to discuss the country's debt restructuring under the Common Framework. Subsequent meetings will determine the amount of debt to be restructured and the treatment of the private sector debt. The Government of Ethiopia has also officially requested an IMF program for which debt sustainability will be a precondition.[12]

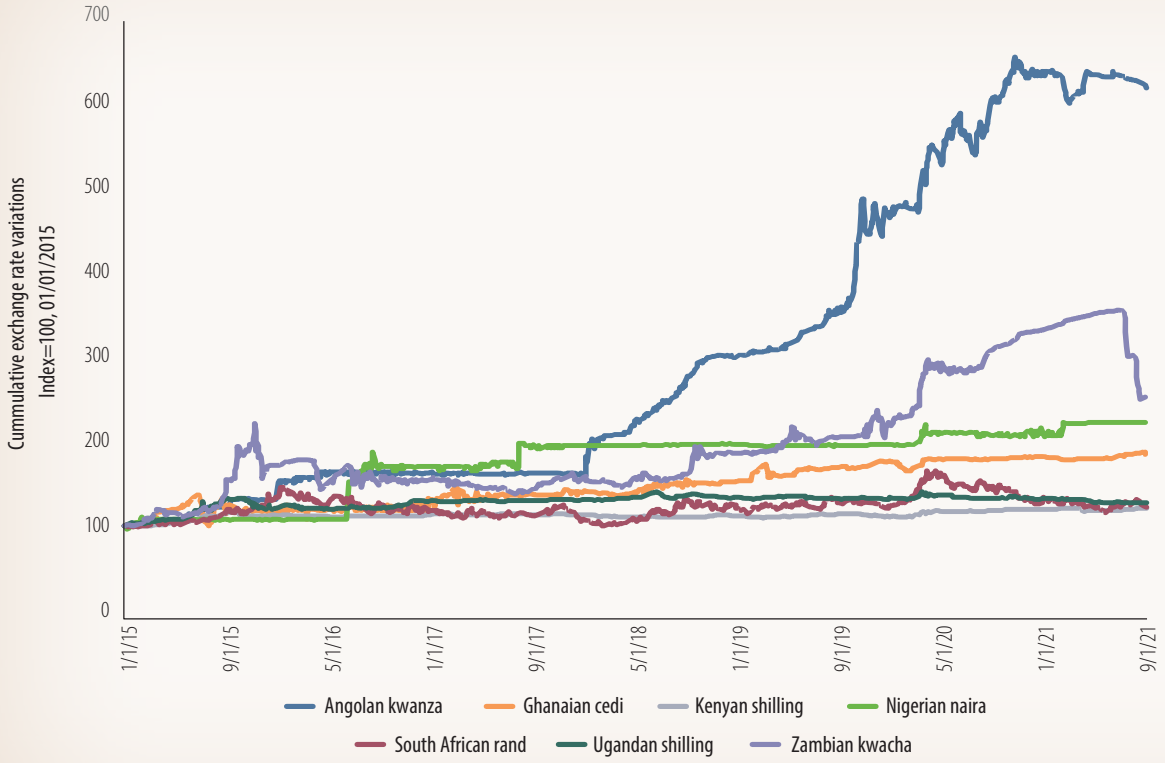
The IMF approved a general allocation of Special Drawing Rights (SDRs) equivalent to US$650 billion (about SDR 456 billion) in August 2021, to address the long-term global need for reserves, build confidence, and foster the resilience and stability of the global economy. About US$275 billion (about SDR 193 billion) of the new allocation will go to EMDEs, including low-income countries, and it will particularly help vulnerable countries reduce their reliance on more expensive domestic or external debt.

After reaching record levels in April, sovereign spreads declined notably, particularly in countries with high debt-to-GDP ratios, such as Zambia and Angola. The risk of default subsided in Zambia after the country started negotiating a program with the IMF. Sovereign bond yields declined further upon the election of opposition leader Hakainde Hichilema. Market participants expect the new president to accelerate market-friendly reforms, adopt sound macroeconomic policies, and put emphasis on fighting corruption, enhancing transparency, and striking a deal with the IMF. As a result, the kwacha appreciated by 19 percent against the US dollar. Similarly, sovereign spreads in Angola retreated from their high levels in April due to fiscal consolidation efforts (as reflected by a reduction in nonessential expenditure) and prospects of a persistent rise in oil prices. In Ghana, sovereign bond yields increased as public debt rose to 77.1 percent in June. Domestic currencies in the region depreciated against the US dollar in July, except for the Zambian kwacha (figure 1.25).

12 Details on the features and participation of African economies on the Common Framework as well other mechanisms of debt relief such as the Debt Service Suspension Initiative (DSSI) and the Sustainable Development Finance Policy (SDFP) are provided in *Africa's Pulse* volume 23.

FIGURE 1.25: Exchange Rate against the US Dollar

Elevated debts have raised the exposure of Sub-Saharan Africa's exchange rate risks.



Source: Bloomberg Analytics.
Note: Data as of September 10, 2021.

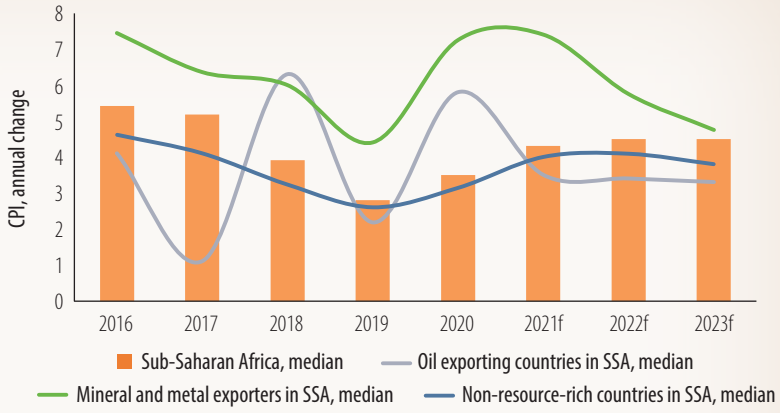
Inflation picked up due to rising food price inflation.

Inflation in Sub-Saharan Africa accelerated from 3.5 percent in 2020 to 4.3 percent in 2021, an increase attributed to higher food and energy prices (figures 1.26 and 1.27). Inflation is expected to increase to 4.5 percent in 2022–23. A higher rate of inflation is also projected among mineral and metal exporting countries, where inflation is projected to peak at 7.4 percent in 2021. It is then expected to drop to 4.8 percent in 2023. Among non-resource-rich countries, inflation is projected to jump from 3.1 percent in 2020 to 4.0 in 2021, followed by a further uptick to 4.1 percent in 2022, before declining to 3.8 percent in 2023. In contrast, deflationary dynamics are expected in oil-exporting countries, where the inflation rate dropped from 5.8 percent in 2020 to 3.5 percent in 2021 and is expected to decline further to 3.3 in 2023. Within Sub-Saharan Africa, the majority of countries (38 of 47) are projected to register single-digit average inflation rates in 2021, while only two countries will post average inflation rates that exceed 50 percent (Sudan and Zimbabwe).

At the country level, inflation in South Africa climbed from 4.6 percent in July to 4.9 percent in August. It is expected to average 4.2 percent in 2021, just below the midpoint of the official target band of 3 to 6 percent, and then rise to the midpoint of the target by 2023. Given this trajectory, it is unlikely that the South African Reserve Bank will raise the policy rate in the near future. In Zambia, inflation remained unchanged at 24.4 percent y-o-y in August, way above the target

Overall, inflation is expected to rise to 4.3 percent; nevertheless, it remains contained within the central banks' objective.

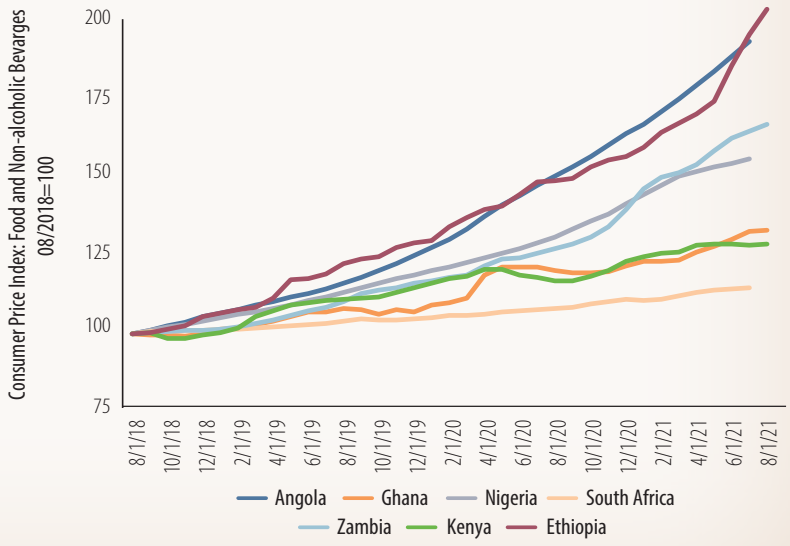
FIGURE 1.26: Inflation in Sub-Saharan Africa, 2016–23



Source: World Bank staff projections.

Inflation increased on the back of elevated commodity prices, in particular food and fuel prices.

FIGURE 1.27: Food Inflation Index for Selected Countries



Source: Haver Analytics.

band of 6 to 8 percent. It is projected to increase to 21 percent in 2021 and drop gradually to 10 percent in 2023, still above the upper bound of the target band. In East Africa, inflation increased marginally in Kenya from 6.55 percent in July to 6.57 percent in August and remains within the central bank objective of 2.5 to 7.5 percent. After recording a 6 percent rise for 2021, the rate of inflation is expected to revert toward the midpoint of the target in 2022-23. The central bank decided to keep the policy rate on hold at 7 percent.

Among the countries with high inflation rates, the annual cost of living in Zimbabwe declined to the lowest level in about three years in August. Inflation during the month of August reached 50.2 percent, down from 56.4 percent in July.[13] Increases in food prices as well as administered prices (say, freight rates) were the culprit of the higher inflation. In Sudan, inflation slowed to 387.6 percent in August, down from 422.8 percent in July, reflecting the lower cost of foodstuffs and imported goods experienced a reduction. This is the first drop in annualized inflation in more than a year. The declining inflation was largely attributed to the country's exchange rate stability, following the currency devaluation in February, and the lower prices for essential food items.[14]

In the West and Central Africa subregion, inflation in Nigeria remained high at 17.4 percent y-o-y in July, although it has been decelerating slightly for the past four consecutive months. The average inflation for this year is projected at 16.5 percent, way above the official target band of 6 to 9 percent. It is expected to slow to 13.5 percent in 2022 and 11 percent in 2023. In Ghana, weak domestic currency combined with a rise in food prices pushed headline inflation from 9

13 However, monthly inflation reached 4.2 percent in August 2021, up from 2.56 percent in July 2021—the highest monthly inflation rate since January 2021.

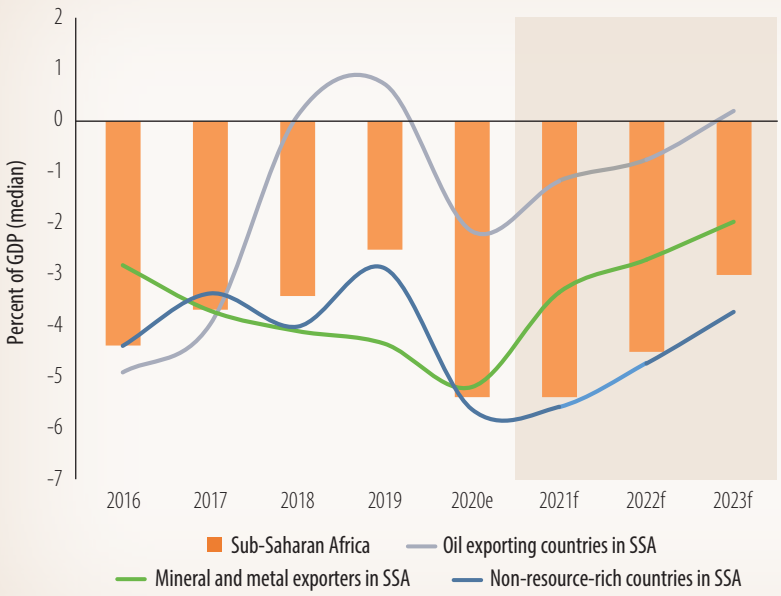
14 Sudan received US$858 million from the SDR allocation from the IMF. According to the Central Bank of Sudan, the additional reserves will shore up reserves and help sustain the exchange rate regime.

percent y-o-y in July to 9.7 percent in August, slightly closer to the upper bound of the official target band of 6 to 10 percent. It is estimated to remain close to the upper bound at 9.8 percent in 2021 and gradually decrease to 6.8 percent in 2023.

Fiscal deficits are expected to remain invariant in 2021, although they will narrow significantly in resource-rich countries.

The fiscal deficit of Sub-Saharan Africa is expected to remain invariant at 5.4 percent of GDP in 2021, although it is expected to narrow to 4.5 percent of GDP in 2022 and 3 percent of GDP in 2023 (figure 1.28). Across country groups in the region, the fiscal deficit is expected to decrease among resource-rich countries (both oil and metal and mineral exporting countries) while it remains unchanged among non-resource-rich countries. Fiscal deficits in oil-rich countries are expected to narrow from 2.1 percent of GDP in 2020 to 1.2 percent of GDP in 2021 on the back of rising revenues from the oil sector. In the case of metal and mineral exporters, the deficit decreased from 5.2 percent of GDP in 2020 to 3.3 percent of GDP in 2021. In some resource-rich countries, such as Angola and Zambia, the improved fiscal balance reflects not only higher international prices for their commodities, but also government efforts to consolidate fiscally. Finally, the fiscal deficit of non-resource-rich countries remained at 5.6 percent of GDP in 2021. In 2022–23, the fiscal balance will continue improving across countries in the region. Although coming from higher budget deficits, the pace of reduction is expected to be faster in non-resource-rich countries than in resource-rich ones for the next two years. Specifically, the fiscal deficit in non-resource-rich countries is expected to ease to 3.7 percent of GDP in 2023.

FIGURE 1.28: Fiscal Balance in Sub-Saharan Africa (% of GDP)



The fiscal balance is expected to remain stable, reflecting fiscal consolidation as concerns over fiscal sustainability mount.

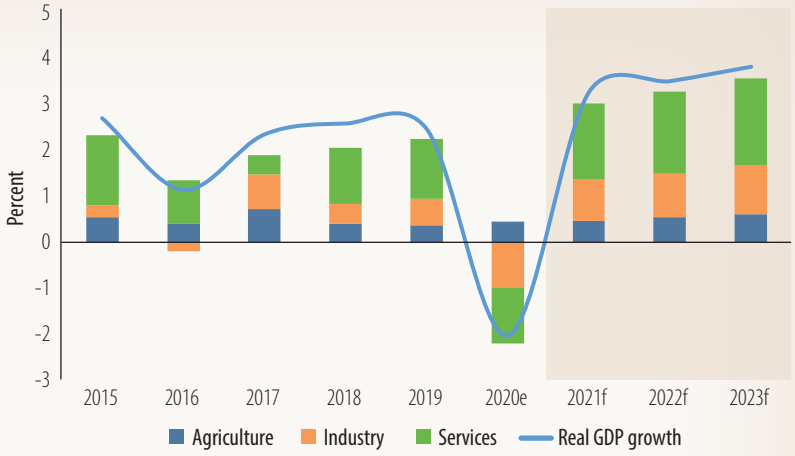
Source: World Bank staff projections.

1.4 OUTLOOK

After a contraction of 2.0 percent in 2020, real GDP in Sub-Saharan Africa is expected to grow by 3.3 percent in 2021 and 3.5 percent in 2022. Growth in 2021 was revised up by 1.0 percentage point compared to the forecast in the *Africa's Pulse* volume 23, thanks to better-than-expected commodity prices supported by global demand (figure 1.29). Activity resumed in the service, industry, and agriculture sectors along with a recovery in private consumption in 2021Q1 and 2021Q2 (figure 1.30). However, the pace of recovery was hampered by the reimposition of containment measures amid an outbreak of the Delta variant of the coronavirus. Constrained by limited fiscal space, Sub-Saharan African countries struggled to provide adequate support to the most vulnerable firms and households. With low vaccination rates, countries in the region remain exposed to the emergence of new variants of coronavirus. Inadequate fiscal support and insufficient vaccine supplies and deployment are hanging a cloud on the outlook of countries in the region.

Growth in Sub-Saharan Africa is projected to recover at 3.3 percent in 2021, supported on the supply side by resumed growth in the service, industry, and agriculture sectors.

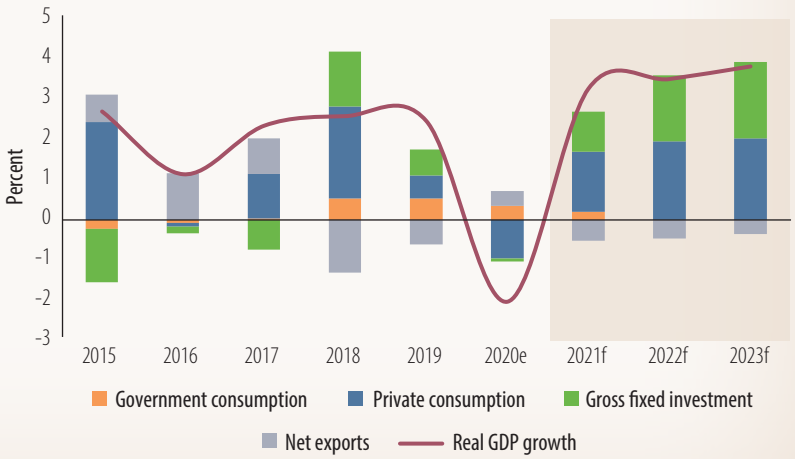
FIGURE 1.29: Contribution to Growth, Supply Side



Source: World Bank staff projections.

On the demand side, the rebound is on the back of a recovery in private consumption and subdued investment as countries reopen.

FIGURE 1.30: Contribution to Growth, Demand Side



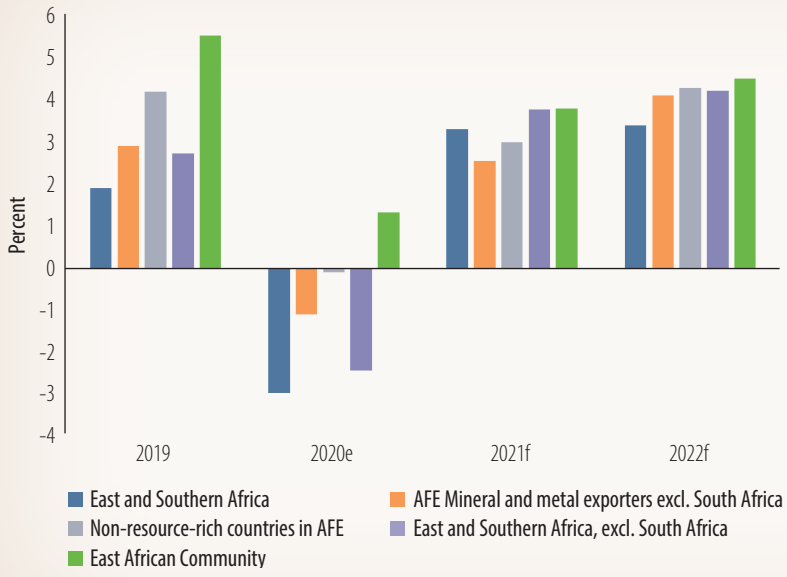
Source: World Bank staff projections.

East and Southern Africa

East and Southern Africa, the hardest hit subregion by the third wave of the coronavirus, is expected to rebound from a 3.0 percent contraction of GDP in 2020 to growth of 3.3 percent in 2021 and 3.4 percent in 2022 (figure 1.31). Growth in South Africa is projected to rebound from -6.4 percent in 2020 to 4.6 percent in 2021, supported by a favorable global environment and base effects. However, the country is facing numerous challenges going forward. The unemployment rate rose from 32.6 percent in 2021Q1 to 34.4 percent in 2021Q2, the highest

level recorded since the publication of the Quarterly Labor Force Survey. In addition, rising debt levels are weighing on the government's capacity to address social issues without jeopardizing the sustainability of its public finances. Addressing electricity shortfalls, corruption in the ruling party, and pressing needs for reform in the labor and product markets remain priorities to push potential growth.

FIGURE 1.31: GDP Growth Forecasts for East and Southern Africa



The recovery varies across the region and across countries, depending on characteristics and policy constraints.

Source: World Bank staff projections.
Note: AFE = East and Southern Africa.

After five consecutive years of recession, economic activity in Angola is projected to rebound from -5.4 percent in 2020 to 0.4 percent in 2021, before accelerating further to 3.1 percent in 2022 on the back of higher oil prices. The adoption of a fiscal consolidation strategy sets the stage for a reduction in nonessential expenditure. The central government is expected to run sizable primary fiscal surpluses for 2021–23, which will help reduce public debt-to-GDP levels—although this outlook remains vulnerable to oil price risks. Monetary tightening and a more stable exchange rate are expected to continue the disinflationary process. Improved supply conditions through structural reforms can also ease price pressures over the medium to long term.

Excluding Angola and South Africa, the subregion is expected to grow by 3.1 percent in 2021 and 4.3 percent in 2022. In Zambia, the economy is projected to grow at 2.2 percent in 2021—up from -3 percent in 2020. The growth rate will accelerate further to 2.9 percent in 2022. An increase in metal prices, particularly copper, will support the recovery; however, downside risks remain due to the slower growth of China amid rising cases of infection caused by the Delta variant. The positive sentiment about Zambia's new leadership will attract more foreign direct investment and put the country toward an accelerated growth path. Fiscal constraints, reliance on rainfed irrigation, and climate change could alter long-term growth prospects.

Non-resource-rich countries in East and Southern Africa are projected to grow at 3.0 percent in 2021—with growth accelerating to 4.3 percent in 2022 thanks to an increase in tourism. Mauritius and the Seychelles are projected to see rapid growth of 5.1 and 6.9 percent in 2021, respectively. This is expected to be followed by rates of 6.6 and 7.7 percent in 2022, respectively. The better performance of these countries reflects a successful vaccination rollout and the subsequent reopening of borders to inoculated visitors. In Rwanda, the economy is expected to bounce back from -3.4 percent in 2020 to 4.9 percent in 2021 and 6.4 percent in 2022. The strong rebound reflects higher consumption and trade before the outbreak of the Delta variant. Trade

has gathered momentum from stronger recovery in advanced economies and some EMDEs, which is expected to support growth in mining and export-oriented sectors. Fiscal sustainability will remain a challenge in the medium term. Increased spending plans include an expansion of the COVID-19 vaccination campaign and providing support to vulnerable households and firms. Public debt is forecast to reach 79.1 percent of GDP in 2021 and 81.3 percent in 2022.

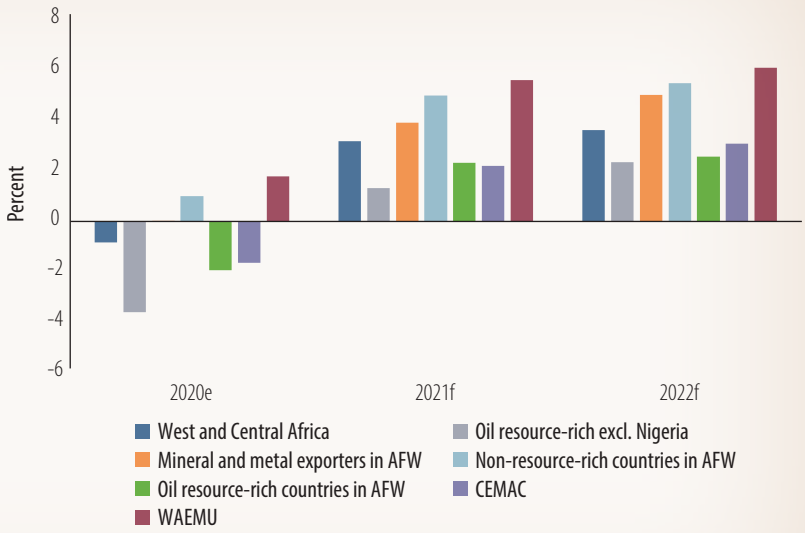
Economic activity in Kenya is projected to rebound from -0.3 percent growth in 2020 to 5.0 percent in 2021, and it is expected to grow at an average of 4.8 percent in 2022–23. This positive outlook reflects improvements in the construction, education, information and communication, and real estate sectors. Inflation remains contained near the central bank objective, and monetary policy continues to support growth. Government debt is projected to rise from 65.8 percent of GDP in 2020 to 69.2 percent in 2021. In Sudan, GDP growth is expected to pick up from a contraction of 3.6 percent in 2020 to an expansion of 0.9 percent in 2021. Improved conditions in agriculture and higher economic activity after lifting the pandemic-related restrictions were the drivers of this performance. Economic activity is expected to grow further in 2022 and 2023, as greater macroeconomic stability would incentivize higher inflows of foreign private capital and development financing.

West and Central Africa

The West and Central Africa subregion is projected to experience a growth rate of 3.2 percent in 2021, up from -0.8 percent in 2020 (figure 1.32). The subregion is estimated to grow further by 3.6 percent in 2022. Nigeria is projected to grow from -1.8 percent in 2020 to 2.4 percent in 2021, thanks to better performance of both oil and non-oil sectors. Reducing heavy reliance on the oil sector through diversification of exports and assets will benefit the economy going forward, especially in the transition to a low-carbon economy in the medium term. Excluding Nigeria, the subregion is expected to pick up momentum from last year's weak performance (0.7 percent) to 4.5 percent in 2021 and 5.3 percent in 2022. The growth rate for the West African Economic and Monetary Union is projected at 5.6 percent in 2021 and 6.1 percent in 2022, reflecting favorable terms of trade. Côte d'Ivoire is projected to grow at rates of 6.2 and 6.5 percent in 2021 and 2022, respectively. The forecast reflects an increase in (public and

The recovery varies across the region and across countries, depending on characteristics and policy constraints.

FIGURE 1.32: GDP Growth Forecasts for West and Central Africa



Source: World Bank staff projections

Note: AFW = West and Central Africa; CEMAC = Economic and Monetary Community of Central Africa; WAEMU = West African Economic and Monetary Union..

private) investment, partly reflecting the political normalization after peaceful and inclusive legislative elections, and ongoing efforts in the national reconciliation. It also reflects an increase in cocoa production, which proved larger than expected in the first half of the year, with volume increasing by 21 percent, as well as cashew nuts, the second largest commodity, growing by 43 percent. The current account is expected to remain in deficit on the back of strong imports and weak exports. Senegal is expected to grow by 4.7 and 5.5 percent in 2021 and 2022, respectively, thanks to expansion in agriculture and mining and the rebound of the service sector as businesses adapt their operations to the COVID-19 environment. Inflation is expected to remain low at around 2 percent and decline to 1.5 percent in 2023. Ghana is projected to exhibit growth of, respectively, 4.9 and 5.5 percent in 2021 and 2022, reflecting strong growth in exports. The economy performed relatively well despite the outbreak of the Delta variant thanks to the fiscal support by the government. Ghana received the equivalent of US$1 billion in the recent IMF SDR allocation, part of which will go to support economic recovery under the COVID-19 Action Recovery and Economic Stimulus (CARES) program. In an effort to meet its ambitious domestic revenue mobilization targets (starting in 2021), the government is implementing planned spending cuts (starting in 2022) and the Energy Sector Recovery Program.

CEMAC countries are expected to grow by 2.2 and 3.1 percent in 2021 and 2022, respectively. Economic activity in the Republic of Congo is projected to continue in recession during 2021 (-1.2 percent) and to grow at 3.2 percent in 2022. The country will gain from higher oil prices and higher liquidity buffers because of the new SDR allocation from the IMF (estimated at 1.7 percent of GDP). Cameroon's economic growth is expected to increase gradually from 0.7 percent in 2020 to 3.4 percent in 2021 and grow at an even faster pace in 2022–23. The rebound was driven by the secondary and tertiary sectors, coupled with improved external demand. Higher commodity prices (and, particularly, oil) also contributed to the recovery, coupled with increased oil production. The service sector recovered on the back of growing consumption and investment following the relaxation of restrictions prior to the outbreak of the third wave of COVID-19.

Risk to the Outlook: The Emergence of New Strains of COVID-19

The risk to the outlook is tilted to the downside. The outbreak of the Delta variant and its impact on economic activity has shown that the region remains vulnerable to the emergence of new variants. Incoming data in many countries provide evidence that the recovery during the first half of the year was derailed by the reimposition of containment measures. Approximately 20 percent of countries were in (nationally or targeted) lockdown or elevated COVID-19-related restrictions during the third quarter of 2021. Given the limited fiscal space, African countries could not afford the unprecedented fiscal stimulus undertaken in advanced economies and emerging markets. The policy space to maneuver will be more restricted with any additional outbreak of the virus. Additionally, the pandemic is leaving long-term scars across economies in the region. The pandemic is lowering potential growth further through its lasting effects on human capital, resulting from disruptions in schooling. Countries that have been successful in speeding up vaccination rollout have small populations and have been aggressive in government intervention.

1.5 ALTERNATIVE GROWTH SCENARIOS

This section examines the scenarios that would render a stronger than projected recovery in Sub-Saharan Africa. These scenarios illustrate the economic impacts resulting from different speeds of vaccine deployment across the region.[15] The baseline forecast assumes that vaccine delivery and coverage would prompt a relaxation of COVID-19 disruptions of domestic economies—in terms of private behavior and regulations—by the start of 2023Q1.[16] The downside scenario projects that vaccine delivery and coverage would not be sufficient to relax disruptions until 2023Q3, whereas the upside scenario assumes that vaccine coverage would be sufficient a full year earlier than in the downside scenario in 2022Q3.[17]

According to the scenarios, vaccination coverage is assumed to be too low in 2021 to allow for additional relaxation of COVID-19 disruptions beyond what has already taken place. Hence, there is no difference across scenarios before 2022. The level of economic disruption is measured as the implicit COVID-19-related impact on private investment and consumption observed in 2021. Estimates of the effects of these alternative scenarios of vaccine deployment on economic activity in the region are presented in figure 1.33.

Downside Scenario

In the *downside* scenario, progress toward the widespread diffusion of vaccines is slower than in the baseline. Chronic economic disruptions from social distancing measures remain at about the same level as in the second quarter of 2021 throughout 2022 and only begin easing in the second half of 2023. In the baseline, recovery begins a half-year earlier toward the beginning of 2023. Due to the slower vaccine rollout, economic confidence is weaker for longer, and private consumption and investment spending remain subdued. Additional risks flow from a weaker-than-expected rebound in the global economy, resulting in lower commodity prices, and rising cost of borrowing due to greater risk aversion.

- In such a scenario, the level of real GDP in the region in 2022 is similar to that in the baseline—as social distancing from COVID-19 restrictions remain unchanged in both scenarios. Output in 2023 is down 1.4 percentage points relative to the baseline projections.
- In the East and Southern Africa subregion, real GDP would be 1.8 percentage points lower in 2023, compared with the baseline.
- In West and Central Africa, real GDP would be lower by 1.0 percentage point in 2023, reflecting the stronger recovery from COVID-19 already implicit in the behavior of the region during 2021.

15 All scenarios (baseline, downside, and upside) were generated using the World Bank's MacroFiscal Model (MFMod) (Burns et al. 2019). Numbers for all scenarios are generated on the basis of specific assumptions about the inherently uncertain progress of COVID-19 and the policy responses to it. As such, they should be interpreted as illustrative rather than predictive.

16 A vaccination coverage of 30-35 percent is used as the threshold for the domestic re-opening of economies. This is based on the vaccination coverage (range, downside – upside) for World Bank Group clients (average, excluding high-income countries) estimated as follows: (i) end-2021, 20 percent (range, 10-30 percent); (ii) end-2022, 35 percent (range, 25-35 percent); and (iii) mid-2023, 50 percent (range, 40-60 percent).

17 The slower progress toward the widespread diffusion of vaccines in the downside scenario compared to the baseline scenario implies that economic disruptions from social distancing measures remain at about the same level as in the second quarter of 2021 through the second quarter of 2023 (versus only until the end of 2022 as in the baseline scenario). In all scenarios, vaccine coverage is assumed to be too low in 2021 to allow for a further relaxation of COVID-19-related disruptions before 2022.

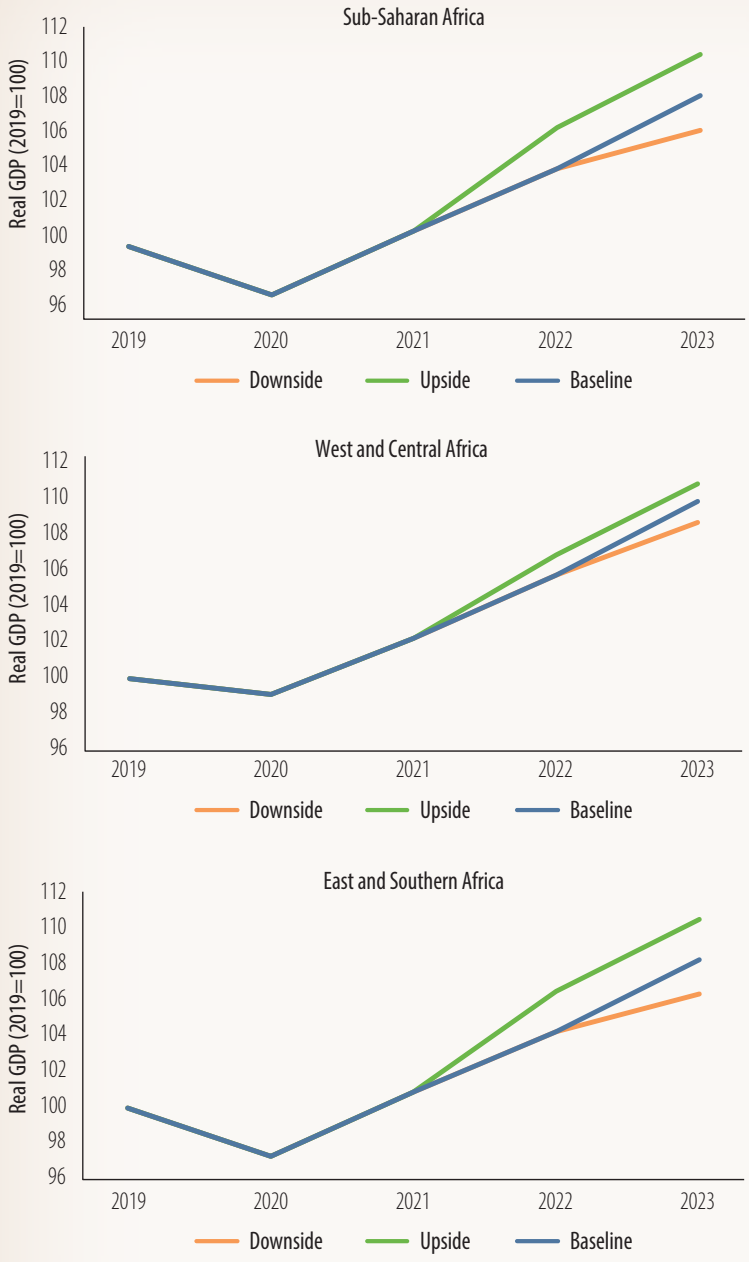
Upside Scenario

In the *upside* scenario, a more rapid deployment of the vaccines would enable the lifting of social distancing and other containment measures by 2022Q3, about half a year faster than in the baseline. This would boost confidence, and consumer and investment spending would accelerate.

- In this scenario, real GDP in the region in 2022 could be raised by 1.6 percentage points higher than in the baseline in 2022 and 1.5 percentage points higher in 2023—the lower number reflecting the catch-up effect in 2023 as baseline COVID-19 restrictions ease. The economic impact of greater access to vaccines will vary across countries depending on the extent to which economic disruptions have already eased in 2021.
- In the East and Southern Africa subregion, real GDP could be raised by 2.1 percentage points in 2022 and again by 2.1 percentage points in 2023, respectively, relative to the baseline.
- In West and Central Africa, the faster recovery would have a smaller impact on GDP (1 percentage point in 2022 and 0.9 percentage point in 2023), reflecting the greater extent to which COVID-19 disruptions have already eased in 2021.

FIGURE 1.33: Alternative Growth Scenarios in Sub-Saharan Africa, 2022–23

Faster vaccine deployment would accelerate growth while lower vaccine delivery would disrupt economic activity in Sub-Saharan Africa.



Source: World Bank staff projections.

Note: The baseline scenario corresponds to the central forecast of the Macro-Poverty Outlook of October 2021. The alternative scenarios were generated using the World Bank's Macro-Fiscal Model (MFMod). The numbers are generated based on specific assumptions about the inherently uncertain progress of COVID-19 and the policy responses to it. As such, they should be interpreted as illustrative rather than predictive.

1.6 POLICIES

The last issue of *Africa's Pulse* argued that the speed of vaccine deployment and credible policy reforms to stimulate investment will be critical to improve the region's growth outlook. Vaccine inequity across the world is dangerously leading to an increasing divergence in health and economic outcomes. Growth in the region in 2021 is estimated at 3.3 percent, with projections for 2022 and 2023 to remain below 4 percent. Compared with advanced countries, the stimulus provided by countries in the region is significantly smaller. Therefore, more resources are needed to mitigate the effects of the pandemic and launch a sustainable and inclusive growth recovery program. Climate change adds to the developmental challenges already faced by the region. It also provides opportunities to build back better and greener.

More Financing Needed to Counter the Pandemic and Launch a Sustainable Recovery

Sub-Saharan African countries responded swiftly to the COVID-19 pandemic in 2020. They implemented a wide array of public health and containment measures to prevent further spread of the coronavirus. At the same time, governments in the region implemented a series of monetary, fiscal, and financial policies to protect the lives and livelihoods of their population—notably, the poor and those who are vulnerable to poverty. The size of the fiscal support measures deployed by Sub-Saharan African governments has been very small compared with those in advanced economies and emerging markets. For instance, the budgetary support to the economy in response to the pandemic since January 2020 amounted, on average, to 2.8 percent of GDP in Sub-Saharan Africa, while the average size of the stimulus represented 17.3 percent of GDP in advanced economies and 4.1 percent in emerging market economies (figure 1.34).[18]

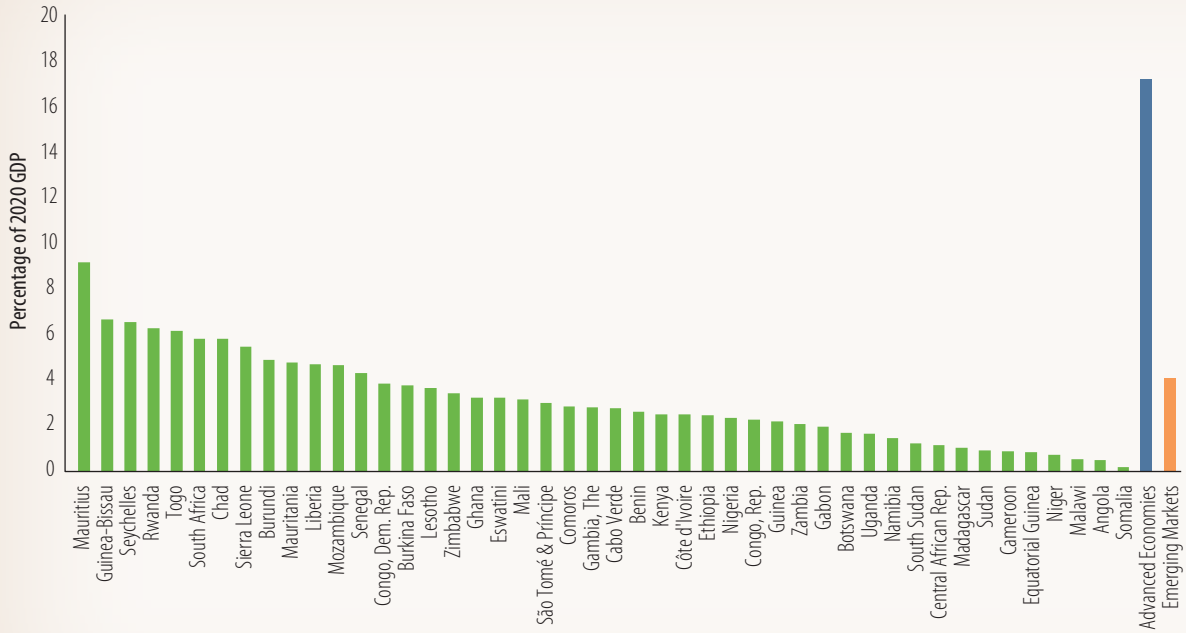
The size of the stimulus masks the wide heterogeneity in budget support across African countries. Although the size of the fiscal support of all African countries was smaller than the average of advanced countries, in eight countries in the region, budget support measures exceeded 5 percent of GDP. The fiscal measures deployed in Mauritius and the Seychelles, which are small island countries that are highly dependent on tourism activities, amounted to 9.2 and 6.6 percent of GDP, respectively. In South Africa, the budget support in response to COVID-19 was nearly 6 percent. Still, these packages paled in comparison with the amount of additional spending and forgone revenues in the United States (25.4 percent of GDP) and France (9.6 percent of GDP), as well as emerging markets such as Brazil (9.2 percent of GDP) and Thailand (11.4 percent of GDP).

African countries have been relatively disciplined on monetary and fiscal policies. Inflation rates have remained relatively under control across countries in the region. For instance, about three-quarters of the countries with available data (35 of 47) had single-digit average rates of consumer price inflation in 2020, and the number of countries is estimated to increase to 38 in

18 The budget support reported here excludes off-budget measures such as equity injections, asset purchases, loans, guarantees (on loans, deposits, and so forth), and quasi-fiscal operations, among others. Only 20 of the 47 countries reporting data for the region conducted such operations. The median liquidity support by Sub-Saharan African countries represented only 0.2 percent of GDP.

FIGURE 1.34: Discretionary Fiscal Response to COVID-19 in Sub-Saharan African Countries (percent of GDP)

Fiscal packages in Sub-Saharan Africa were significantly smaller than those in advanced economies.



Source: "Database of Country Fiscal Measures in Response to the COVID-19 Pandemic," International Monetary Fund, 2021, https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19.

Note: Estimates as of June 5, 2021. The values represent budget support as measured by additional spending or forgone revenues as a percentage of 2020 gross domestic product (GDP). Country group averages are weighted by GDP in US dollars adjusted by purchasing power parity.

2021. At the same time, the expectation of low interest rates for a longer period in advanced economies is enabling African central banks to maintain an accommodative monetary policy. On the fiscal front, public sector deficits have not expanded at a faster pace than in advanced economies. Amid the pandemic, the median fiscal deficit in the region expanded by 2.9 percentage points of GDP in 2020 as opposed to an expansion of 7.6 percentage points of GDP in advanced countries. Nearly 57 percent of the countries in the region (20 of 47) had an overall budget deficit that exceeded 5 percent of GDP in 2020, while that proportion was about 75 percent (29 of 34 countries) among advanced economies.

The tighter fiscal space has prevented countries from injecting the level of resources required to launch a solid reform.[19] With this insufficient fiscal support, countries in the Sub-Saharan Africa region have been growing below trend. In this context, countries in the region cannot implement procyclical fiscal policies when the exogenous health shock is still disrupting economic activity and affecting long-term growth prospects—in particular, the likely long-term effects on health and education. An aggressive fiscal consolidation at this juncture might prove detrimental in the long run.

19 The fiscal space of African countries was limited prior to the pandemic, and it became even tighter as the coronavirus hit the region and led to lockdowns and other containment measures. In terms of fiscal space, the amount of public debt to be repaid for the median country in the region represented five years of tax revenues by 2020. That proportion is less than three years for six countries, namely, Botswana, Lesotho, Eswatini, Namibia, the Democratic Republic of Congo, and South Africa. About 12 countries have very poor fiscal space—that is, they would need more than six years to repay their public debt.

The effectiveness of countercyclical fiscal policies depends, among other things, on the magnitude of the fiscal space.[20] This implies that the amount of own resources and the ability to borrow funds are essential to determine the size of such fiscal packages. With nearly inexistent fiscal savings, the ability to finance the fiscal expansion is determined by the country's capacity to repay its debt. African countries have been disciplined when it comes to monetary and fiscal policies and, at the same time, some of them are seizing the opportunity to undertake reforms (for example, energy reform in South Africa, fuel subsidy reform in Nigeria, and privatization of telecommunications in Ethiopia).[21] As countries in the region are keeping their end of the bargain, it is essential for the international community to honor its end of the bargain and support African countries with more financing to counter the effects of the pandemic and launch a sustainable recovery program.

The international community needs to help African countries expand their fiscal space by alleviating some of their debt burden. The DSSI may need to be extended to help participating International Development Association–eligible countries redirect their limited resources to the recovery effort. The Common Framework for Debt Treatments beyond the DSSI should move faster to help countries address the problem of higher debt at its roots. On August 2, 2021, the Board of Governors of the IMF approved a general allocation of SDR 456 billion (US$650 billion) to boost global liquidity. Of this amount, nearly SDR 17 billion (3.7 percent of the global amount) was allocated to Sub-Saharan African countries.[22]

The top six countries in Sub-Saharan Africa (South Africa, Nigeria, the Democratic Republic of Congo, Zambia, Angola, and Ghana) claim about half the amount of SDRs allocated to the region. The amounts distributed to South Africa and Nigeria are about SDR 2.9 billion and SDR 2.4 billion, respectively. As a percentage of their general government gross debt, the amount of SDRs allocated to five countries in the region exceeds 10 percent, namely, Burundi, South Sudan, the Central African Republic, Liberia, and the Democratic Republic of Congo (table 1.1). Although this is a large amount for some countries, the SDR allocation is not a panacea. It is a good start, but it will not be sufficient. As the pandemic lingers, it cannot remain as a permanent solution and, thus, it cannot substitute other financing channels. The international community needs to continue exploring different options that would enable rich countries to share their surplus SDRs voluntarily with the poor countries in the region with the greatest financing needs.

20 Huidrom et al. (2019).

21 For more details, see *Africa's Pulse* volume 22 (World Bank 2020b).

22 On August 23, 2021, the general allocation of SDRs became effective. The newly created SDRs are credited to IMF member countries in proportion to their current quotas in the international institutions.

TABLE 1.1: SDR Allocation in Sub-Saharan African Countries, 2021

Country Name	SDR Allocation (In millions) SDR	USD	LCU	SDR Allocation As percent of GDP	Govt. Debt
Angola	709	1,022	670,483	1.64	1.29
Burundi	148	213	413,773	7.06	10.16
Benin	119	171	91,388	1.13	2.48
Burkina Faso	115	166	88,847	1.00	2.27
Botswana	189	272	2,937	1.71	8.56
Central African Republic	107	154	82,226	6.50	14.47
Côte d'Ivoire	623	898	479,961	1.46	3.20
Cameroon	265	381	203,641	0.98	2.26
Congo, Dem. Rep.	1,022	1,472	2,901,555	3.00	19.78
Congo, Rep.	155	224	119,567	2.19	2.15
Comoros	17	25	9,874	2.02	7.52
Cabo Verde	23	33	2,935	1.87	1.34
Eritrea	15	22	330	1.05	0.57
Ethiopia	288	415	16,263	0.43	0.78
Gabon	207	298	159,371	1.91	2.63
Ghana	707	1,019	5,868	1.49	1.91
Guinea	205	296	2,953,915	1.91	4.62
Gambia, The	60	86	4,433	4.49	5.92
Guinea-Bissau	27	39	20,941	2.73	3.50
Equatorial Guinea	151	217	116,256	2.28	4.47
Kenya	520	749	81,795	0.75	1.10
Liberia	248	357	58,586	11.76	19.04
Lesotho	67	96	1,406	4.66	9.27
Madagascar	234	337	1,290,160	2.44	5.59
Mali	179	258	137,660	1.46	3.31
Mozambique	218	314	23,495	2.18	1.78
Mauritania	123	178	6,517	2.17	3.65
Mauritius	136	196	7,760	1.72	1.96
Malawi	133	192	148,094	2.26	3.36
Namibia	183	264	3,858	2.50	3.80
Niger	126	182	97,085	1.33	3.00
Nigeria	2,353	3,388	1,290,916	0.79	2.25
Rwanda	154	221	214,996	2.13	3.50
Sudan	604	870	47,846	2.53	0.96
Senegal	310	447	238,825	1.83	2.78
Sierra Leone	199	286	2,901,437	6.81	9.47
Somalia	157	226	..	4.58	..
South Sudan	236	340	60,207	8.34	18.57
São Tomé and Príncipe	14	20	408	4.89	6.01
Eswatini	75	108	1,581	2.74	5.83
Seychelles	22	32	682	2.79	2.83
Chad	134	194	103,476	1.80	4.19
Togo	141	203	108,326	2.70	4.69
Tanzania	381	549	1,262,258	0.87	2.27
Uganda	346	498	1,818,950	1.32	2.90
South Africa	2,924	4,212	61,856	1.39	1.81
Zambia	938	1,350	28,582	7.29	6.19
Zimbabwe	677	976	79,794	4.64	5.22

Source: International Monetary Fund.

Note: The figures on the SDR allocation can be downloaded from: https://www.imf.org/en/Topics/special-drawing-right/2021-SDR-Allocation. They are converted into US dollars and local currency using the exchange rate of the SDR vis-à-vis the corresponding currency at the end of 2020. The SDR allocation as percentages of GDP and government debt is computed as a percentage of their corresponding 2020 values. GDP = gross domestic product; Govt.Debt = general government gross debt; LCU = local currency; SDR = Special Drawing Rights, USD = US dollar.

Climate Change Adaptation to Improve Resilience and Deliver Jobs

Implementing a sustainable and inclusive recovery program in Sub-Saharan Africa faces a series of obstacles, and climate change adds to the region's already daunting development challenges. Confronted with mounting fiscal pressures and stress, countries in the region still need long-term support to recover and address the structural problems they face. Recent evidence shows that 15 percent of global spending in response to COVID-19 was devoted to recovery spending, while 85 percent was deployed to rescuing the economy.[23] The recovery spending includes comparable shares of green and brown spending (19.4 and 20.4 percent, respectively).[24] Broadly speaking, the recovery in most countries has been characterized by brown or light brown spending—thus reinforcing patterns of carbon-intensive development.[25] Still, an important percentage of recovery spending (47 percent) was invested in activities with zero impact on climate, such as general research and development spending, education, and support to culture and the arts.

Any endeavor to foster sustainable and inclusive growth cannot be divorced from consideration of the climate crisis—for which Africa bears the least responsibility but the largest brunt. The region accounts for only 2 to 3 percent of the world's carbon dioxide emissions from energy and industrial sources. Despite being the lowest contributor to global carbon emissions, Sub-Saharan African countries are disproportionately affected by climate change. From the Sahel to the Horn of Africa, and to the south of the continent—all are experiencing the devastating effects of more extreme weather patterns and slow onset changes. The social and economic disruptions of singular and recurrent climate shocks are wide-ranging and can multiply quickly with intergenerational consequences.

Temperatures have increased at a faster pace in Sub-Saharan Africa over the past four decades, and extensive areas of the region will exceed 2°C of warming by 2100. Droughts and floods have become more frequent and severe. For instance, relative to 1970–79, the numbers of droughts and floods were nearly threefold and tenfold, respectively, by 2010–19. In this context, the greater sensitivity of the different productive sectors to climate change patterns and natural hazards leads to a disproportionate impact across countries in the region—especially among poorer countries and poorer segments of the population. Climate impacts on the poor include loss of lives and livelihoods, damage to essential infrastructure and disruption of services, poor health and malnutrition, and an escalation of distress-driven migration. The persistent food, water, and environmental crises amplified by climate impacts can lead to protracted fragility, conflict, and distress-driven migration.

23 Pigato, Rafaty, and Kurle (2021) classify fiscal responses to COVID-19 into green, brown, or neutral recovery measures using data for 85 countries (24 high-income countries and 61 emerging markets) from the Oxford-based Global Recovery Observatory. The fiscal spending across these countries is recorded from March 2020 to May 2021.

24 Most of the emergency relief spending undertaken by countries (85 percent) is classified as "legacy" or "light brown" spending—directed to support families, businesses, and activities that would otherwise have terminated in the absence of these policies (Pigato et al. 2021).

25 Green spending refers to the outlays that are likely to reduce emissions compared to a situation in which policies are not implemented to do so. Brown spending comprises the investments in activities with large associated greenhouse gas emissions (compared to a situation in which they do not take place). Finally, light brown expenditure denotes the expenditure to support economic activities that would have otherwise stopped or been reduced in absence of these policies (Pigato et al. 2021).

Sub-Saharan African countries are characterized by large productivity gaps across sectors (agriculture versus non-agriculture sectors) and across space (urban versus rural). The well-documented low productivity in agriculture as well as the lack of opportunities in the rural sector translate into weak structural change in the region. Compared with other world regions, the substantial lag in Sub-Saharan Africa's structural transformation process is attributed to: (i) a still large share of people working and making a living in agriculture, and (ii) the slow decline of the employment share in agriculture over time. A more efficient allocation of workers across sectors and space could accelerate structural transformation and enhance economic development. However, adverse weather shocks (rising temperatures and extreme weather events) have lowered agricultural incomes and productivity and can potentially slow the sectoral reallocation process.

Empirical research shows evidence of long-term growth effects of persistent climate shocks through their impacts on physical capital, human capital (education, health, and mortality), labor productivity, and conflict. The evidence suggests that a 1°C increase in temperature reduces Africa's GDP growth by 0.67 percentage point, and these impacts can vary widely across countries in the region.[26] Droughts and floods can lower the region's medium-term economic growth by 1 and 0.5 percentage point per year, respectively.[27] The fact that these impacts in Africa are larger than in the rest of the world reflects weak resilience and lack of coping mechanisms in the region, as well as its dependence on rainfed agriculture. Across sectors, rising temperatures affect crop production and yields, as well as manufacturing activities—especially in hot climate countries. However, services value-added appears to be shielded from weather shocks.[28] Climate change can also exacerbate the already existing inequalities in the region. For instance, natural hazards can increase food insecurity by 5-20 percentage points in Ethiopia, Malawi, Mali, Nigeria, and Tanzania.[29] Climate-induced deteriorations in health and school attendance would widen gender inequality and reduce long-term income prospects.[30] Finally, a meta-analysis across 55 studies shows that temperature and precipitation anomalies heighten conflict risk. Aggregate productivity also declines if climate shocks lead to political instability and greater conflict.

Climate change adaptation provides a series of opportunities to build back better and greener in the post-COVID-19 era, as is highlighted in section 2. Africa's unique context—of low baseline development, preexisting climate vulnerabilities, limited energy access, and high reliance on climate sensitive sectors—poses challenges but there are also opportunities the region can harness for sustainable, green, clean, and resilient transitions:

1. An energy strategy that combines an expansion of national grids along with increasing adoption of renewable energy technologies (solar and wind) is essential to render universal access a more achievable goal.

26 Abidoye and Odusola (2015).
27 IMF (2020).
28 IMF (2017).
29 IMF (2020).
30 Shahidul and Zehadul Karim (2015).

2. Investments in climate-smart infrastructure will help cities create jobs and leverage limited public finance with private sector investment while addressing climate-related problems such as pollution, floods, extreme heat, and energy access.

3. Proactive government policies, planning, and investments will be required to provide information, incentives, and an enabling environment to encourage communities, households, and the private sector to change their behaviors and investment choices to mitigate climate change (low-carbon growth) and adapt to it (resilience building)—particularly in agriculture and food production.

4. Land policies are powerful levers for reducing greenhouse gas emissions and strengthening resilience to climate change. The land use sector has potential to reduce emissions, sequester carbon, and increase human and biophysical resilience. Sustainable land management and restoration often provide positive and lasting contributions toward societal well-being and sustainability—including multiple benefits such as job creation, disaster risk reduction, climate change mitigation, and adaptation for current and future generations. Land issues and policies are key considerations for adaptation planning, to strengthen land tenure and management arrangements in at-risk environments.

5. Policies to foster asset diversification by supporting human and renewable natural capital accumulation are crucial to reduce the risk of stranded assets among countries with abundant renewable natural capital.[31] Setting up a coherent fiscal framework that includes targeting fiscal incentives, reducing subsidies to fossil fuels, and instituting some form of carbon pricing is critical to foster private investment and innovation in clean energy and other green activities.[32]

6. Policies should be implemented to foster production and downstream value addition in pivotal sectors in countries that are abundant in the metals and minerals that are required for low-carbon energy technologies (for example, cobalt, lithium, copper, manganese, nickel, and zinc) as the world decarbonizes.

The transition to a low-carbon economy would lead to net job creation worldwide—with most of these jobs requiring high levels of nonroutine cognitive skills and higher dependence on formal education, work experience, and on-the-job training (compared with non-green jobs).[33] In Sub-Saharan Africa, job creation is a massive challenge as 12 million people enter the labor force every year. A recovery that is green, resilient, and inclusive in the region will be powered by productive jobs. However, green jobs alone will not be enough. Inclusive growth must be accompanied by both green and brown jobs. This implies that green human capital formation needs to be supported by education policies and learning-by-doing to shape the adaptation of workers' skills to the demands of a changing product space.

31 This will also involve prudent commodity revenue management. For more details on commodity revenue management, see *Africa's Pulse* 22 (October 2020).

32 Pigato, Rafaty, and Kurle (2021).

33 Evidence shows that adequately designed green stimulus can deliver jobs—although country context may weigh on its effectiveness. For instance, clean energy investments can create more jobs per dollar spent than traditional fossil fuel–based energy investments. Energy efficient sectors create 7.5 to 7.7 full-time-equivalent jobs per US$1 million invested, while fossil fuels create only 2.6 jobs (Garret-Peltier 2017).

Financing climate change adaptation policies is key, and policy makers need to mobilize resources both domestically and internationally not only to create new jobs that are greener and in the vicinity of existing products, but also to move the product space toward more green products in the medium term. Linking climate-related finance with critical governance reforms and conservation of natural capital as foundational assets may serve as an entry point. There is an unmet potential of sustainable revenue that can benefit African economies and human development. Finally, the global energy transition must be inclusive and equitable. Given the different realities of economies and various pathways to net-zero by 2050, the development community needs to advocate for and support low-income countries in this transition without leaving anyone behind, especially with respect to universal electricity access for their populations, while advancing climate goals.

Section 2: Climate Change Adaptation and Economic Transformation in Sub-Saharan Africa

2.1 MOTIVATION

Building a path to inclusive growth in Sub-Saharan Africa faces a series of challenges. Climate change adds to the region's already immense development challenges. Massive investments are necessary to help meet development goals—including climate-related objectives. And the cost of climate change in the region comes on top of the COVID-19 shock. Africa has been hit hard by climate change and there is a need for massive investment in adaptation—for instance, decarbonization of the grid with renewable energy, nature-based urban infrastructure, scale-up of climate-smart agriculture, and modernization of food systems, among others. Estimates suggest that adaptation to climate change will cost US$30 billion to US$50 billion (2-3 percent of regional gross domestic product (GDP)) each year over the next decade. Still, financing adaptation is more cost-effective than frequent disaster relief.[1]

Sub-Saharan Africa has contributed the least to greenhouse gas (GHG) emissions but suffers the most from the impact of climate change. The region produced 7.6 percent of worldwide GHG emissions (equivalent to 3.7 gigatons carbon dioxide (CO_2)-equivalent per year)—and that global share declines to a meager 3 percent when South Africa is excluded.[2] Most of the region's GHG emissions come from agriculture, forestry, and other land use (62 percent), while more than 75 percent of emissions worldwide come from the energy sector. The temperature has increased sharply in Sub-Saharan Africa. Across the continent, the annual temperature has increased at an average rate of 0.13°C per decade since 1910; however, the pace of warming has more than doubled to 0.30°C since 1981.[3] Long-term forecasts predict that extensive areas of the region will exceed 2°C of warming by the last two decades of the 21st century under medium scenarios.[4]

Additionally, the frequency of extreme weather events has increased substantially in the region over the past four decades—and it has increased at a faster pace than in the rest of the world. Relative to 1970–79, the frequency of droughts in Sub-Saharan Africa nearly tripled by 2010–19, while it more than quadrupled for storms and increased more than tenfold in the case of floods. More than a third of the world's droughts and about a fifth of the world's floods took place in the region during the past decade. Still, the increases in temperature and incidence of the different natural hazards are heterogeneous across the region.

Climate change and extreme weather events are already having a negative impact on economic activity across countries in the region, and these adverse effects will accelerate as early as 2030, thus disproportionately affecting countries with low capacity, poor governance, weak natural resource management, and high reliance on climate-sensitive activities.[5] For instance, rising temperatures and heat waves can harm growth in different sectors, leading to productivity losses, physical injuries, and degradation of land and water resources, among others. Crop production and livestock losses due to droughts and other damage to infrastructure (say,

1 IMF (2020).
2 These figures are for 2018 (World Resources Institute 2020).
3 Furthermore, the region's 10 warmest years have all occurred since 2005, with the five warmest ones taking place since 2010 (NOAA 2021).
4 IPCC (2014).
5 World Bank (2020).

housing, power generation, and transportation) associated with the occurrence of natural hazards (say, floods, mudslides, and earthquakes, among others) are becoming more frequent and costlier.

The engines of growth across Sub-Saharan African countries are quite diversified. However, agriculture is still one of the largest sectors of economic activity, with 15.5 percent of the region's GDP and 53 percent of the region's total employment.[6] Macro and micro evidence shows that total factor productivity (TFP) drives agricultural growth rather than use of greater amounts of land, water, and other inputs.[7] In turn, downside risks to agricultural productivity might emerge from temperature and precipitation anomalies as well as climate hazards—for instance, droughts in East and Southern Africa and security threats and resource scarcity in the Sahel, among others.[8] The greater sensitivity to climate shocks of the different engines of growth in Sub-Saharan Africa (agriculture, natural capital, and infrastructure) highlights the need to bolster climate-smart development at scale and across economic sectors.

Climate change and development in Sub-Saharan Africa are not only interdependent, but also hard to disentangle. Relative to other regions, the greater sensitivity of the different productive sectors to natural hazards and climate change patterns leads to disproportionate impacts across countries in the region, especially among poorer countries and poorer segments of the population. For instance, the 2018–19 cyclone season—and, notably, Cyclone Idai—severely affected Mozambique and Zimbabwe, with the associated flooding in both countries affecting nearly 1 million people. In Mozambique, Idai flooded an estimated 3,000 square kilometers of land and 715,378 hectares of cultivated land. The damage caused by Cyclone Idai in Mozambique was estimated to exceed US$1.4 billion, falling primarily on the transport sector (US$442 million), housing sector (US$411 million), industry and commerce (US$140 million), and energy sector (US$133.5 million).[9]

Why is climate change adaptation necessary in Africa? Climate-related shocks and stresses, which are another major roadblock to inclusive growth and poverty reduction, will become more frequent and more severe if the challenges associated with climate change are not tackled. The climate is closely connected to most of the shocks that affect the poor and those who are vulnerable to poverty—for example, natural disasters (floods and earthquakes), health shocks (food-, vector-, and water-borne diseases), crop losses, food insecurity, and food price increases (droughts).[10] The poorer segments of the population are more disproportionately affected by climate-related shocks not only due to their higher exposure and vulnerability, but also because they have fewer own resources and weaker support from key social and economic systems (family ties, community, enterprises, and the financial system), including the government (social protection, public goods, and public policy). In sum, they lack the supportive external environment to prevent, cope with, and adapt to climate shocks.[11]

Climate change may affect economic activity by increasing conflict. A meta-analysis of empirical

6 Still, there is greater heterogeneity in value added and employment shares across countries in the region. For instance, the share of value added fluctuates between 2.1 percent (Botswana) and 61.3 percent (Sierra Leone). Employment shares—although declining over time—still remain high and vary between 5.3 percent (South Africa) and 86.2 percent (Burundi). In four countries in the region, at least three-quarters of the population are engaged in agricultural employment (Chad, Malawi, Somalia, and Burundi).

7 Restuccia, Yang, and Zhu (2008); Restuccia and Santaeulalia-Llopis (2017).

8 Fuglie et al. (2020).

9 GFDRR (2019).

10 The effect of these climate-related hazards on the population is manifested via labor income losses, greater health expenditures, and capital/asset losses, among others.

11 Hallegatte et al. (2016); World Bank (2013).

studies suggests that deviations from moderate temperature and precipitation patterns may systemically raise the likelihood of conflict risk.[12] Overgrazing, deforestation, and non-sustainable agriculture pose challenges to the livelihoods of farmers and herders in the Sahel and Southern Africa. These problems may deteriorate if poor economic and political structures cannot address social inequality and widespread poverty.[13] In this context, "business-as-usual" responses to climate change may not be able to stop the increase in civil conflict and political stability relative to a world without climate change.

Climate change will also force people to move to less drought-prone areas—as is the case in East Africa. Crop failures, water stress, and sea level rise resulting from climate change may increase the likelihood of migration and dislocation—thus posing challenges for human development. For instance, poor water availability and declining crop yields will drive climate migrants from rainfed cropland areas in the northern highlands of Ethiopia. The poorer (and vulnerable) segments of the population have the fewest opportunities to adapt locally or mitigate the risk, and the decision to migrate is typically a last resort. In this context, governments need to set up an adequate enabling environment for migration that is supported by skill-training and job creation programs so that people move to areas of lower risk and better opportunities.[14]

Developing countries—and, notably, Sub-Saharan African countries—are typically characterized by large productivity gaps across sectors (agriculture and non-agriculture sectors)[15] and across space (urban versus rural).[16] In Sub-Saharan Africa, the low agricultural productivity growth translates into weak structural change. The substantial lag in the process of structural transformation in the region is attributed to the following factors: (i) a large share of people working and making a living in agriculture across countries in the region, and (ii) the employment share in agriculture has been declining over time in Sub-Saharan Africa at a slower pace than that recorded historically by other world regions.[17] In this context, a more efficient allocation of workers across sectors and space could accelerate structural transformation and enhance economic development.

Adverse weather shocks (rising temperatures and extreme weather events) have lowered agricultural incomes and productivity and can potentially slow the sectoral reallocation process.[18] Hence, it is likely that climate-related shocks may disrupt the reallocation of labor in developing countries where most workers engage in rural (rainfed) agriculture. Recent studies have examined whether the pace of reallocation of workers within local labor markets is affected by rising temperatures through structural transformation and urbanization. An investigation of sectoral and spatial movements in Indian districts over six decades shows that[19]: (i) rising temperatures hinder the structural transformation (on average, a 1^{0}C increase in mean decadal temperature leads to an increase of 17 percent in the share of agricultural labor force and a decline of 8.2 percent in the share of non-agricultural labor), while their impact on urbanization

12 Burke, Hsiang, and Miguel (2015b) find that a one standard deviation increase in (contemporaneous) temperature leads to an increase in interpersonal conflict by 2.4 percent and intergroup conflict by 11.3 percent.

13 Hoste and Vlassenroot (2009).

14 Rigaud et al. (2018).

15 Duarte and Restuccia (2010); Gollin, Lagakos, and Waugh (2014); Herrendorf and Schoellman (2018).

16 Young (2013).

17 Duarte and Restuccia (2018).

18 Emerick (2018); Taraz (2018); Aragón, Orteiza, and Rud (2021).

19 Liu, Shamdasani, and Taraz (2021).

is negligible[20]; (ii) the adverse impact of rising temperatures on structural transformation is intensified over longer periods of time (reflecting the failure of individuals' adaptation strategies); and (iii) local demand effects drive the impact of rising temperatures on structural transformation (for example, a contraction in the demand for non-agricultural labor is attributed to lower demand for non-agricultural goods and services, which, in turn, is attributed to lower productivity-driven farm incomes).

The transition to a green economy will imply changes in the existing product space of countries across the world. Recent research builds on the economic geography and economic complexity literature to develop novel measures of the capacity of countries to reinvent themselves toward the green economy.[21] It identifies green diversification opportunities that are tightly associated with their existing production capabilities (that is, existing set of skills, know-how, and infrastructure).[22] The analysis suggests that countries that are the farthest from a greener product space are those with a productive system that heavily relies on the extraction of fossil fuel resources (for example, Angola and Nigeria). Developing countries with less advanced technological capabilities are also not as close to highly complex green products. For instance, Uganda's product space is characterized by few green exports, many of which are low-complexity products and made from vegetable materials, such as screens and matting materials, which are used to prevent soil erosion.[23]

This thematic section of this issue of *Africa's Pulse* presents a comprehensive but by no means exhaustive discussion of climate change adaptation in Sub-Saharan Africa. It provides a launchpad for further research that will be conducted in the regional research report, "The Economics of Climate Change Adaptation in Sub-Saharan Africa." The transition toward a low-carbon economy provides long-term benefits not only in the form of reduced environmental hazards, but also *new opportunities for economic development*. African policy makers must harness these opportunities to build back better and greener—especially in the face of escalating climate impacts and the reality of a new climate normal as early as 2030[24]:

- Securing universal access to energy is critical to achieve long-term sustainable development goals. Nearly 600 million people have no access to energy in Sub-Saharan Africa, thus limiting their ability to start and run a business. Even megacities across the largest countries in the region have an inadequate and unreliable supply of energy. To eradicate this access problem, African countries should combine an expansion of national grids along with the increasing adoption of renewable energy technologies—notably, solar and wind. African countries may be able to leapfrog fossil fuel–dependent and centralized power system models as clean energy technologies continue to become more cost-effective. These new technologies may render universal access to energy a more achievable goal. And they can also deliver jobs. Firms offering training for jobs in solar energy are already springing up in Africa—for instance, Green

20 Henderson et al. (2017) also find no average impact of adverse changes in climate on urbanization in Sub-Saharan Africa.

21 Mealy and Teytelboym (2021).

22 The authors develop a green adjacent possible indicator that combines (i) the relationship of the product to the country's current capabilities, and (ii) the most proximate diversification opportunities for each country.

23 Mealy and Teytelboym (2021).

24 IPCC (2018).

Solar Academy (South Africa) and its partners throughout the continent are providing training and workshops that cover the basics of running a solar business and system design.[25]

- Cities have borne the brunt of business closures, job losses, and reduced revenues for local services due to the pandemic. In a region where much of the infrastructure, cities, and transportation systems are yet to be built, climate-smart infrastructure investments can help cities create jobs and leverage limited public finance with private sector investment while addressing climate-related problems such as pollution, floods, extreme heat, and energy access. For instance, energy-efficient retrofits of buildings, low-carbon municipal waste and water, and green urban transport can deliver benefits to cities in the short and medium term.[26] Recent evidence shows that major cities in the region may need investment in more compact, clean, and connected cities. South Africa will need US$215 billion in investment in its cities, Kenya US$27 billion, and Ethiopia US$42 billion. These investments, however, will deliver benefits in Ethiopia, Kenya, and South Africa of US$240 billion, US$140 billion, and US$700 billion, respectively. They will also support additional jobs—resulting in an average of 210,000 net new jobs in Ethiopia, 98,000 in Kenya and 120,000 in South Africa to 2050.[27]

- Proactive government policies, planning, and investments will be required to provide information, incentives, and an enabling environment to encourage households, communities, and the private sector to change their behaviors and investment choices to mitigate climate change (low-carbon growth) and adapt to it (resilience building)—particularly, in agriculture and food production. Digital technologies have become increasingly accessible and affordable to farmers. Technological development such as aerial imagery from drones or satellites, weather forecasts, and soil sensors are enabling farmers to manage their crops in real time. Financial solutions are evolving (including mobile money and digital loan options) to connect smallholder farmers with financial institutions and provide greater market access. Adoption of modern agricultural practices (for example, new seed varieties, fertilizers, irrigation, and machinery) can also help create a resilient food production and distribution system. Governments, investors, and international organizations are essential to establish localized agricultural planning and facilitate access to credit and digital tools.

- Land policy is a powerful lever for reducing GHG emissions and strengthening resilience to climate change. The land use sector has potential to reduce emissions, sequester carbon, and increase human and biophysical resilience. Sustainable land management and restoration often provide positive and lasting contributions toward societal well-being and sustainability—including multiple benefits such as job creation, disaster risk reduction, climate change mitigation, and adaptation for current and future generations. Land issues and policies are key considerations for adaptation planning, to strengthen land tenure and management arrangements in at-risk environments. Secure land rights, provided on an individual or community basis, are likely to increase people's incentives to invest in and take advantage of adaptation strategies.

25 Kacungira (2021).
26 IFC (2021).
27 Coalitions for Urban Transitions (2021).

- Countries that are abundant in nonrenewable resources need to manage the transition as the world decarbonizes. The lower global demand for nonrenewable energy commodities (notably, fossil fuels) because of decarbonization will lower the international price of such commodities. The shift away from oil, gas, and coal poses risk to the value of the wealth of countries that are already abundant in nonrenewable energy (for example, Nigeria and Angola), but also to countries with recent oil and gas discoveries (Mozambique, Kenya, and Senegal). The risk of stranded assets in these countries highlights the need to accelerate the reduction of their wealth exposure to carbon risk. Policies should be designed to foster asset diversification by supporting the accumulation of human capital and renewable natural capital and narrowing the infrastructure gap. Prudent management of commodity revenues may help finance those investments. Setting up a coherent fiscal framework that includes targeted fiscal incentives, reducing subsidies to fossil fuels, and some form of carbon pricing are critical to foster private investment and innovation in clean energy and other green activities.[28]

The green transition would lead to net job creation worldwide. For instance, it is estimated that the transition to energy sustainability by 2030 will create 25 million jobs and eliminate 7 million globally.[29] The investments needed to train close to 20 million workers in the skills required for the new jobs will be enormous. Recent evidence from the United States shows that green jobs feature higher levels of nonroutine cognitive skills and higher dependence on formal education, work experience, and on-the-job training (compared with non-green jobs).[30]

In Sub-Saharan Africa, job creation is a massive challenge as 12 million people enter the labor force every year. A recovery that is green, resilient, and inclusive in the region will be powered by productive jobs. However, green jobs alone will not be enough. Inclusive growth must be accompanied by both green and brown jobs. This implies that green human capital formation needs to be supported by education policies and learning-by-doing to shape the adaptation of workers' skills to the demands of a changing product space.

African countries can seize the opportunity of climate change to transform the economy and create jobs. Policy makers need to leverage climate change technologies to improve and/or increase industrialization and the non-agricultural labor force—for instance, the insertion into global value chains associated with green metals as their price increases with decarbonization. The region has the opportunity to leapfrog high-emitting manufacturing technologies and systematically erect a low-carbon manufacturing sector. Such efforts will require US$2 trillion in manufacturing and power, and deliver 3.8 million jobs over the next three decades. Of these investment needs, US$600 million is required to decarbonize existing manufacturing industries and power networks, while the remaining US$1.4 trillion would create new low-emitting businesses that replace or supplement high-emitting legacy sectors—for instance, coal-to-liquids, petroleum refining, and cement.[31]

28 Pigato, Rafaty, and Kurle (2021).

29 According to these global estimates, labor reallocation can employ 5 million workers, while 1-2 million occupy jobs that will be lost without equivalent vacancies in other industries and would need reskilling in other jobs (ILO 2019).

30 Consoli et al. (2016).

31 McKinsey (2021).

Policy makers need to identify opportunities with early climate actions and bring in the private sector to help finance the transitions associated with a low-carbon economy. In this context, the *Country Climate and Development Report*, a new core country analytics product by the World Bank, is a tool that will help identify opportunities for climate action by the public and private sectors to achieve the country's sustainable development objectives. Addressing climate change requires bold actions and massive investments across key economic sectors—say, creating the conditions for the transition out of coal and into scaling up renewables in the energy mix; investing in shared, low-carbon transport in cities; boosting sustainable food and land use systems; investing in resilient water infrastructure (including improved management); and reducing emissions from critical industrial value chains.[32]

Finally, the debate on climate change needs to be shifted back to policy makers in Sub-Saharan African countries. They need to focus on climate change as a potential source of economic transformation and job creation. Policy makers need to mobilize resources both domestically and internationally not only to create new jobs that are greener and in the vicinity of existing products, but also to move the product space toward more green products in the medium term. Climate change adaptation should be at the at the center of economic policymaking in African countries.

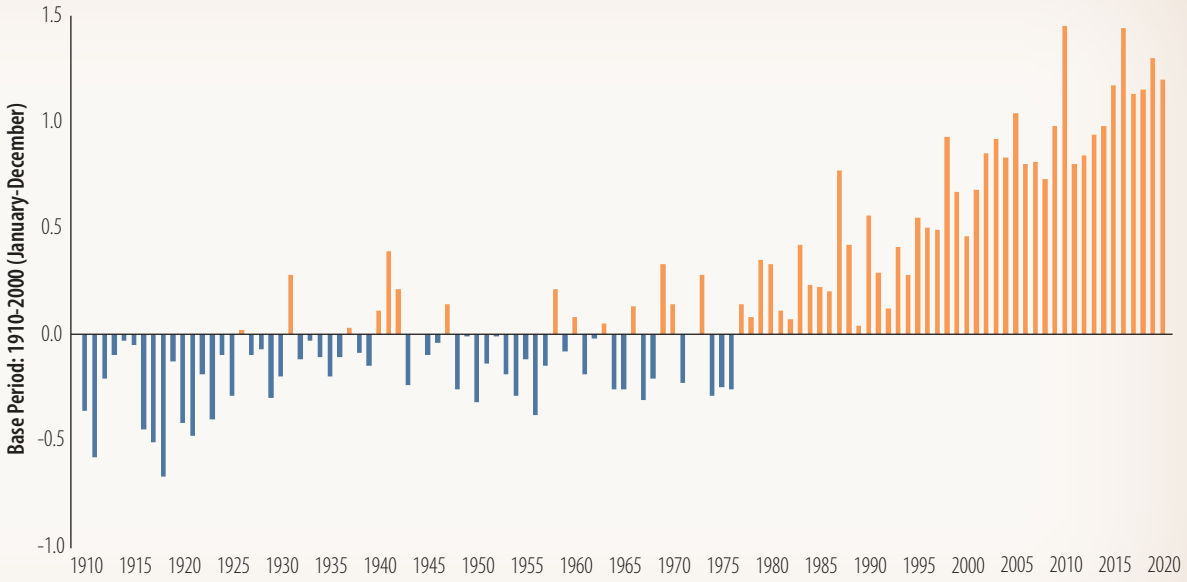
32 Okonjo-Iweala (2020).

2.2 THE CLIMATE SITUATION IN AFRICA

The temperature in the African continent has been warming in recent decades at rates comparable to those of other continents, and at a faster pace than the world's mean surface temperature. The year 2020 was the fourth warmest year in the African continent since 1910. The annual average temperature was 1.19°C above average. The region's 10 warmest years have all occurred since 2005, with the five warmest ones taking place since 2010 (figure 2.1).[33] The years 2010 and 2016 are Africa's warmest years on record at 1.44°C above average. Africa's annual temperature has increased at an average rate of 0.13°C (0.23°F) per decade since 1910; however, it has more than doubled to 0.30°C (0.54°F) since 1981.[34] Long-term forecasts predict that extensive areas of the region will exceed 2°C of warming by the last two decades of the 21st century under medium scenarios.[35]

Temperature has increased above historical patterns over the past four decades.

FIGURE 2.1: Africa's Temperature Anomalies, 1920–2020 (degrees Celsius)



Source: NOAA 2021.

Note: Global and hemispheric anomalies are with respect to the 20th century average. Coordinate anomalies are with respect to the 1981 to 2010 average. All other regional anomalies are with respect to the 1910 to 2000 average.

Rising temperature and changes in precipitation across many countries in Sub-Saharan Africa are leading to increasing frequency and intensity of extreme weather events—heatwaves, droughts, floods, and storms, among others. The duration and intensity of heatwaves have increased over parts of the region since the second half of the 20th century—most notably in Southern Africa and East Africa. For instance, Southern Africa has experienced increases in temperature of up to 2°C over the past century—with the largest increases in temperature observed since the 1980s. Western parts of Southern Africa, from Namibia to Angola and the Congo, experienced less summer rain during the second half of the 20th century, while other southern countries, like Botswana, Zimbabwe, and western parts of South Africa, have also had modest decreases

33 The average temperature for the region does not account for the wide heterogeneity across geographic locations and months.

34 NOAA (2021).

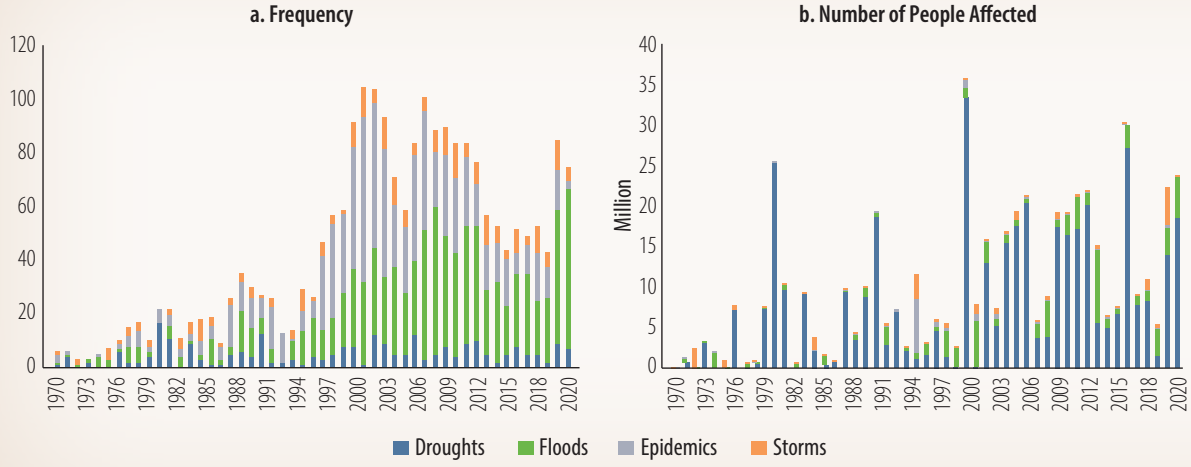
35 IPCC (2014).

in rainfall. Rising temperatures across the continent—along with weather events being more frequent and severe—may lead to deaths, displacement, climate-related conflict, irregular rainfall, water shortages, and dampened agricultural production.

Climate change in Sub-Saharan Africa is characterized not only by temperature and precipitation anomalies, but also natural disasters. The frequency of natural disasters has increased substantially in the region over the past four decades—and at a faster pace than worldwide. Relative to 1970–79, the frequency of droughts in Sub-Saharan Africa nearly tripled by 2010–19, it has more than quadrupled for storms, and it has increased more than tenfold in the case of floods (figure 2.2). At the same time, the worldwide frequency of storms during 2010–19 was fivefold that of 1970–79, and threefold for storms over the same period. These figures imply that the incidence of natural disasters in Sub-Saharan Africa is higher than that across the world. For instance, more than a third of the world's droughts during 2010–19 took place in the region. Sub-Saharan Africa's global shares of floods and epidemics are about 20 and 60 percent, respectively. Greater frequency and intensity of natural disasters leads to a greater number of people affected by them. For instance, the number of people affected by droughts in Sub-Saharan Africa increased from 19.3 million in 1970–79 to nearly 115 million in 2010–19, while in the case of floods it went from 3.5 million to 28.1 million (figure 2.2). Although droughts are less frequent relative to other natural hazards, they had the largest human toll in terms of the number of people affected.

FIGURE 2.2: Natural Disasters in Sub-Saharan Africa, 1970–2020: Frequency and Number of People Affected

Natural disasters are becoming more frequent and severe in Sub-Saharan Africa.

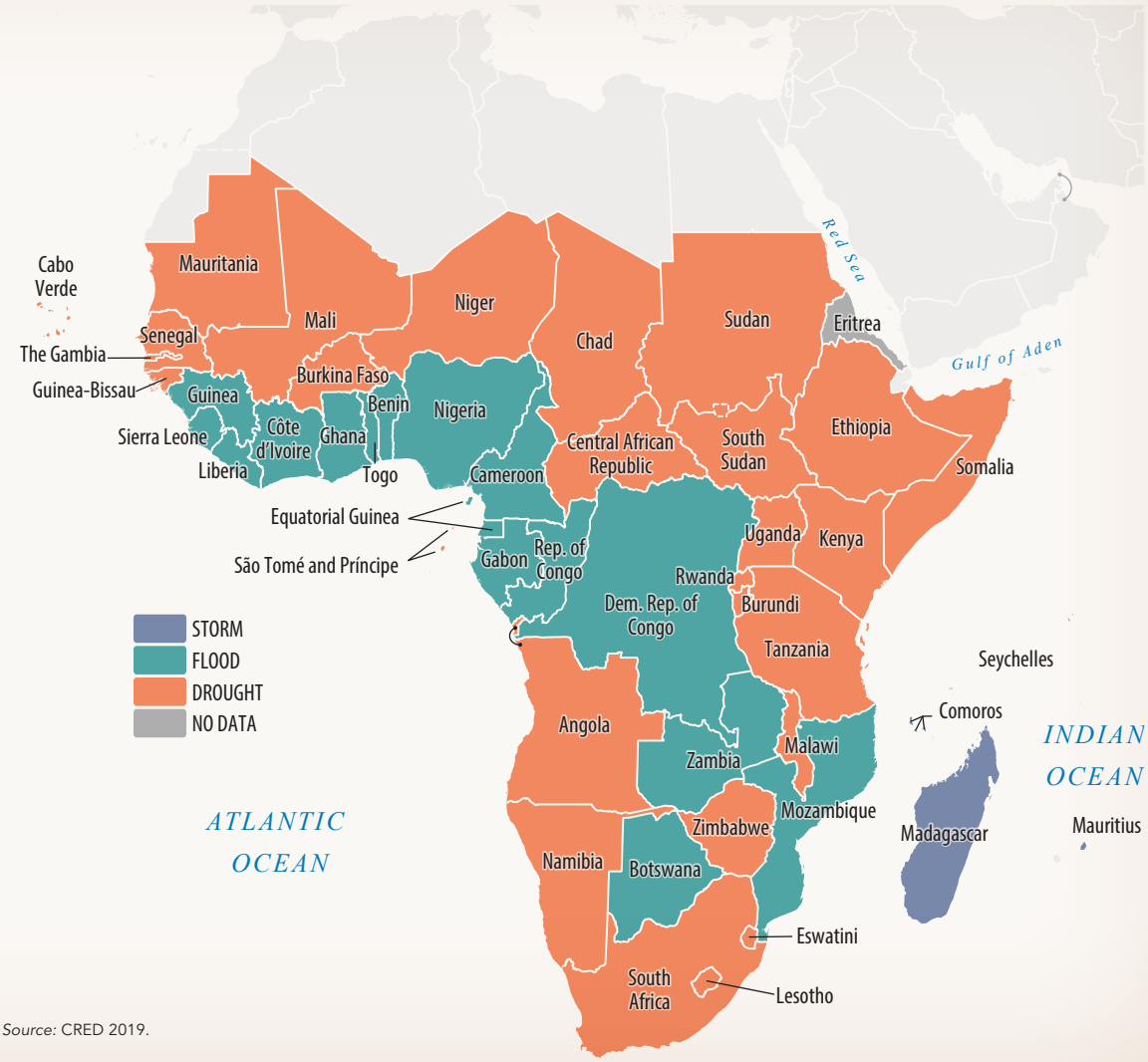


Source: CRED 2019.

Going beyond the aggregates, the threat of natural hazards varies widely across geographic locations and months within a year. Map 2.1 depicts the type of natural hazard affecting the largest number of people in each Sub-Saharan African country over the past two decades: (i) countries in the southern part of the continent, the Horn of Africa, and the Sahel have been largely affected by droughts; (ii) most countries in West and Central Africa have been primarily affected by floods; and (iii) countries in southeastern African experience an annual cyclone

The types of natural hazards affecting countries vary across the region.

MAP 2.1: Natural Hazards Affecting the Most People across Sub-Saharan African Countries, 2000–19



Source: CRED 2019.

season and, thus, are mainly affected by storms.[36] Of the 1,053 weather-related hazards that occurred in the region from 2000 to 2019, about two-thirds were floods, followed by storms (15 percent) and droughts (12 percent). Natural disasters occur across all the countries in the region, but their frequency and intensity vary widely across geographical locations. For instance, the three countries with the highest numbers of disasters during 2000–19 are Kenya (60), South Africa (56), and Mozambique (55)—with floods and storms representing more than three-quarters of these events over the past two decades. In terms of the disaster-induced death toll since 2000, Somalia had the greatest number of casualties (20,739) as a result of the 2010 drought. It is followed by Mozambique (2,291), with more than a quarter of these fatalities attributed to Cyclone Idai.[37]

36 This group includes small island countries such as the Comoros, Mauritius, and the Seychelles (CRED 2019).
37 See CRED (2019).

Sub-Saharan Africa has contributed the least to GHG emissions but suffers the most from the impacts of climate change. GHG emissions have been on the rise globally despite a series of mitigation measures implemented at the national level—although with different levels of intensity. Emissions reached a global total of about 49 gigatons of CO_2-equivalent per year (GtCO2eq/yr) in 2018.[38] More than three-quarters of GHG emissions worldwide have emanated from the energy sector; 15 percent from agriculture, forestry, and other land use (of which 12 percent came from agriculture); 6 percent from industrial processes; and 3 percent from waste management activities. In contrast, GHG emissions in Sub-Saharan Africa totaled 3.7 GtCO2eq/yr (7.6 percent of worldwide emissions).[39] Agriculture, forestry, and other land use contributed 62 percent of the region's emissions (of which 25 percent was from agriculture).[40] This implies that mitigation efforts in African countries' nationally determined contributions should give a greater weight to emissions from agriculture, forestry, and other land use to reach the goals of the Paris Agreement in terms of curbing average global temperature increases.[41] These interventions should be undertaken in ways that ensure a just transition and sustainability.

African countries should seek to harness renewable energy sources to meet the large-scale energy needs of the population, 50 percent of which uses gas—thus, seizing the opportunity of declining prices of renewables. Additionally, actionable policies should be implemented to move away from biomass-based cooking fuel, which is typically used by poor rural households. About 729 million people in Sub-Saharan Africa (73 percent of the region's population) lack the ability to cook efficiently, cleanly, conveniently, reliably, safely, and affordably. Only 10 percent of the population in the region has access to modern energy cooking services.[42] Access to clean cooking solutions in the region should reduce pressure on deforestation and ecosystem services that are essential to buffer climate shocks.

38 World Resources Institute (2020): https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters.

39 Excluding South Africa, the region's GHG emissions represent only 3 percent of worldwide emissions.

40 The energy sector in Sub-Saharan Africa was responsible for 31 percent of the region's emissions in 2018.

41 The mitigation measures include conservation of soil and vegetation cover, climate-smart agricultural practices, afforestation and reforestation, reducing losses and waste of food, changes in human diet, and changes in wood consumption, among others (IPCC 2014).

42 Modern energy cooking services refers to a household context that has met the standards of Tier 4 or higher across all six measurement attributes of the Multi-Tier Framework: convenience, (fuel) availability (a proxy for reliability), safety, affordability, efficiency, and exposure (a proxy for health related to exposure to pollutants from cooking activities). For more details on the definition, see ESMAP (2020).

2.3 THE ECONOMIC IMPACT OF CLIMATE CHANGE IN SUB-SAHARAN AFRICA

Climate change is adversely affecting economic activity worldwide. Chronic and extreme climate-related effects (for example, floods, droughts, and land degradation) are not only eroding ecosystems, but also deteriorating health. Staving off the impact of climate change would require much-needed resources that may cut other key investments—such as economic and physical infrastructure, research and development, and human capital. Across the world, countries are already experiencing the detrimental effects of climate change on economic activity, and these adverse impacts will accelerate as early as 2030—thus exacerbating the vulnerabilities of countries with low capacity, poor governance, weak natural resource management, and high reliance on climate-sensitive activities.[43] For instance, rising temperatures and heat waves can harm growth in different sectors, leading to productivity losses, physical injuries, and degradation of land and water resources, among others.

Climate-related shocks are disproportionately affecting Sub-Saharan Africa—a subcontinent that produced 2 percent of global GDP in 2020, is home to close to 15 percent of the current global population, and will make up more than half of the projected global population by 2100.[44] This is primarily attributed to the region's geographic exposure, low income, greater reliance on climate-sensitive sectors, and weak capacity to adapt to weather shocks. For instance, droughts in the Sahel can affect economic activity—and, particularly, agricultural production. Droughts and flooding events can lead to a large number of casualties. For instance, the 2018–19 cyclone season led to unprecedented levels of damage. Cyclones Idai and Kenneth displaced close to 2.2 million people in Malawi, Mozambique, and Zimbabwe.[45] Economic losses in Mozambique translated into a slowdown in GDP growth to 2.5 percent in 2019, compared with planned growth of up to 4.7 percent.[46] Empirical evidence shows that African economies are quite sensitive to changes in climatic variables and climate-related disasters due to the vulnerability of their main engines of growth—agriculture, forestry, pastoralism, energy, tourism, and coastal and water resources.[47]

The climate-development nexus has been empirically evaluated using two approaches. The first one emphasizes estimating the relationship between climate (temperature and precipitation averages and anomalies as well as extreme weather events) and aggregate economic activity (output and productivity levels and growth).[48] Empirical evidence using this approach finds a negative relationship between temperature and income levels, as well as between climate anomalies and economic growth.[49] However, this relationship might be driven by other country-specific features such as the quality of institutions.[50] The second approach uses microeconomic evidence to quantify the impact of climate shocks and then aggregates them to compute the net effect on national income. It is embedded within Integrated Assessment Models (IAMs), which have been broadly used to model climate-economy interactions and evaluate policy

43 World Bank (2020).
44 The population projections assumed the United Nations constant-fertility variant for 2020–2100.
45 USAID (2019).
46 GFDRR (2019).
47 Dell, Jones, and Olken (2012); Abidoye and Odusola (2015); Boko et al. (2007).
48 See, for instance, Gallup, Sachs, and Mellinger (1999); Nordhaus (2006); Abidoye and Odusola (2015); Kahn et al. (2019).
49 See, for example, Dell, Jones, and Olken (2009, 2012); IMF (2017) and references therein.
50 Acemoglu, Johnson, and Robinson (2002).

options to reduce GHG emissions. This approach is complex as: (i) there is a wide array of channels through which temperature may impact economic activity, and (ii) the specification, interaction, and aggregation of these different impact channels pose substantial challenges.[51]

Aggregate Econometric Evidence

Initial contributions to the literature show that rising temperatures can affect economic growth. Using a panel of 136 countries from 1950 to 2003, Dell, Jones, and Olken (2012) find that, on average, a 1°C rise in temperature in a given year among poorer countries would reduce economic growth by 1.3 percentage points, while the impact is negligible among rich countries.[52] Nonlinearities in the relationship between growth and temperature render asymmetric effects of warming across countries. The significant effect of higher temperatures among the poorer countries is attributed to overreliance on climate-sensitive industries (such as agriculture), and that they have limited resources (low income and savings) to counter the weather shocks.[53] Their evidence also shows that higher temperatures not only affect the level of output, but also reduce the growth rate of poor countries. Finally, temperature affects the growth of poor countries through different impact channels. Downswings in agricultural output and productivity are only one element of the narrative. Rising temperatures can also affect industrial output and lead to political instability in poor countries.[54]

Estimates of the nonlinear relationship between temperature and productivity suggest that after peaking at an annual average temperature of 13°C, economic productivity would sharply decline at higher temperatures.[55] From a sample of 166 countries over 1996–2010, it was found that economic productivity at the country level reaches a maximum at 13°C—well below the threshold values obtained from microeconomic-level analyses. Productivity then declines at a faster pace at higher temperatures.[56] Evidence from a larger sample of countries and a longer time period confirms these findings: temperature has uneven effects on economic performance across the world.[57] Higher temperature will lower growth per capita in countries with high average temperatures, while the opposite effect takes place in countries with much colder climates. The estimated threshold temperature ranges between 13°C and 15°C.[58] Given that emerging markets—and, particularly, low-income developing countries—tend to exhibit higher temperatures, per capita GDP growth is adversely affected by warming temperatures. Quantitatively, a 1°C increase from a temperature of 25°C for the median low-income developing country reduces growth by 1.2 percentage points in the same year. And recovery from a weather shock is not fast for low-income developing countries: output per capita remains 1.5 percent lower seven years after the shock.

51 See Stern (2007) for a review of the applications of this approach to the assessment of climate shocks and policy evaluation.

52 If richer countries are unaffected by temperature, this could indicate that wealth and human-made capital are substitutes for natural capital (for example, the composition of the atmosphere) in economic activity.

53 Alternatively, rich and poor nations can be equally vulnerable to rising temperatures but have different baseline temperature exposures—and, hence, different economic consequences when temperature increases (Burke et al. 2015b).

54 These effects are in line with other work that highlights the broad impacts outside agriculture of rising temperatures (Hsiang 2010).

55 See Burke, Hsiang, and Miguel (2015b).

56 Burke, Hsiang, and Miguel (2015b) argue that poor tropical countries exhibit sharper drops in productivity, on average, because they are exposed to higher temperatures rather than because they are poorer.

57 IMF (2017) evaluates the impact of weather shocks on real GDP per capita for 180 countries during 1950–2015. The response of real GDP per capita to climatic shocks is estimated using local projection methods (Jordà 2005).

58 Emerging market economies and particularly low-income developing countries tend to have much hotter climates, and a rise in temperature significantly lowers per capita GDP growth (IMF 2017).

Further empirical analysis investigated not only the growth effects of average temperatures, but also those of temperature anomalies.[59] The evidence suggests that climate change—as measured by temperature anomalies over a two-decade period—better captures the impact on economic growth of African countries than the average temperature (over a 20-year period).[60] The adverse impact of climate change on growth in Africa is negative with a 93 percent probability. The regression estimates show that a 1°C increase in temperature reduces GDP growth by 0.67 percentage point. Additionally, the impacts of temperature anomalies vary widely across countries in the region—with the highest impacts on the Democratic Republic of Congo, Zimbabwe, the Central African Republic, and Madagascar and the smallest effects on Nigeria, Botswana, and Eswatini.

The greater frequency and extent of climate impacts are hampering countries' ability to achieve their development objectives. Cross-country evidence on the macroeconomic impact of climate change shows that persistent changes in climate conditions (as measured by deviations of temperature from their historical norm) have a long-term negative effect on growth per capita.[61] In this context, Kahn et al. (2019) estimate the long-term macroeconomic effects of climate change across 174 countries over 1960 to 2014.[62] Their evidence shows that persistent changes in climate conditions have an adverse impact on long-term growth per capita.[63] In contrast to previous literature, they failed to detect (i) an asymmetric long-term growth impact from positive and negative temperature anomalies, and (ii) asymmetric climate impacts on poor and rich countries. They argue that the empirical findings belong to poor or rich, and hot or cold countries alike as growth per capita is affected not only by temperature, but also by climate variability. A series of counterfactual exercises are conducted to evaluate the cumulative income effects of yearly increases in temperature over 2015–2100. Their estimations suggest that increases in average global temperature of 0.04°C per year (in a scenario of higher GHG emissions and no mitigation policies) reduce the world's real GDP per capita by 7.2 percent by 2100.[64] If temperature increases are limited to 0.01°C per year (in line with the Paris Agreement), the output loss is only 1.1 percent. Although all regions (cold or hot, and rich or poor) would experience large declines in income per capita by 2100 in the absence of climate change policies, the extent of such income effects varies across countries depending on the pace of the temperature increase and historical variability of climate conditions in each country.[65] These findings show that although climate change adaptation could reduce the negative long-term growth effects, it will not offset them entirely.[66] This calls for more energetic climate change mitigation and adaptation policy responses.

59 The annual average deviation in temperature is computed over a five-year horizon in Barrios et al. (2008) and over a 20-year horizon in Abidoye and Odusola (2015).

60 Abidoye and Odusola (2015) show that the coefficient of temperature anomaly is negative with a probability of 92 percent.

61 The strand of the literature that evaluates the impact of climate events on economic performance is incipient and mainly focuses on short-term effects (IPCC 2014; Dell, Jones, and Olken 2014; Cashin, Mohaddes, and Raissi 2017). Initial contributions have been challenged due to: (i) reliance on cross-sectional approaches without accounting for the time dimension of the data (for example, Nordhaus 2006; Dell, Jones, and Olken 2009), and (ii) the likely reverse causality from growth to climate (Burke et al. 2015b; Hsiang 2016). In his dynamic integrated climate-economy model, Nordhaus accounts for the two-way causality between economic activity and average temperature (Nordhaus 1992).

62 The authors estimate the long-run growth effects of persistent temperature increases using the half-panel Jackknife FE estimator proposed in Chudik, Pesaran, and Yang (2018) to deal with the possible bias and size distortion of the commonly used FE estimator—given the weak exogeneity of climate variables. This renders the estimates robust to likely feedback effects from economic activity to climate.

63 Specifically, an annual 0.01°C increase (decline) in temperature above (below) its historical norm would lower growth per capita by 0.0543 percentage point per year (Kahn et al. 2019).

64 The increase in average global temperature of 0.04°C per year corresponds to the Representative Concentration Pathway 8.5 scenario, which assumes higher GHG emissions in the absence of mitigation policies.

65 Kahn et al. (2019).

66 Countries may adapt to particular temperatures in the long run and would be able to mitigate the short-term economic impacts. Successful adaptation policies may explain why the estimates of short-run economic effects of temperature shocks are larger than those implied by the cross-sectional relationship between temperature and income worldwide (Kahn et al. 2019).

Recent empirical analysis uses novel district-level panel data on climate and economic activity across 37 countries and multiple decades.[67] District-level evidence shows that economic production falls sharply amid warmer temperatures. In contrast to the cross-country evidence, the district-level estimates fail to show significant evidence of a positive relationship between climate and development in cooler regions. At the global level, the district-level evidence suggests that an increase in temperature (above the 2001–15 average) will lower growth in nearly all world regions—including the richest ones.[68] At the same level of disaggregation used by Burke and Tanutama (2019), provincial-level evidence for Sub-Saharan Africa shows that a 0.5°C increase in temperature in a given month (from its 30-year average) reduces satellite-recorded nightlights by 2.1 percent. This translates into a 1 percent decline in monthly real GDP for a province.[69] The estimated growth effect in Sub-Saharan Africa is double that of the world and 1.6 times the average of emerging markets and low-income developing countries. However, these effects may not be persistent throughout the year and would likely be offset by other factors.[70]

In Sub-Saharan Africa, natural disasters can have lasting adverse economic effects—and they can be substantial as is the case of droughts and extreme storms (cyclones). Country estimates show that (i) natural disasters can significantly affect medium-term growth. A drought in a Sub-Saharan African country can lower its medium-term economic growth by one percentage point per year—while the economic toll from floods (including extreme storms) is about half that from droughts. (ii) The disproportionate impact of climate-induced natural disasters in Sub-Saharan Africa reflects weak resilience and lack of coping mechanisms in the region, as well as its dependence on rainfed agriculture.[71] (iii) The growth effects of disasters are driven by their intensity rather than by their frequency.[72]

Challenges to economic growth after a natural disaster are compounded by larger current account deficits, mounting fiscal and debt vulnerabilities, and pressures on international reserves. In the near term, the adverse growth effects can be partly mitigated by remittances, foreign aid, and reconstruction. Upgrades to damaged infrastructure can partly alleviate losses to physical capital. However, human capital loss from deaths, malnutrition, or lower school enrollment after a disaster is irreparable.[73] Coping with more frequent temperature and precipitation anomalies affects the volume and pattern of exports.[74] Financial stability can be affected by climate-related shocks: assets stranded due to extreme weather events could reduce the collateral value of economic agents and harm the soundness of financial institutions.

67 The dataset includes information on more than 11,189 districts combined with information on average temperature and precipitation in each district-year using several sources of climate information (Burke and Tanutama 2019).

68 See Burke and Tanutama (2019).

69 Analogously, a 10-millimeter deviation in precipitation (relative to the 30-year average for that month) may reduce nightlights in Sub-Saharan Africa by 0.8 percent—thus translating into a reduction in real GDP of 0.4 percent. Precipitation shocks during peak growing season may lead to a persistent effect for more than a year.

70 See IMF (2020).

71 For instance, the adverse growth effect of droughts in Sub-Saharan Africa is nearly eight times that in other emerging markets and developing countries (IMF 2020).

72 This finding is consistent with Noy (2009) and Fomby, Ikeda, and Loayza (2013).

73 IMF (2020).

74 See Jones and Olken (2010).

Channels of Transmission

Climate change can significantly affect economic activity through a series of channels. One of the direct channels through which climate can affect the level of economic activity is agricultural output (for example, by changing agricultural yields), given that temperature and precipitation are inputs in crop production.[75] Additionally, empirical research shows evidence of long-term growth effects of persistent climate shocks through their impact on physical capital, human capital (education, health, and mortality), labor productivity, and conflict.[76]

Sectoral activity. Recent research finds that, given the average temperature in the median low-income developing country, value-added in agriculture, crop production, and yields decline with higher temperatures—and remain depressed over the medium term. Rising temperatures also hurt industrial output—especially in hot climate countries—while value added in services seems to be shielded from weather shocks.[77]

In agriculture, a 1°C increase in temperature among poor countries is associated with a decline in agricultural output of 2.7 percentage points—while the impact of a similar temperature increase for wealthier nations is negligible. Greater precipitation (that is, an additional 100 millimeters of annual rainfall) is associated with higher agricultural output growth in both rich and poor countries—although the impact is not statistically significant.[78] Evidence shows that rising temperature has a more severe impact on agriculture in Sub-Saharan Africa—for example, the gap in agricultural production of Sub-Saharan Africa relative to other developing areas at the end of the 20th century would have been 32 percent of the current gap if temperature and rainfall conditions were at their pre-1960s levels.[79]

Industrial output is also affected by climate shocks: a 1°C increase in temperature among poor countries is associated with a reduction of industrial output of 2 percentage points. Rising temperature also has an adverse effect on the exports of agricultural and industrial products in poor countries, and many of the export sectors affected by temperature are not necessarily downstream processors of agricultural goods (for example, electronic equipment and light metal manufacturers).[80] The large impact of weather shocks on industrial output can be attributed to: (i) demand spillovers from adverse climate shocks on agricultural output, and (ii) contractions in labor supply and/or labor productivity losses in factories or industries with high weather exposure.[81]

Sources of growth. As a supply shock, an increase in temperature could lead to persistent output losses and affect growth if it has an adverse effect on the pace of capital accumulation. At the temperature of the median low-income developing country, there is a sharp reduction in investment in the medium term in response to a 1°C increase in temperature—that is, investment is 6 percent lower seven years after the weather shock. Imports that are partly related to investment show a similar response to temperature increases. Additionally, higher temperatures in countries with hot climates may reduce (future) labor supply—as they influence

75 For example, see Meehl, Tebaldi, and Nychka (2004).
76 See Dell, Jones, and Olken (2014); Carleton and Hsiang (2016); Heal and Park (2016).
77 IMF (2017).
78 Dell Jones, and Olken (2012).
79 Barrios, Ouattara, and Strobl (2008).
80 Jones and Olken (2010).
81 Graff Zivin and Niedell (2010).

mortality rates. A 1°C increase in temperature raises infant mortality by 0.12 percentage point in the year of the weather shock. The physiological impact is compounded by climate-related income losses and food insecurity,[82] as well as the negative impact on health and educational attainment of children. Exposure to heat above a certain threshold affects people's performance on cognitive and physical tasks.[83] The impact of weather shocks through the productivity channel appears to be considerably larger in heat-exposed industries—including agriculture, forestry, fishing and hunting, construction, mining, transportation, and utilities, as well as manufacturing in facilities that may not be climate controlled in low-income countries and whose production processes often generate considerable heat.[84] Aggregate productivity will also decline if climate shocks lead to political instability and greater conflict.

Political instability. Rising temperature can have an adverse effect on output if it leads to political instability. In turn, political instability may stymie the accumulation of physical and human capital and slow productivity growth—especially in poor countries. The probability of leader transitions increases by 3.1 percentage points in poor countries after a 1°C rise in temperature—and this is mainly explained by irregular leader transitions (such as coups). The impact of climate shocks on political instability among poor countries suggests an impact on productivity growth and income levels through deterioration of the institutional framework.[85] A hierarchical meta-analysis across 55 studies shows that temperature and precipitation anomalies heighten conflict risk. A one standard deviation increase in temperature leads to greater interpersonal conflict by 2.4 percent and intergroup conflict by 11.3 percent. If future responses to climate shocks are similar to past ones, anthropogenic climate change could significantly increase global violent crime, civil conflict, and political instability, relative to a benchmark scenario of no climate change.[86]

Inequality. Climate change can potentially exacerbate the already existing inequalities in Sub-Saharan Africa. Nearly half the population lives below the poverty line and makes their living in climate-sensitive activities such as rainfed agriculture, pastoralism, and fishing. The weak capacity to adapt reflects limited financial buffers and poor levels of education and health—thus, increasing vulnerabilities to income losses, unemployment, and food insecurity, among others. For instance, evidence shows that food insecurity increases by 5-20 percentage points in Ethiopia, Malawi, Mali, Nigeria, and Tanzania in the event of a flood or a drought.[87] Climate-induced deteriorations in health and school attendance would heighten gender inequality and reduce long-term income prospects.[88] Unable to cope with climate shocks, rural populations are moving to cities and looking for jobs and lodging. Cities in Sub-Saharan Africa are already struggling to accommodate the rapid increase in urban population, and the need to build climate-resilient infrastructure. Conflict and violence arising from these challenges would lower growth and increase inequalities.[89]

82 Cross-country evidence documents the robust relationship between weather and health outcomes such as mortality and prenatal health, among others (Kudamatsu, Persson, and Strömberg 2012; Guo et al. 2014; IMF 2017).

83 See, for instance, Seppänen, Fisk, and Lei (2006).

84 Graff Zivin and Neidell (2014).

85 IMF (2017).

86 Burke, Hsiang, and Miguel (2015a).

87 IMF (2020).

88 Shahidul and Zehadul Karim (2015).

89 Hsiang, Meng, and Cane (2011); IMF (2019).

Computable General Equilibrium Modeling

Another strand of the literature models climate risks using computable general equilibrium (CGE) models and IAMs, where IAMs feed environmental damages into macroeconomic models. Earlier IAM models were often based on the neoclassical growth framework with an aggregate production sector.[90] Subsequent efforts have incorporated multiple sectors into IAM models—for example, DART,[91] GTEM,[92] and ENVISAGE.[93] Dynamic variants of these models have been simulated to evaluate the effects of temperature changes on global economic growth and wealth distribution. The estimated macroeconomic effects are significant but with uneven impacts at the regional and sectoral levels.[94] Earlier models explored channels of transmission in climate scenarios, such as labor productivity. They were built on evidence of the effects of heat, climate guidelines for safe work environments, and the global distribution of the working population.[95] ENVISAGE models have been used to evaluate a wider array of transmission channels—such as rising sea levels, agricultural productivity, water availability, health, tourism, and energy demand.[96] The models suggest a heterogeneous impact of climate change across regions and channels of transmission. For instance, labor productivity changes explain 84 percent of the worldwide economic activity losses in 2050 (-1.8 percent of global GDP). The Middle East and North Africa and East Asia experience the most severe impacts of climate change. Direct labor productivity losses and rising sea levels are the predominant channels explaining these effects, respectively.

Global dynamic CGE models are typically used to examine the economic effects of climate change and conduct policy analysis.[97] An expansion of country and sector dimensions as well as the development of new solution methods enabled researchers to simulate large-scale intertemporal CGE models and assess the effects of climate change in different Representative Concentration Pathway (RCP) scenarios. Kompas, Van Ha Pham, and Che (2018) simulate a Global Trade Analysis model with forward-looking investors for 139 countries to examine the economic effects of climate change for a wide array of temperature changes. Their simulations confirm differences in the impact of climate change across regions and economic sectors as well as a rising impact over time. The impact of climate change is more deleterious in Sub-Saharan Africa, India, and Southeast Asian countries—and, broadly, in all countries near the equator.

In Sub-Saharan Africa, the estimated potential GDP loss is US$2,889.66 billion for 3°C global warming by 2100—with GDP losses across African countries as high as 19 percent per year. The impact of climate change is transmitted through a series of channels, including lower crop yields, reduced agricultural and labor productivity, and damage to human health. Assuming no major changes in the world's social, economic, and technological trends, climate change that leads to a 3°C temperature increase (RCP 6.0) will reduce the region's GDP by as much as 8.6 percent per year after 2100. If limited to 1.5°C (Paris Agreement), the decline in GDP will be reduced to 3.8

90 See Stern (2007) for a review of these earlier models.

91 Deke et al. (2001).

92 Pant, Tulpulé, and Fisher (2002).

93 Roson and van der Mensbrugghe (2012).

94 Eboli, Parrado, and Roson (2010).

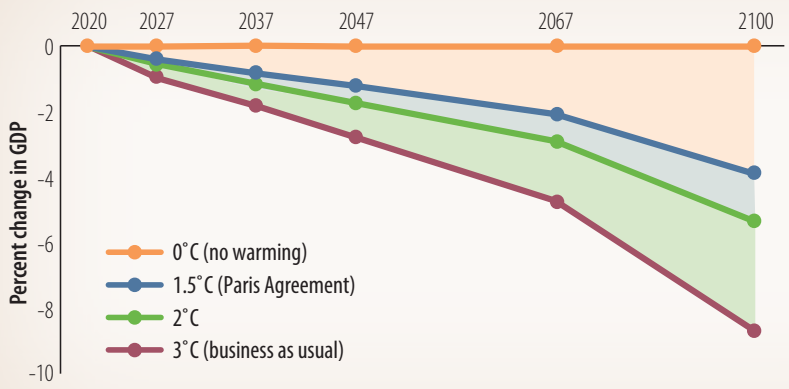
95 Kjellstrom et al. (2009).

96 Roson and van der Mensbrugghe (2012).

97 Earlier attempts used the G-Cubed model (McKibbin and Sachs 1991; McKibbin and Wilcoxen 1999) to form an intertemporal global economy to predict future CO2 emissions under different scenarios. However, they had limited dimensions—for example, the 14-country, 12-sector model in McKibbin, Pearce, and Stegman (2009).

percent per year after 2100 (figure 2.3). Furthermore, the long-run impact of climate change on economic activity varies widely across African countries. For global warming of 3°C by 2100, GDP losses could be as low as 3.4 to 4.4 percent (Namibia and South Africa)—with a regional median loss of 7-8 percent (Kenya, Madagascar, Tanzania, and Rwanda).[98]

FIGURE 2.3: Impact of Climate Change on Sub-Saharan Africa's GDP



The estimated GDP losses are significantly higher if there is no action against climate change.

Source: Kompas, Pham, and Che 2018.

Microeconomic Evidence of the Impact of Climate Change on Manufacturing

This subsection explores the relationship between temperature and economic performance using detailed production data at the line or plant level. One of the strands in this empirical literature looks at heat stress caused by climate change and heat-related productivity losses. Theoretically, it has been argued that heat-related health effects can adversely impact activity by: (i) reducing the size of the working population due to deaths—including worker mortality, infant mortality, and migration[99]; (ii) raising medical expenditures[100]; (iii) reducing the number of working hours if workers are sick and absent from the job[101]; and (iv) lowering labor productivity due to physiological/clinical heat impacts.[102]

A recent empirical survey suggests that global economic losses due to heat-related labor productivity losses can, on average, amount to 0.44 percent (RCP 2.6) to 2.9 percent (RCP 8.5) of global GDP in 2100.[103] The large economic losses take place in South and Southeast Asia, Sub-Saharan Africa, and Central America. This meta-analysis of research studies highlights that the differences in results occur not only across areas, but also within the same area given the differences in methodologies and assumptions on adaptation policies assumed in those studies. In this context, the adaptation measures considered included air conditioning installation, shifting working hours, mechanization, and increased ventilation. Additionally, adaptation measures were estimated to reduce economic losses by 22-68 percent.

Recent evidence from three different manufacturing settings in India—cloth weaving, garment sewing, and steel products—suggests that there is lower worker productivity and higher absenteeism on hot days as well as in weeks with more hot days.[104] The temperature-absenteeism relationship is strong (weak) among workers with paid (unpaid) leave. Additionally,

98 See Kompas, Pham, and Che (2018).
99 See Chen et al. (2018), Banerjee and Maharaj (2020), and Cattaneo and Peri (2016).
100 See Schmeltz et al. (2016) and Borg et al. (2021).
101 See Zander et al. (2015) and Yu et al. (2019).
102 Adhvaryu, Kala, and Nyshadham (2018).
103 Zhao et al. (2021) review 26 journal articles and four reports.
104 Somanathan et al. (2021).

annual plant output falls in years with more hot days. For instance, it is predicted that annual output may decline by 2.1 percent per degree Celsius. At a higher level of aggregation, manufacturing output for the average Indian district declines 3 percent per degree Celsius. Given that heat stress plays a role in lowering output, firms should undertake climate-control investments and allocate these resources toward labor-intensive tasks. Overall, climate control can significantly reduce productivity losses.

An analysis of the garment factories around Bangalore, India, shows a negative but nonlinear relationship between production (at the line level) and temperature. It also shows that introducing light-emitting diode (LED) technology on factor floors mitigates the adverse relationship between temperature and productivity.[105] By emitting less heat than conventional bulbs, LED lighting lowers the temperature on factory floors (through reduced heat dissipation) and increases productivity—most notably, on hot days. This study reveals that adopting energy-saving technologies (such as LED) may have important private co-benefits. Failure to account for the productivity benefits of LED technology may underestimate the private returns to adoption by about fivefold.

Severe weather—as manifested by extreme rain, snow, heat, and wind—affects the productivity of work that takes place outside. However, it can also hinder the production of work indoors. Evidence of weekly output data from 64 automobile plants in the United States from 1994 to 2005 shows significant production losses amid adverse weather conditions.[106] Specifically, for an average plant, weekly production of automobiles declines by 8 percent in a week with six or more days of heat exceeding 90^0F (or one additional day of heavy winds). Six or more days of rain within a weak reduces weekly output by 6 percent (compared with a no rain scenario). The output losses due to severe weather across locations range from 0.5 to 3 percent, and the evidence shows that plants recover their losses in later weeks rather than the week after the weather event took place. These findings suggest that the prevalence of bad weather is an additional factor under consideration for building or locating a new production facility.

Temperature also affects firm performance across Sub-Saharan African firms. Evidence from registered firms in Côte d'Ivoire during 1998–2013 shows that amid increased temperatures: (i) firms' revenues, profits, and survival rates drop, and (ii) TFP declines—including both labor and capital productivity.[107] More specifically, a one standard deviation increase in days with average temperature that exceeds 27^0C lowers the firm's TFP by 3.6 percent (compared with the impact of days with average temperature between 25^0C and 27^0C).[108] The evidence shows that the TFP effects of higher temperatures are transmitted not only through lower labor productivity, but also lower capital productivity. Firms' revenues and profits decline by 14.8 and 21.7 percent, respectively, in response to a similar increase in temperature relative to days with moderate average temperature. The adverse impact of high temperature on revenues is reduced among firms that invest in climate mitigation technologies. Additionally, increased temperatures would increase production costs and, hence, reduce the firm survival rate. Specifically, a one standard deviation increase in days with high average temperatures raises the firm exit rate by 0.04 percent. Overall, climate change—as proxied by higher average temperatures—has a negative impact on firms' competitiveness.

105 Adhvaryu, Kala, and Nyshadham (2018).
106 Cachon, Gallino, and Olivares (2012).
107 Traore and Foltz (2018).
108 One standard deviation in days with average temperature above 27^0C is 51.7 days.

2.4 LONG-LASTING IMPACT OF CLIMATE CHANGE: HUMAN CAPITAL

Climate change amplifies the frequency and impacts of shocks that disproportionately affect the poorest households with long-term impacts on human capital. In response to shocks, the poor are often forced to resort to a variety of damaging coping strategies that undermine human capital formation and thus perpetuate the cycle of poverty and vulnerability. This is illustrated by evidence from the Sahel where one in four households is vulnerable to repeated climate shocks.[109] In the absence of effective social protection programs, climate shocks through droughts or floods can contribute to maternal and child malnutrition by leading to reductions in food intake, trigger decisions to take children out of school, or lead poor households to sell productive assets, thereby perpetuating and deepening inequities.

Africa has seen a significant expansion in access to safety net programs during the past two decades, with the emergence of a model of "adaptive" social protection (ASP) with cash transfers as a "platform" for climate shock resilience (see box 2.1). The potential of ASP to address the economic and social impacts of climate shocks has been illustrated by the response to the COVID-19 shock, which triggered an unprecedented expansion of social safety net programs. Across the continent, 48 countries adopted social protection response measures in 2020.

Social protection systems in Sub-Saharan Africa can be leveraged to become more adaptive to help build greater household resilience to climate shocks and stresses.

Enhancing the ability of adaptive social protection systems to reach more poor and vulnerable households in the event of climate shocks depends on increasing the robustness of emerging ASP delivery systems around four key system building blocks.

1. *Institutional coordination.* There is a need to strengthen and clarify institutional coordination for shock response between agencies in charge of social protection, disaster risk management, agriculture, and public finance. Building adaptive national systems is also redefining the role of humanitarian actors and their relationship with development and national actors, with a greater emphasis of adaptive social protection system-building through humanitarian action and a shift in financing through national systems.

2. *ASP programs and delivery systems.* Cash transfer programs and accompanying productive inclusion measures (cash transfers "plus") need reinforcing, including by deliberately empowering women to boost their role as drivers of household resilience. Digital technologies allow reaping efficiency gains in government-to-person payments as well as in identifying and targeting households.

3. *Data and information.* ASP systems can be leveraged better with good climate early warning system data and information that is available quickly to inform shock response programs. Moreover, this entails efforts to build foundational identification systems and more "adaptive" social registries. which can be built and updated as needed using technology. It also creates new challenges and risks such as personal data privacy, which must be mitigated.

109 Brunelin, Ouedraogo, and Tandon (2020).

4. *Finance*. To achieve wider coverage of adaptive social protection programs, and their "reach" of households impacted by shocks, many countries in Africa can reprioritize social protection in the national budgets even in times of extremely tight budgets and develop diversified strategies for financing adaptive social protection. This involves the development of disaster risk finance strategies that reflect a given country's risk profile and matches financial instruments to main risks, for example, differentiating between high-frequency and low-impact risks (such as the annual lean season) on the one hand and low-frequency and high-impact risks (a serious drought, the COVID-19 pandemic, or the 2020 locust invasion).

BOX 2.1: Building Household Resilience to Climate Change through Adaptive Social Protection

Adaptive Social Protection (ASP) has emerged in recent years as a critical tool to help poor and vulnerable households and communities better cope and become more resilient to climate change and other covariate shocks (such as the COVID-19 pandemic). The "adaptive" approach integrates social protection interventions around cash transfers with disaster risk management and climate change adaptation measures to better anticipate and respond to shocks.[a] Drawing on climate early warning systems backed by disaster risk financing strategies, ASP systems anticipate climate-related events such as droughts, quickly scale up cash transfers via their social safety net programs in response, and provide an overall cost-effective response to temporarily increased needs. Emerging adaptive social protection systems in Africa feature cash transfers as a platform linked with complementary "productive inclusion" interventions (also referred to as cash transfer "plus" interventions) like community savings and loan groups or life skills and entrepreneurship training for beneficiaries to help reinforce their adaptive capabilities by helping them to diversify their livelihoods in and beyond agriculture. They also often include a focus on early childhood and human capital, especially through behavior change components, to address the adverse effects of climate shocks on human capital.

Emerging evidence from the Sahel indicates that cash transfer programs have significant impacts, maximized when involving a "plus." For example, evidence from Niger shows strong impacts on household consumption, (climate) shock resilience, women's empowerment (with indications that women often act as primary drivers of livelihood diversification in the household), and human capital-relevant parenting practices. Moreover, cash transfer "plus" programs have been found to be cost-effective because they build off the same platform and delivery systems.[b] ASP systems have also been leveraged significantly across Africa in the response to the social and economic impacts of the COVID-19 shock.

The experience from both climate shocks and the COVID-19 pandemic illustrates that effectiveness of ASP systems in quickly reaching those impacted by shocks critically depends on the underlying social protection delivery systems: unique personal identification systems, social registries of poor and vulnerable households (or entire populations in climate shock-prone regions), payment systems to deliver cash to people, and grievance redress mechanisms to increase efficiency and address targeting errors. The forward-looking reform agenda includes (i) further strengthening government delivery systems with an increasing emphasis on leveraging digital technologies as well as national and subnational institutional coordination, and (ii) developing diversified financing strategies for ASP that mix external financing with better managed domestic fiscal space and disaster risk financing that can be drawn on for shock response.

a. Bowen et al. (2020).
b. Premand and Stoeffler (2020); Bossuroy et al. (2021).

2.5 NATURAL WEALTH IN SUB-SAHARAN AFRICA: STYLIZED FACTS[110]

Total wealth and wealth per capita in Sub-Saharan Africa increased sharply over the past quarter century: it more than doubled during 1995–2018 (that is, it grew at an annual average rate of 3.5 percent), whereas global wealth only grew by 91 percent (that is, an annual average rate of 2.9 percent). This implies that Sub-Saharan Africa's share of global wealth increased from 1.5 percent in 1995 to 1.7 percent in 2018. The region's share in global wealth is considerably smaller than that of East Asia and the Pacific (34 percent) and Latin American and the Caribbean (6 percent). In per capita terms, the growth of wealth in the region was less stellar—an increase of 19 percent from 1995 to 2008 (or an annual average of 0.74 percent). Wealth per capita in the region grew at a slower pace than the world (1.6 percent per year) as well as other developing regions. As a result, the ratio of wealth per capita in Sub-Saharan Africa relative to the world declined from 0.16 in 1995 to 0.13 in 2018—as opposed to East Asia and the Pacific where the ratio increased from 0.66 in 1995 to 1.1 in 2018.

Composition of Natural Wealth in Sub-Saharan Africa

The slow growth of wealth per capita in the region might be related to its composition when compared with other developing areas (figure 2.4). The world regions with slower growth in wealth per capita tend to have a greater share of wealth in natural capital—say, the Middle East and North Africa (40 percent in 2018) and Sub-Saharan Africa (20 percent in 2018, down from 34 percent in 1995). Within the region, the cumulative decline in the share of natural capital has been greater in West and Central Africa (from 42 to 21 percent) than in East and Southern Africa (from 30 to 19 percent). Compared with other developing areas, Sub-Saharan Africa is the only region that registered a cumulative decline in its natural wealth of 36 percent from 1995 to 2018—which translates into an average annual drop of 1.9 percent (figure 2.4).[111] Within the region, the decline in natural wealth per capita over the period was more pronounced in West and Central Africa (-2.2 percent per year) than in East and Southern Africa (-1.3 percent per year).

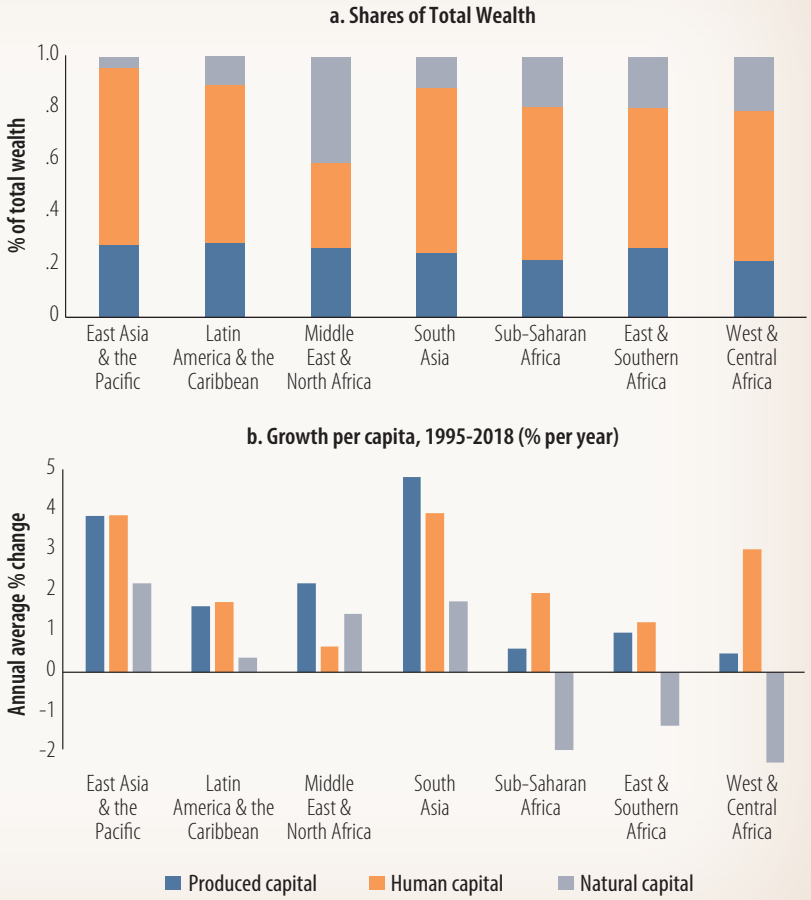
The share of natural capital in total wealth for the region as a whole (about one-fifth in 2018) masks the wide heterogeneity across countries (figure 2.5). The share of natural capital fluctuates from 2 to 66 percent in the same year. In 2018, the countries with the greatest shares of natural capital were the Central African Republic (66 percent), Guinea (61 percent), Mozambique (52 percent), Malawi (52 percent), and Gabon (48 percent), while those with the lowest shares of natural capital include Mauritius (2 percent), the Comoros (8 percent), Lesotho (9 percent), Botswana (10 percent), and South Africa (11 percent). From 1995 to 2018, 38 of the 44 Sub-Saharan African countries with data available experienced a decrease in their natural wealth per capita—with the largest contractions experienced by Equatorial Guinea, the Seychelles, Cabo Verde, Mozambique, and Mauritania. In contrast, only six countries in the region registered an increase in natural wealth per capita—namely, Burundi, Nigeria, Mauritius, Namibia, Zimbabwe, and Tanzania.

110 This subsection draws heavily from World Bank (2021).

111 Additionally, the region had the lowest annual growth rate in produced capital per capita over the same period (0.6 percent).

Natural capital per capita in Sub-Saharan Africa declined over 1995–2018.

FIGURE 2.4: Shares of Total Wealth and Growth in Wealth per Capita in Sub-Saharan Africa and Other Regions, by Type

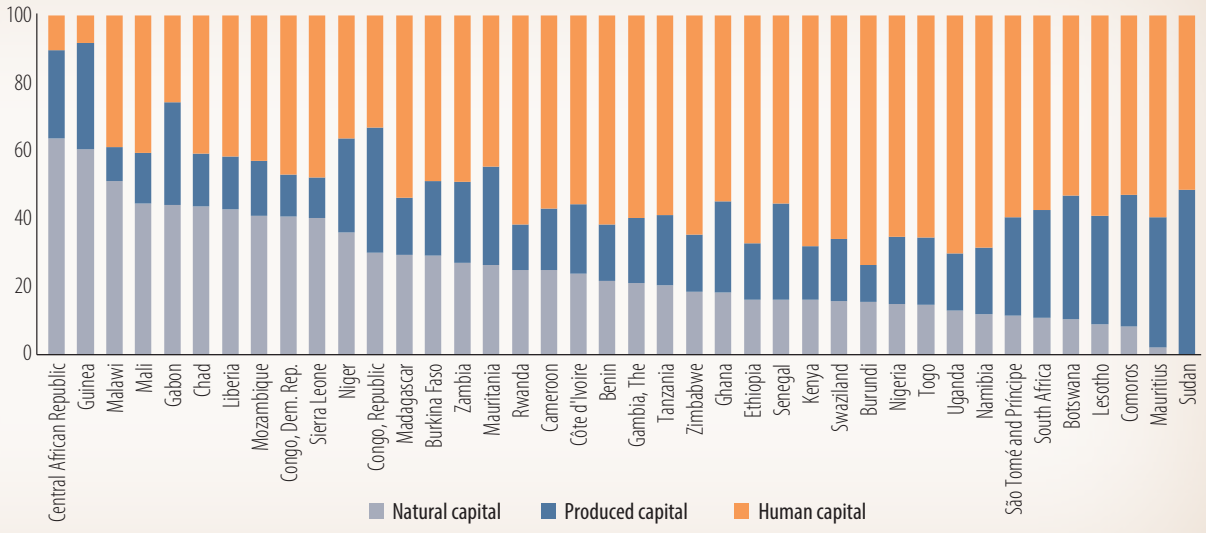


Source: World Bank 2021.

The evolution of natural capital in Sub-Saharan Africa shows a protracted increase from 1995 to 2014 and a sharp drop afterward (figure 2.6). Natural wealth in the region increased from US$3.3 trillion in 1995 to US$4.5 trillion in 2014 (a cumulative increase of 37 percent over the period).[112] By 2018, the value of natural wealth was US$3.9 trillion (a cumulative drop of 14 percent). The trends observed in natural wealth are mainly attributed to the behavior of nonrenewable wealth (fossil fuels and minerals): it grew from US$0.6 trillion in 1995 to US$1.7 trillion in 2014 (a cumulative increase of 175 percent). It then dropped to US$1.05 trillion in 2018 (a cumulative

The wealth share of natural capital varies widely across Sub-Saharan African countries.

FIGURE 2.5: Wealth Shares across Sub-Saharan African Countries, 2018 (%)



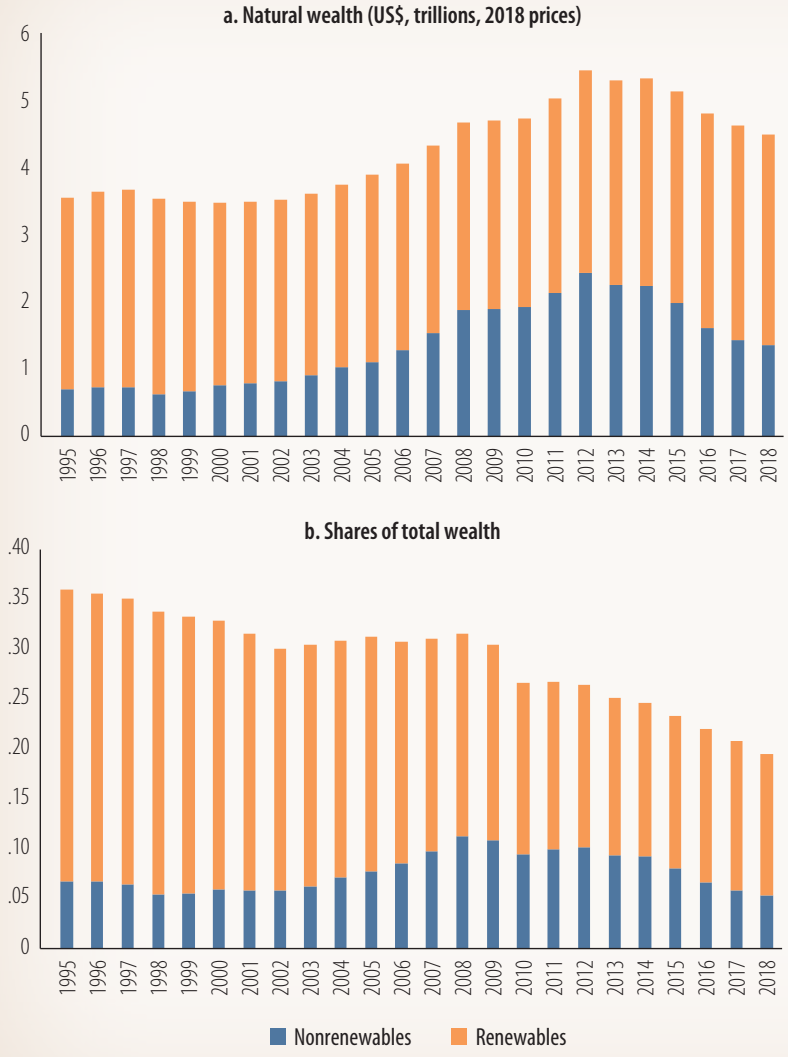
Source: World Bank 2021.

112 These figures are denominated in 2018 international dollars.

decline of 38 percent). The loss in valuation of nonrenewable wealth coincided with the 2014 plunge in commodity prices. In contrast, the value of renewable wealth remained relatively invariant over the past two decades (that is, it only grew a cumulative 6 percent over that period). When normalized by total wealth, the share of natural wealth has declined over the period—although at a faster speed since 2009 (figure 2.6): natural wealth declined from 30 percent in 2009 to nearly 20 percent in 2018. Since 2009, the wealth shares of renewables and nonrenewables have declined—although their shares decreased at a similar pace (about 5 percentage points for both renewables and nonrenewables).

FIGURE 2.6: Natural Wealth in Sub-Saharan Africa, by Type, 1995–2018

The drop in natural wealth is primarily driven by the nonrenewable wealth.



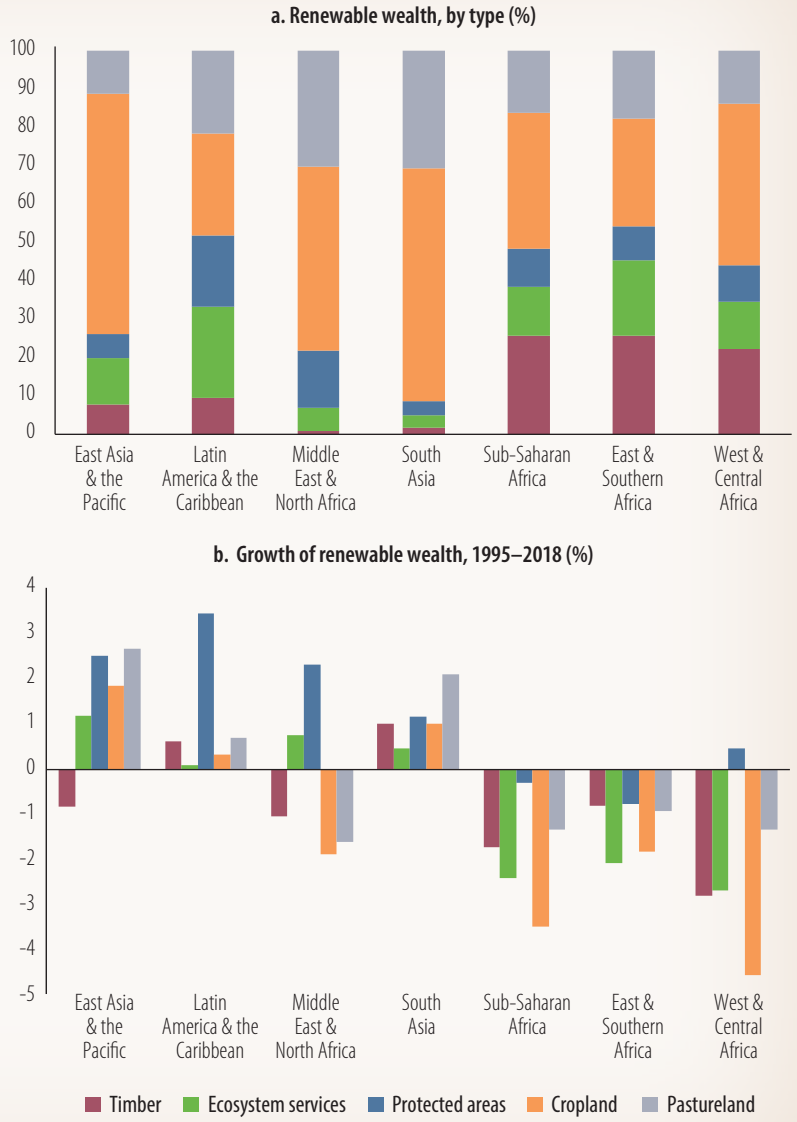
Source: World Bank 2021.

Renewables sector. Renewable wealth consists of different types of assets: forests (timber and ecosystem services), protected areas, and agricultural land (pastures and cropland).[113] Agricultural land constituted more than half the value of renewable wealth in Sub-Saharan Africa by 2018 (51.5 percent), followed by forests (38.4 percent) and protected areas (10.1 percent). From 1995 to 2018, the share of agricultural land declined while the shares of forests and protected areas increased. Specifically, the share of agricultural land in renewable wealth declined from 59 percent in 1995 to 51.5 percent in 2018—and this was mainly attributed to a reduction in the share of cropland (from 46 to 35 percent over the same period). Within the region, the trade-off in the shares of renewable wealth between agricultural land and other types of land (forests and protected areas) occurred in West and Central Africa where the share of cropland decreased from 57 percent in 1995 to 42 percent in 2018 (figure 2.7).

113 Forest ecosystem services include three categories: (i) recreation, hunting, and fishing (referred to as "recreation"); (ii) watershed protection, including the benefits of forests for water quality/water quantity, often in the context of controlling water flow and pollution from erosion and other sources, enabling hydropower, avoiding disasters, or the impact on crop yields by controlling weather ("water services"); and (iii) non-wood forest products (World Bank 2021).

There is a trade-off in the shares of renewable wealth between agricultural land and other types of land—especially in West and Central Africa.

FIGURE 2.7: Renewable Wealth in Sub-Saharan Africa, by Type, 1995–2018



Source: World Bank 2021.

The share of agricultural land in renewable wealth varies widely across countries in the region. By 2018, the share of agricultural land was more than 75 percent in nine countries in the region, while it was lower than 25 percent in five countries. Among the countries with the largest shares of agricultural land, pastures were the most common asset in Lesotho and Mauritius, while cropland was more extensive in Burundi, Rwanda, and Nigeria. In contrast, Equatorial Guinea, Liberia, and Gabon are among the countries with the lowest shares of agricultural land in renewables. In those three countries, forests constituted the largest share, with more than 80 percent.

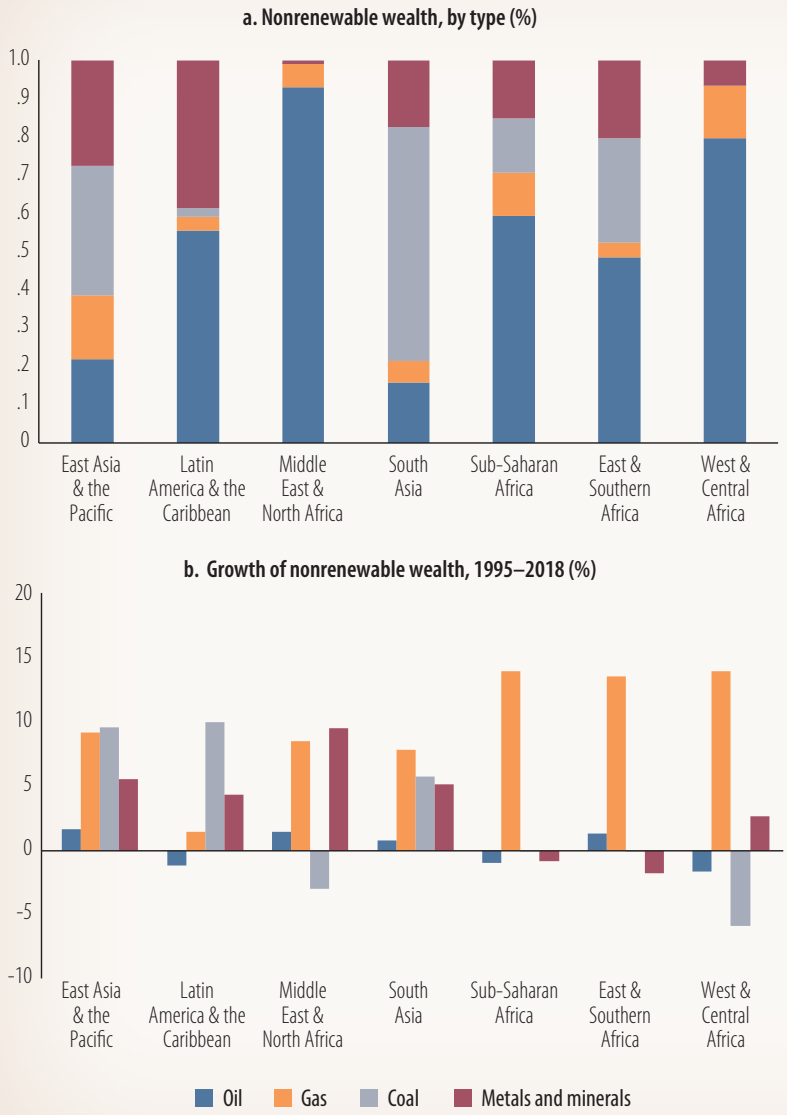
In per capita terms, renewable wealth in the region declined at an annual average rate of 2.5 percent during 1995–2018, with the renewable asset experiencing the largest drop being cropland (3.5 percent). In contrast, renewable wealth per capita increased in East Asia and the Pacific and South Asia at annual average rates of 1.5 and 1.3 percent, respectively. In these two regions, all renewable asset types increased over the past two decades. Within the Sub-Saharan Africa region, the largest reduction in renewable wealth per capita occurred in West and Central Africa (3.3 percent per year)—with cropland and forest declining by 4 and 3.2 percent, respectively, per year during 1995–2018 (figure 2.7).

Nonrenewables sector. The nonrenewables sector is represented by two broad types of assets: fossil fuels (oil, natural gas, and coal) and metals and minerals. Fossil fuels constitute the lion's share of nonrenewable wealth in Sub-Saharan Africa (85 percent in 2018)—with oil representing about 60 percent of nonrenewable assets (figure 2.8). The only region with a higher share of

fossil fuels in nonrenewables is the Middle East and North Africa (99 percent)—of which oil and natural gas represent 93 and 6 percent, respectively. Within the region, the share of fossil fuels in nonrenewable wealth is greater in West and Central Africa (94 percent) than in East and Southern Africa (80 percent). In the latter region, metals and minerals represent one-fifth of nonrenewable assets. During 1995–2018, the share of fossil fuels increased slightly (from 83 to 85 percent), but its composition changed: the share of oil declined (from 69 to 60 percent) while that of natural gas increased sharply. The share of metals and minerals in nonrenewables decreased slightly (from 17 percent in 1995 to 15 percent in 2018). Within the subregions, while the share of oil wealth increased in East and Southern Africa—thanks to recent oil discoveries—that of West and Central Africa decreased by more than 15 percentage points over 1995–2018. The share of oil in nonrenewable wealth varies widely in the region, with seven countries having shares that exceed 80 percent—including Equatorial Guinea, Nigeria, the Republic of Congo, Angola, Gabon, South Sudan, and Chad. The share of metals and minerals in nonrenewables is very high in countries like the Democratic Republic of Congo, Mauritania, and Zambia.

FIGURE 2.8: Nonrenewable Wealth in Sub-Saharan Africa, by Type, 1995–2018

Wealth per capita in nonrenewable energy decreased in Sub-Saharan Africa—particularly in oil and coal.



Source: World Bank 2021.

In per capita terms, wealth per capita in energy nonrenewables decreased in Sub-Saharan Africa at an annual average rate of 0.3 percent from 1995 to 2018. Within the nonrenewable energy assets, oil and coal declined by 1 and 0.1 percent, respectively, over the same time period, while natural gas increased by 14 percent per year. In the Middle East and North Africa, nonrenewable assets per capita increased by 1.7 percent per year—with greater wealth in oil and gas (1.5 and 8.6 percent per year, respectively) and lower in coal (3 percent per year). Nonrenewable assets

per capita in East and Southern Africa increased by 0.7 percent per year during 1995–2018, while in West and Central Africa they decreased by 0.8 percent per year. Finally, the value of oil assets per capita increased, while that of metals and minerals declined in East and Southern Africa. The opposite occurred in West and Central Africa (figure 2.8).

Wealth and Resilience

Sub-Saharan African countries have the lowest per capita stocks of produced and human capital, and their gap relative to high-growth developing regions (such as East Asia) is quite significant. In 2018, the wealth per capita gap of Sub-Saharan Africa relative to East Asia was larger. For instance, the value of productive capital in East Asia was 11 times that of Sub-Saharan Africa, while the value of human capital per capita was 10 times as large. For some low- and middle-income countries in the region, natural capital provides an opportunity to generate revenues that finance accumulation of produced and human capital. However, countries that are abundant in fossil fuels need to extract and sell these resources to benefit their people.

Still, low- and middle-income countries in Sub-Saharan Africa that are abundant in nonrenewable energy commodities face a dilemma. On the one hand, weather-related shocks (including natural disasters) will hit them disproportionately if no progress is made in combating climate change. On the other hand, decarbonization of the world economy poses a risk among these countries as global demand for their commodities will permanently decline in the future, sharply reducing the value of their natural wealth.[114] In this context, countries that are highly dependent on nonrenewable energy for their wealth face a series of challenges.[115]

First, countries with a high share of carbon and carbon-linked wealth are highly exposed to carbon risk. Not only will the value of their nonrenewable capital be affected by the transition to a low-carbon economy, but also their government revenues. In Sub-Saharan Africa, five countries have more than 10 percent of their wealth in fossil fuels, namely, Gabon, the Republic of Congo, Chad, Mozambique, and Nigeria.[116] At the same time, the share of carbon-related revenues in government revenues exceeded 60 percent in Angola, the Republic of Congo, Equatorial Guinea, Nigeria, and South Sudan. A permanent reduction in the demand for nonrenewable energy commodities for these countries will severely affect government revenues and limit public spending on health, education, and infrastructure that can boost growth and reduce poverty.

Second, policies and investments implemented by countries that are abundant in nonrenewable energy commodities may elevate their carbon risk exposure. This exposure is not restricted to the extraction of fossil fuels. It also involves investments in nationally-owned resource companies, which are a large share of the securities linked to fossil fuel prices in the portfolio of sovereign wealth funds, and the formation of skills, businesses, and infrastructure associated with the fossil fuel industry. There are also investments in complementary downstream industries—especially in the areas of refining, processing, power generation, and industrial uses of fossil fuels. These policies and investments will increase the risk profile of their wealth and magnify the consequences of a future permanent drop in the demand for their nonrenewable energy commodities.

114 The so-called carbon risk not only affects exporters of oil, gas, and coal, but also countries with other forms of wealth associated with fossil fuels, including produced capital (for example, power plants and downstream industries and infrastructure), human capital (such as petroleum sector skills and expertise), and other kinds of assets such as government holdings in national oil companies or fossil fuel equities held by sovereign wealth funds (Cust and Manley 2018).

115 See Cust, Manley, and Cecchinato (2017); Cust and Manley (2018); Cust and Rivera Ballesteros (2021a).

116 The country with the largest carbon wealth per capita in the region is Nigeria (US$110,934 in 2018 prices), followed by Equatorial Guinea (US$38,197) and South Sudan (US$23,500).

Third, diversifying away from nonrenewable energy wealth has proved difficult for resource-rich countries. These countries have a less than stellar record in export diversification away from nonrenewable energy commodities.[117] This might be explained by competitiveness losses in tradable sectors and low quality of economic policies amid resource booms.[118] In the transition to a low-carbon economy, actionable policies that convert the nonrenewable energy wealth into produced and human capital may sit at the top of the government's agenda. Still, most of these countries have found a series of difficulties in transforming their natural wealth into other forms of reproducible capital (physical, human, and infrastructure).[119] Since 2004, many countries have failed to use the proceeds from their fossil fuel assets to accumulate other types of capital and, thus, have run down their overall asset base—as reflected by their negative net saving adjustment.[120]

As the world decarbonizes, countries that are abundant in metals and minerals may face a different future from that of those that are abundant in oil, gas, and coal. A greater demand for the metals and minerals required for low-carbon energy technologies (for example, cobalt, lithium, copper, manganese, nickel, and zinc) could increase their prices in the future.[121] Hence, the policy implications to address the carbon transition are different from those for countries that are abundant in fossil fuels vis-à-vis metals and minerals. For fossil fuel abundant countries, policies and investments should accelerate the diversification away from nonrenewables and reduce their wealth exposure to carbon risk.[122] In contrast, countries that are abundant in the so-called *transition minerals* will increase their production and/or create downstream value addition in pivotal sectors.

Asset diversification appears to be a more attractive and sustainable policy option than export diversification among nonrenewable energy abundant countries.[123] Focusing on shifting the composition of wealth to other assets (say, physical capital, human capital, and renewable natural capital) will avert the consequences of Dutch disease and the exposure to carbon risk. This strategy might provide a more feasible path for economic diversification as well as sustainable and inclusive growth. Hence, the governments of fossil fuel abundant countries should design policies that support the accumulation of human capital and renewable natural capital as well as narrow the gaps in economic infrastructure.[124] This approach also suggests that prudent management of commodity revenues by the government may help finance investments in these forms of reproducible capital. However, asset diversification also poses challenges: it requires that fuel exporters invest in unexplored produced capital, skill formation, and capabilities and discover new comparative advantages.[125]

117 Ross (2019).

118 Resource abundance can hurt other exports such as manufacturing, commercial agriculture, and traded services (Corden and Neary 1982; Harding and Venables 2016).

119 Venables (2016).

120 The declining (and, in some countries, negative) adjusted national saving rates are attributed not only to the depletion of nonrenewable energy resources, but also the fall in gross national savings—especially in Nigeria and South Africa (Cust and Rivera Ballesteros 2021a, 2021b).

121 Galeazzi, Steinbuks, and Cust (2020); Hund et al. (2020).

122 The rising probability that the demand for fossil fuels will decrease in the future creates the risk of stranded nations—that is, countries that no longer find it profitable to extract their fossil fuel reserves. Although there is uncertainty on the timing and extent of this stranding, policy makers in low- and middle-income countries that have large nonrenewable energy assets should seize the moment to promote other economic activities (Cust, Manley, and Cecchinato 2017).

123 A more detailed discussion is presented in Cust and Rivera Ballesteros (2021b).

124 Baunsgaard et al. (2012); Gill et al. (2014); Peszko et al. (2020).

125 Ollero et al. (2019).

2.6 POLICIES TO ADDRESS CLIMATE CHANGE IN SUB-SAHARAN AFRICA

Macroeconomic Policies for Climate Change and Development

The low-carbon transition involves a substantial transformation of the economy that might need support from public policies to overcome the presence of several market failures. Typically, policies to prevent or cope with climate change focus on energy and variants of carbon pricing policies. However, the potential role of macroeconomic policies—namely, fiscal, monetary, and financial policies—is being tested by governments.

Fiscal Policy

As reviewed above, temperature and rainfall anomalies can severely affect economic activity, especially in sectors that are sensitive to climate shocks (such as agriculture, fishing, and tourism). The ensuing downturn in economic activity has an impact on the level and composition of tax revenues. Extreme weather events (such as droughts, storms, and floods) not only disrupt economic activity, but also heighten the volatility of government revenues. Furthermore, the fiscal consequences of these chronic and extreme climate shocks depend on the country's exposure to climate shocks, its level of preparedness, and the government's liability for the climate-related damages. Preventing or coping with these impacts can be onerous—especially in small island nations and low-income countries, thus jeopardizing the sustainability of their fiscal accounts. In this context, fiscal policy has a role to play in adapting to and mitigating climate change and its effects.[126]

Climate change adaptation policies involve a series of public sector interventions. They can take the form of: (i) policies that align the price of the country's resources to their social values to promote conservation and sustainable management (for example, water), (ii) public infrastructure investments that boost social and economic resilience to climate shocks, or (iii) regulations that address climate-related risks (for example, zoning regulations precluding construction in flood vulnerable areas).

Fiscal instruments are considered the most effective tools to address climate change and they can potentially improve the citizens' welfare. For instance, environmental taxes—such, levies on energy, transportation, and pollution, among others—can promote innovation and investment in more efficient and cleaner sources of energy by discouraging fossil fuel burning. The ultimate economic impact of the environmental taxes depends on the use of the raised revenues. In turn, these revenues can be used to lower other (distortionary) taxes (say, labor and capital taxes) or finance spending on health, education, public infrastructure, and social protection to enhance the country's resilience to climate change.[127]

Environmental tax reform revenues can finance climate change adaptation and mitigation policies, alleviate the social impact of the consequences of climate risks, and speed up the transition toward more efficient infrastructure and cleaner technologies. Packaging environmental taxes with other fiscal measures (say, shifts in other taxes, development,

126 Catalano, Forni, and Pezzola (2020).
127 Pigato (2019).

and social spending) not only reduces climate-related risks, but also produces important development co-benefits (for example, air quality, cleaner water, safer roads, financing energy access, health, and education) and boosts productivity and employment.[128]

Under certain circumstances, environmental tax reforms may have a negative impact on the incomes of low-income households. In this context, social protection programs may play a role—for example, targeted transfers to low-income households. Other measures include targeted public spending on health care, education, and housing for the poor.[129] Environmental taxes—in particular, taxes on oil and petroleum products—tend to be more progressive in developing countries as the share of income of low-income households devoted to pollution-intensive goods and services (for example, automobiles) is smaller than that of low-income households in developing countries.[130] Additionally, higher prices of oil and petroleum products as a result of greater taxes may lead to short-term competitive pressures and adjustment costs—especially for energy-intensive, trade-exposed sectors. In this context, measures to protect energy-intensive, trade-exposed sectors, such as lower corporate taxes, support for resource efficiency, and consumption-based taxes, are essential. Still, these measures need to be reviewed regularly, be time-limited, and provide long-term incentives to adapt.[131]

Model simulations evaluate the impacts of both persistent and extreme climate shocks on economic activity as well as the effectiveness of two different policy actions: (i) adaptation measures to anticipate the impact of climate change (preventive actions), and (ii) coping measures responding to realized impacts (remedial actions).[132] Specifically, the model evaluates the impact of preventive investments in climate change adaptation financed by public borrowing. The baseline scenario of no action in response to gradual warming and more frequent extreme events finds a sharp decline in GDP, widened fiscal deficits, and higher public debt stocks. Instead, preventive policies to address climate change are associated with higher growth in economic activity relative to a baseline scenario of no policy action or an alternative scenario with policy makers waiting to launch coping policies if needed. Reactive rather than proactive behavior in addressing climate shocks would translate into larger and more onerous future adjustments. Adaptation measures can build fiscal and economic resilience; however, they might not be sufficient to deal with climate-related hazards—especially among poor countries and small island nations.

Preventive policies include infrastructure investments, liquidity, and policy buffers to enhance shock resilience, and adequate fiscal and debt management. Design and implementation of these preventive policies could be more effective if undertaken in collaboration with development partners and multilateral institutions. However, national governments and the international community have typically focused on coping rather than preventive policy actions. Many countries in the region have underinvested in climate change adaptation or failed to strengthen fiscal buffers to prepare for climate-related hazards. Lack of consensus on the best

128 Pigato (2019) argues that the so-called co-benefits are particularly large in developing countries—and that they are significantly larger than the benefits of lower climate risks.
129 There is evidence for developed countries that 6 to 12 percent of environmental taxes may compensate the poorer households (Dinan 2015).
130 Parry, Mylonas, and Vernon (2017).
131 Pigato (2019).
132 See Catalano, Forni, and Pezzola (2020) and Pigato (2019).

adaptation practices compounds incentives to delay financing these measures. Policy bias toward remedial rather than preventive measures is attributed to moral hazard and overreliance on official foreign aid and assistance.[133]

More recent simulations examine the effectiveness of different fiscal tools (or a combination of them) in supporting a fiscally sustainable green recovery. Specifically, studies have examined whether carbon price measures, green public investments, and fiscal incentives for green private investment can help meet the Paris commitments while boosting output growth and maintaining fiscal sustainability.[134] Given the Intergovernmental Panel on Climate Change scenarios for future carbon emission paths, the simulations provide insights on the fiscal package (say, carbon taxes and fiscal incentives for green investments) that can meet those emission paths while minimizing the economic costs of the transition to low carbon.

To incentivize green private investments, governments in the region should provide macroeconomic, institutional, and regulatory frameworks that support investments in green solutions and technologies. Tax incentives should be consolidated in tax laws to boost transparency. Fossil fuel subsidy reforms—along with the introduction of carbon pricing—are essential to provide relative price signals to reallocate resources to green sectors. Green incentives should have clear eligibility criteria to limit government discretion. This implies a gradual shift among countries in the region from broad-based tax holidays to more targeted and cost-based incentives.

Carbon taxes are likely the most effective instrument to affect relative prices and reallocate resources toward green and green-related economic sectors; however, continuous increases in nonrenewable energy prices are not politically feasible. Hence, public investment in low-carbon sectors might become more attractive despite the fiscal costs. The model simulations show that carbon pricing alone cannot achieve the reduction of emissions outlined in the Paris targets.[135] The increase in carbon prices (through a carbon tax or by selling emission rights) would have to climb sharply to meet these targets. Although this measure would increase fiscal revenues and reduce debt in the short term, the fiscal outcomes are reversed due to the negative impact on economic activity during the transition period.

Green public investments alone (amid no increase in carbon prices) would enhance growth in the short run, but this strategy would result in a considerable increase in the level of public debt.[136] In addition, the simulations show that in a scenario where policy makers do not jeopardize debt sustainability, the maximum public investment would not meet the Paris targets. The simulations also suggest that carbon pricing and green investments are complementary tools and must be used jointly. Fiscal incentives for green private investments financed by the revenues arising from carbon taxation would further encourage the private sector to invest in green energy and technologies.[137]

133 Pigato (2019).

134 See Forni and Catalano (2021) and Pigato et al. (2021).

135 Forni and Catalano (2021) assume that the carbon tax would affect firms' input costs and that these higher costs are transferred to consumers.

136 See Forni and Catalano (2021) and Pigato et al. (2021).

137 Recent evidence shows that spending multipliers for clean energy and biodiversity conservation for a sample of developed and developing countries from 1991 to 2019 are greater than one. The point estimates of the renewable energy investment multiplier are 1.1 to 1.5, while those of fossil fuel energy investment are 0.5 to 0.6. More broadly, multipliers associated with green spending are larger than those associated with non-green spending, although the magnitude of such differences depends on the horizon and specification (Batini et al. 2021).

Finally, debt-financed public investments in green sectors, when jointly undertaken by countries, would support the economic recovery by reducing GHG emissions and improving fiscal space and debt sustainability—especially in countries that are more exposed to climate-related shocks. Additional green investment that is undertaken only by high-emitting governments (mostly in advanced and emerging economies) would increase domestic demand and induce positive trade spillovers for low-income and climate-vulnerable countries, and it would help mitigate increases in temperature.

Monetary and Financial Policies

Climate change and monetary policy are interrelated through the response of central bankers to supply or demand shocks triggered by climate disruptions. For instance, droughts may harm agricultural production and lead to spikes in agricultural prices. Floods may damage infrastructure in major cities and industrial areas (affecting property and physical plants), disrupting power supply and displacing workers. In other words, climate change is important for monetary policy to the extent that climate shocks (and mitigation policies) influence the frequency and amplitude of supply shocks (for example, spikes in agricultural prices), output fluctuations, and other sources of risk and economic volatility.

How should central banks react to climate-related increases in inflation and declines in economic activity? Model simulations suggest that targeting nominal income rather than prices better accommodates output fluctuations and anchors inflationary expectations. Targeting income is also more resilient to imperfect information on the current state of the economy, compared with other monetary policy rules. Furthermore, climate policies can pose challenges to the central bank response to climate-related shocks. For instance, central bank inflation forecasting is more difficult with fluctuating energy prices under cap-and-trade policies than under carbon taxes. Finally, the increase in the frequency and amplitude of climate-related negative supply shocks poses challenges in forecasting output gaps and, hence, inflation.[138]

The low-carbon transition also poses risks to the financial system—and they take the form of losses associated with stranded capital and dwindling revenues and profit prospects in carbon and carbon-related activities.[139] According to the literature, monetary policy could support the transition to a low-carbon economy in two ways: (i) adapting the collateral framework of central banks, and (ii) using environmental, social, and governance criteria to purchase assets in large scale.[140] Some have suggested operations that shift the central bank portfolio to green assets and away from carbon-related assets to reflect climate risks.[141] First, there is the need for better assessment of climate risks in central banks' collateral frameworks and asset portfolios. It has been proposed that central banks should develop their own methods to assess climate risks as credit rating agencies tend to underestimate them. It is the mandate of the central bank to reflect adequately the risks in its portfolio—including climate risks. Second, some have proposed the recalibration or implementation of parallel asset purchases that boost the price of low-carbon assets.[142] Others have suggested the use of guarantees by the central bank to increase

138 McKibbin et al. (2020).
139 See NFGS (2019).
140 Coeuré (2018).
141 Krogstrup and Oman (2019).
142 van Lerven and Ryan-Collins (2017); Olovsson (2018).

financing for the massive investments required to transition to a low-carbon economy.[143] Finally, the extent of the transition risks from climate change may increase the vulnerability of the financial sector to climate risks. Ensuring financial stability may require the integration of macroprudential and monetary policies into a unified macro-financial stability framework.[144]

The economic transformation associated with the shift to a low-carbon economy requires massive investments. In this context, a wide array of financial policy measures have been proposed to mobilize resources supporting private climate finance[145]: (i) tools redressing the underpricing and opacity of climate risks in financial markets and regulatory prudential frameworks (for example, capital adequacy requirements and sectoral capital buffers targeting credit to particularly climate-exposed sectors), (ii) measures improving the governance framework of financial institutions (to strengthen incentives for financing socially desirable investments), (iii) support for market development for green financial instruments (that is, promoting the development of platforms, information, and active issuance), and (iv) incentives toward climate finance (for instance, via unconventional monetary policies for financial regulation adjustments).[146]

Agriculture and Climate Change Adaptation Measures

One of the main channels through which climate change adversely impacts the economy is lower agricultural production—and many countries in Sub-Saharan Africa are vulnerable to climate change since they are heavily reliant on rainfed agriculture.[147] Household-level evidence corroborates the hypothesis that climate change adversely affects farmers. For instance, climate shocks lead to a reduction in crop net revenue in Ethiopia, and the impact varies by agroecological area.[148] In East and Southern Africa, there is evidence of reduced harvests and income in the aftermath of El Niño.[149] Additionally, poorer households have greater exposure to drought risk in Zambia, and their likelihood of being poor increases by 2 percentage points in the event of lower-than-normal rainfall.[150] Climate shocks can lead to spikes in agricultural prices. Climate-related increases in cereal prices can sharply increase urban and rural poverty in Eswatini.[151]

Achieving the greenhouse mitigation targets at the lowest cost possible requires major changes in behavior and production methods. In this context, many countries are implementing adaptation policies and investments to shield the economy from the negative impact and exploit the positive effects associated with climate change. Public spending policy will need to remain flexible to enhance climate resilience (see box 2.2). Proactive government policies, planning, and investments to provide information, incentives, and an enabling environment to encourage households, communities, and the private sector to change their behaviors, consumption, and investment choices are needed. Given the higher frequency and intensity

143 Dasgupta et al. (2019).
144 Aglietta et al. (2018).
145 Krogstrup and Oman (2019).
146 The first three types of measures are aimed at more adequately assessing climate risks, while the last one raises a series of issues of policy trade-offs (Krostgrup and Oman 2019).
147 See Collier, Conway, and Venables (2008); Abidoye and Odusola (2015).
148 Deressa and Hassan (2009).
149 Al Mamun et al. (2018).
150 Ngoma et al. (2019).
151 Sam, Abidoye, and Mashaba (2021).

of climate-related events, farmers need to enhance their resilience to climate change. Climate change can affect food production and, hence, heighten food insecurity and increase poverty as people in rural areas rely on agriculture to earn their livelihood. Having a better understanding of the impact of climate change will be key to developing an ecosystem management system that will ensure sustainability.[152]

Farm-level research has investigated how Sub-Saharan African farmers adapt to climate change. For instance, evidence from farmers in three regions in South Africa—Limpopo, North West, and KwaZulu Natal—shows that: (i) more than four in five farmers were aware of increased variability and unpredictability of rainfall (climate change), (ii) farmers shifted resources away from crop production and toward livestock management in response to dry spells, and (iii) farmers acted collectively to reduce the vulnerability related to climate uncertainty—in particular, farmers involved in poultry and egg production that rely on indigenous breeds due to their resistance to drought.[153] In Ethiopia and South Africa, there is evidence that 1,800 farmers have adapted to climate change by sowing different crops, changing sowing dates, increasing access to irrigation, and practicing soil conservation.[154] However, there were some differences in adaptation practices across countries. For instance, access to extension services and climate information were essential in Ethiopia, while access to fertile land and government farm support were key for farmers in South Africa.[155] Restricted access to credit, inadequate extension services, and poor provision of improved seeds hamper climate adaptation measures among Kenyan farmers.[156]

A survey of 325 small and medium-size enterprises in semiarid regions of Kenya and Senegal evaluates their ability to adapt to climate shocks. It distinguishes sustainable adaptation (say, changing the product mix) from unsustainable responses (say, distress asset sales). The surveyed enterprises are heavily exposed to climate risks and use a wide array of strategies to deal with them. Some of the measures are aimed at keeping business continuity (sustainable adaptation) but others yield a contraction in activity (unsustainable adaptation). Sustainable adaptation practices are less effective if the extreme climate events become more frequent. The ability of firms to adapt sustainably depends on factors that can be influenced by policy intervention. On the one hand, financial barriers and poor market access reduce the probability of sustainable adaptation. On the other hand, access to information, government support, and specific assistance increase that probability. Finally, firms will start planning for future climate change as long as they continuously engage in sustainable adaptation.[157]

Recent evidence claims that more intensive use of imported inputs among low-income countries can help improve agricultural TFP and shield this activity from the adverse effects of climate-related shocks.[158] Using a broader sample of 162 countries from 1991 to 2015, it was found that there were stronger weather effects on agricultural productivity in countries using fewer imported inputs, and temperature and rainfall anomalies do not significantly affect those using a higher proportion of imported inputs. These findings could be attributed to the high

152 Abidoye (2021).

153 Thomas et al. (2007).

154 Additional evidence from Ethiopia suggests that crop diversification, soil and water conservation, and seasonal migration were the most prominent adaptation strategies used by farmers in the Dera woreda (Atinkut and Mebrat 2016).

155 Bryan et al. (2009).

156 Bryan et al. (2013).

157 Crick et al. (2018).

158 Garcia-Verdu et al. (2019).

quality of imported inputs and that they embed better technologies. Hence, a greater proportion of imported inputs makes farmers less vulnerable to local climate shocks. These effects are compounded by likely spillovers on the producers of domestic intermediate goods.

Climate-smart agriculture (CSA) is perceived as an appropriate strategy to attain food security while adapting to and mitigating the effects of climate change.[159] A wide array of CSA technologies being implemented in the region are promising tools for climate change adaptation and risk management—including agroforestry, soil and water conservation technologies, and climate information services, among others (Goyal and Nash 2017). Future climate projections for Sub-Saharan Africa suggest that most countries in the region will fail to meet the targets of the Sustainable Development Goals if no actionable measures are implemented to reduce the climate-related risks to agriculture.

Conservation agricultural practices are influenced by increased soil degradation—notably, in arid and semi-arid areas of the continent, where low soil organic matter, limited use of fertilizers, and recurrent droughts are lowering crop yields.[160] These conservation practices include crop rotation, mulching to maintain soil cover, and minimum tillage.[161] Evidence shows that growing cover crops, applying green manures, and mulching have contributed to improved soil fertility and soil water retention in the dry areas of Burkina Faso, Senegal, and Niger.[162] Minimizing tillage activities also provides several benefits to African farmers, including increased water infiltration, improved soil organic matter, and moisture retention. It also reduces labor costs in land preparation and synchronizes better early planting with the onset of rainfall.[163]

Diversifying agroecosystems with integrated approaches such as agroforestry (which combines trees with crops and/or livestock) can contribute to improve food security and, more broadly, resilience to climate change.[164] Farmers in the arid and semi-arid zones of West Africa have been applying farmer-managed natural regeneration (FMNR) practices. For instance, these practices in Niger led to the planting of millions of trees with a series of co-benefits, namely, soil fertility, biomass for household energy, and resilience of cultivated fields to windstorms. Leaves of planted fodder trees have been used to feed the livestock—especially during periods of drought and grass scarcity.[165] FMNR practices can also play the role of a safety net for farmers in the event of climate-related output and productivity contractions. In Ghana, FMNR practices such as planting and protecting multi-purpose trees on farmlands could increase household income by US$887 per year.[166]

159 CSA involves innovations that boost productivity for improved food security, enhance adaptation and resilience to climate change and variability, and cut GHG emissions (FAO 2010; Lipper et al. 2014).

160 Buah et al. (2017); Lahmar et al. (2012).

161 Giller et al. (2009).

162 Bayala et al. (2012).

163 Obalum, Igwe, and Obi (2012).

164 Sinare and Gordon (2015).

165 Tougiani, Güero, and Rinaudo (2009); Martin et al. (2016).

166 Binam et al. (2015).

BOX 2.2: Public Spending on Agriculture: Emerging Priorities to Enhance Climate Resilience

Public spending policy will need to remain flexible to cope with future challenges, and for agriculture, probably none is more urgent than climate change. It is a threat for agriculture across the world, but the lack of resilience of poor farmers makes it particularly severe in Sub-Saharan Africa. Projections show yield decreases in the near term of 5 percent, potentially growing to 15–20 percent across all crops and regions in Sub-Saharan Africa by the end of the century. Agriculture is also an important contributor to greenhouse gas emissions, particularly from deforestation, and Africa is the only region where most production increases have come from expanding cultivated areas, generally at the expense of forests. In Africa, as around the world, a more climate-resilient agriculture sector is needed to achieve the triple win of enhancing agricultural productivity, mitigating emissions of greenhouse gases, and helping farmers adapt to climate change.

Most investments to mitigate climate change (low-carbon growth) and adapt to it (resilience building) will need to be made by farmers and other private agents. But proactive government policies, planning, and investments will be required to provide information, incentives, and an enabling environment to encourage communities, households, and the private sector to change their behaviors and investment choices. Many climate-resilient investments will not be very different from productive investment choices. Building resilience has overall benefits in any case, but their value is amplified by the changes that will occur with global warming.

For public spending priorities, climate-smart agriculture entails using landscape approaches to invest in managing climate risks through developing drought- or flood-resistant technologies, understanding and planning for transitions to new adapted cropping and livestock systems and livelihood options, and reducing greenhouse gas emissions from livestock practices and land use changes that cause deforestation and losses of biomass and soil carbon. Increasing resilience, restoring degraded lands, and managing ecosystem services better will play key roles in all of these. Efforts to craft budgetary and policy choices to create a more climate-smart agriculture will have to cope with special challenges rooted in many uncertainties, distributional issues, and the long-term nature of the problem. To help meet these challenges, public expenditure reviews will need to do a better job than in the past of incorporating considerations of climate change.

Source: Goyal and Nash (2017).

Climate information services are an important tool for climate risk mitigation among farmers in Sub-Saharan Africa—as most of them depend on rainfed agriculture.[167] Climate services can provide farmers information on rainfall distribution patterns, frequency and intensity, and the likelihood of extreme events (for example, droughts). Having easy access to such information is essential to decide when to start land preparation, when to plant, and crop selection variety, among other tasks.[168] There is evidence that farmers using climate information services used fewer inputs in their production systems relative to those who did not use these services. It reduced production costs and increased profits from high-yield crops.[169] Finally, the use of innovative digital technologies among farmers in the region can help improve their access to accurate local weather forecasts.

167 Lodoun et al. (2014); Boansi et al. (2019).
168 Fitchett and Ebhuoma (2018); Zare et al. (2017); Wanders and Wood (2018).
169 Ouédraogo et al. (2015).

Institutions supporting CSA practices are essential to promote awareness and capacity development of CSA innovations in the region. Here, nongovernmental organizations, civil society organizations, the private sector, governments, and farmer-based organizations can play an important role. Yet, CSA practices may face a series of challenges, including[170] (i) limited understanding of the technologies that need to be prioritized for productivity, adaptation, and mitigation; (ii) compatibility in objective-setting for farmers and policy makers—as well as management of their trade-offs; (iii) the need to understand the economic implications of CSA practices and develop a business case to attract investments; and (iv) compatibility challenges posed by the mainstreaming of CSA into already existing policy frameworks.

Land policies. Land policy is a powerful lever for reducing GHG emissions and strengthening resilience to climate change. Land is fundamentally linked to both climate change mitigation and adaptation. The land use sector has potential to reduce emissions, sequester carbon, and increase human and biophysical resilience. Large and growing evidence demonstrates that sustainable land management and restoration often provide positive and lasting contributions toward societal well-being and sustainability. This includes multiple benefits such as job creation, disaster risk reduction, climate change mitigation, and adaptation for current and future generations. Climate change raises questions for land policies as a whole, not just questions of tenure security, but also wider issues of land access and redistribution, urban settlement, and the overall governance of land resources.[171]

Although the linkages between climate change and land tenure are complex and indirect, the effects of climate change and variability are felt through changes in natural ecosystems, land capability, and land use systems. Increasingly, these changes place a limited supply of land under greater pressure, for both productive use and human settlement. As a result, land issues and policies are key considerations for adaptation planning, to strengthen land tenure and management arrangements in at-risk environments. Secure land rights, provided on an individual or community basis, are likely to increase people's incentives to invest in and take advantage of adaptation strategies. Africa's dryland farmers and pastoralists, for example, face serious implications including the decreased viability of rainfed dryland farming, changes in the geographical ranges within which arable farming and cattle raising are feasible (including possible increased opportunities as well as constraints for pastoralists in some regions), and overall increased land and water competition.[172] These are all issues for which Africa's dryland farmers have already been adapting to some degree to current and recent patterns of climate variability, which, under climate change, are likely to be exacerbated. However, the adaptive responses required in the future should not in principle be very different from existing adaptations to climate variability except in scale and pace, at least in the medium term and excepting extreme climate change impact scenarios. In view of this, much can be learned from understanding how farming populations and the formal and informal institutions that shape and regulate land resource use have adapted to these changes.

170 Partey et al. (2018).
171 IPCC (2019).
172 Brooks (2006).

However, current assessments of the challenges of adaptation tend to focus on the scope for substitution of existing crops with more drought tolerant species and varieties, adaptive research to develop more suitable varieties, land use management and agroforestry to improve water retention and promote crop diversification, wider development of credit availability, crop insurance, improved weather forecasting, and introduction of payments for avoided deforestation/reforestation by small farmers to substitute for loss of farm income. African farmers have traditionally spread their risks by planting a variety of crops in different types of locations or agroecological niches. However, growing populations and increasing competition for land are eroding farmers' opportunities to pursue these strategies. Tenure security tends to increase the incentives for people to invest in and take advantage of these types of adaptation. Examples from northern Nigeria and Niger illustrate cases of successful adaptation practiced in high population density areas despite decreases in rainfall and population growth. Farmers have been able to preserve soil fertility and yields through more intensive small-scale farming practices involving higher livestock densities, soil and water conservation, crop diversification, and integrated farm management approaches. Reasonable confidence in tenure security appears to be an important underlying condition for these sorts of sustainable intensification.[173]

In East Africa, local adaptation involving small-scale and precision irrigation has been carried out and is a proven strategy to cope with climate variability. To sustain these strategies, the right of the poor to access these water resources needs to be recognized and incorporated into national or local natural resource arrangements. Specific land policy measures and integration of land policy action with wider adaptive planning will need to take place at the national and subnational levels, according to specific sets of climate change impacts and bearing in mind existing legal and institutional frameworks. The coherence of land policy with related areas, including agricultural, forest, and environmental management policies, is a critical concern.

The urban poor are also vulnerable because they are frequently located in informal settlements in low-lying areas vulnerable to flooding, which generally suffer from poor drainage, infrastructure, and sanitary conditions and inadequate housing conditions. There is widespread analysis showing that climate change compounds existing baseline stresses in urban areas. Perhaps the most important experiences in making the urban poor less vulnerable to climate change in cities are those that have successfully improved housing conditions, infrastructure, and services in low-income settlements (Quan and Dyer 2008).

Energy Access

Sub-Saharan Africa has the lowest access rates to electricity in the world. Nearly half the population in the region has access to electricity while only one-third has access to clean cooking. By 2019, 13 countries in the region had less than 33 percent access to electricity, while only four countries had access rates that exceeded 90 percent. The lack of energy access hinders economic growth. Clean energy presents opportunities to unlock sustainable development, improve health, and build resilience in communities and countries—thus reducing the risk of massive migration

173 Quan and Dyer (2008); Ingram and Yu-Hung (2011).

across the continent.[174] Decentralized solar power systems for electricity and improved biomass or liquefied petroleum gas for clean cooking are solutions that could help Africans narrow the energy access problem. However, governments need to implement policy reforms and mobilize public and private finance to reach the goal of universal access in the region.

In sorting through various possibilities for accelerated electrification, it is important to note that national electrification strategies generally seek to address several development objectives. These include facilitating accelerated income growth and job creation, 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 will also 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.[175]

Access to electricity via national grids will still play an important part of energy access solutions in the continent. In addition, advances in renewable energy technologies—particularly, solar and wind—can provide opportunities for access to the populations that are unserved or underserved by national grids. Progress in clean energy technologies may enable African countries to leapfrog fossil fuel–dependent and centralized power system models.[176] For instance, decentralized solar power systems—including mini-grids—are allowing the rural unconnected and the urban underserved populations to enhance their access to electricity in East Africa and West Africa. Although the cost per kilowatt-hour for clean energy alternatives is still higher than grid connection, clean energy reduces pollution and provides cheaper access than diesel generators for local use.

The estimated level of investment required to meet the goal of universal energy access in Sub-Saharan Africa is US$27 billion per year over 2018–30.[177] The investment needs more than double the current level of financing—thus emphasizing the need for dramatically mobilizing resources from private actors at home and abroad. In the short term, fossil fuel subsidy reform could help shift resources toward clean energy and contribute to narrowing the financing gap. Still, mobilizing private finance is key for implementing decentralized clean energy solutions. There is also a role for development finance in attracting and blending with private finance to deliver decentralized renewable solutions in the region.

A well planned, evidence-based strategy for national electrification is essential. Such a plan includes 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

174 Rigaud et al. (2018).
175 Blimpo and Cosgrove-Davies (2019).
176 World Bank (2018).
177 IEA (2018).

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.

Improved electricity sector governance is critical 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.[178]

Finally, most Sub-Saharan African countries fail to have a comprehensive clean-cooking strategy, while others have poorly financed strategies.[179] National poverty alleviation and health strategies should include policies and financing for clean cooking. The gender component is critical in the strategy and its role extends from awareness campaigns to engaging women as entrepreneurs and champions. The financing gap for clean cooking is US$1.8 billion—an amount significantly lower than for electricity.[180] Still, progress in clean cooking requires the buildup of domestic capacity and outreach.[181]

178 Blimpo and Cosgrove-Davies (2019).
179 Hosier et al. (2017).
180 IEA (2018).
181 OECD, World Bank, and UN Environment (2018).

Appendix: Country Classifications

TABLE A.1: Country Classification by Resource Abundance in Sub-Saharan Africa

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

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

TABLE A.2: West and Central Africa Country Classification

Resource-rich countries		Non-resource-rich countries	
Oil	**Metals & minerals**		
Chad	Guinea	Benin	Gambia, The
Equatorial Guinea	Liberia	Burkina Faso	Ghana
Gabon	Mauritania	Cabo Verde	Guinea-Bissau
Nigeria	Niger	Cameroon	Mali
Republic of Congo	Sierra Leone	Central African Republic	Senegal
		Côte d'Ivoire	Togo

Note: Since July 2020, for operational purposes, the World Bank Africa Region has been split into two subregions—West and Central Africa and East and Southern Africa. The analysis in this report reflects this setup.

TABLE A.3: East and Southern Africa Country Classification

Resource-rich countries		Non-resource-rich countries	
Oil	**Metals & minerals**		
Angola	Botswana	Burundi	Mozambique
South Sudan	Democratic Republic of Congo	Comoros	Rwanda
	Namibia	Eritrea	São Tomé and Príncipe
	South Africa	Eswatini	Seychelles
	Zambia	Ethiopia	Somalia
		Kenya	Sudan
		Lesotho	Tanzania
		Madagascar	Uganda
		Malawi	Zimbabwe
		Mauritius	

Note: Since July 2020, for operational purposes, the World Bank Africa Region has been split into two subregions—West and Central Africa and East and Southern Africa. The analysis in this report reflects this setup.

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