



# CONSOLIDATING THE RECOVERY: SEIZING GREEN GROWTH OPPORTUNITIES

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# Executive Summary

## Consolidating the Recovery

The Latin America and the Caribbean region (LAC) is progressing toward consolidating its recovery from the COVID-19 crisis. Vaccination is well-advanced in most of the region, increasing resilience against new variants. The region is on track to recovering previous levels of GDP and employment. Schools are opening and firms are hiring. The long-term scars of the pandemic remain and continue to require attention. Since the onset of the pandemic, poverty rates for the region, excluding Brazil (measured at the poverty level of \$US5.50/day) rose to 27.5 percent in 2021 and are still above their pre-COVID levels of 25.6 percent. Students have lost between one and one-and-a-half years of education—leading potentially to 10 percent loss in their lifetime incomes. And many of the new jobs that have been created, particularly for women, are in small firms that are often informal. Further, the region faces increased uncertainties as it navigates recovery. New variants may appear; rising global inflation poses new policy dilemmas; the tragedy unfolding in Ukraine threatens the world economy in profound and unpredictable ways; and intensified urgency around global warming is prompting demands for far-reaching preventative action at national and transnational levels.

Still, amid this uncertainty, the need to continue to pursue the foundations for dynamic, inclusive, and sustainable growth remains paramount—and is even more urgent. The previous *Semiannual Report* in October 2021 (World Bank 2021) stressed the long-standing challenges in infrastructure, education, and technological and managerial innovation, and examined how the region might finance the necessary investments through a more effective state, efficient revenue mobilization, and reprioritization of spending. These reforms will take place in, and will need to reflect, the rapidly shifting global environment.

Chapter 1 describes the recent social and macroeconomic evolution of the region in the six months since the last *Semiannual Report*, and the near-term challenges it faces emerging from the pandemic, and, in particular, those arising from changes in the international growth context. The Russian invasion has introduced substantial uncertainty in forecasts but will clearly dampen the region's recovery and exacerbate inflationary pressures. Of longer-term salience, increased alarm over the pace of climate change has placed the issue squarely on the region's policy agenda. Chapter 2 examines some of the profound challenges climate change presents the region in terms of mitigation and adaptation, and as importantly, the growth opportunities a greening international context offers. The two are in fact related: in the short run, the war-driven spikes in energy prices and shortfalls in supply, particularly to Europe, have shifted focus from decarbonization to increasing the immediate supply of oil and gas, however possible, while simultaneously highlighting the need to develop renewables to become more independent of petroleum over the medium term.

LAC has now largely overcome the unexpected Omicron variant, with COVID-19 fatality ratios sharply abating by the end of February 2022. However, the pandemic cannot be said to be definitively over. New variants, such as the Omicron BA.2, are spreading in Europe, and major cities in China are again under lock down. However,



health systems around the world have developed tools and protocols that appear to be reducing the virus to an endemic, and plausibly manageable problem. Still, the accumulated social costs from the previous waves remain a challenge to redress, and many countries have not strengthened their resilience to future waves to the extent possible. Big gaps remain. While some countries in the region, including Chile and Uruguay, have among the highest complete vaccination rates in the world, many countries in the Caribbean and Central America have barely begun their vaccination drives and show little progress.

The strength of the economic recovery in LAC also varies greatly across countries—and remains susceptible to the weakening of previously strong tailwinds. While commodity prices remain strong, growth in China and advanced economies is slower than before the pandemic, dampening demand for the region's exports, and global interest rates are rising toward long-term levels. Forecasts of 2022 and 2023 growth remain modest, at 2.3 percent and 2.2 percent respectively. Currencies of commodity-exporting nations appear to have delinked from rising commodity prices—their weaknesses possibly reflecting political uncertainty, concern about the damage done by COVID-19, or rising debt burdens.

## ***Progress and Complications Facing the Recovery***

*Recurrence of the virus.* Any recurrence of the virus will lead to declines in economic activity, not only because of government measures to enforce social distancing, but also because half of the decline in economic activity arose from voluntary distancing due to people's fear of the disease. This is particularly the case in the Caribbean, where countries with high vaccination rates, such as the Dominican Republic, saw their tourism industries rebound, while those with low rates continue with sluggish growth.

*Rising global and local inflation.* Inflation in the region is hovering around 7 percent, giving rise to fears that wage contracts will build in expectations of future inflation, leading to a wage-price spiral that will be difficult to repress. Both headline and core inflation rates have exceeded central bank targets across the region, stressing household budgets and increasing poverty.<sup>1</sup> Authorities have become increasingly aggressive with interest rate hikes, with concomitant depressive effects on the recovery.

This situation is compounded by higher-than-expected inflation in the advanced economies, now exacerbated by commodities pressure and depressed global economic activity arising from the Russian aggression. Forecasts for growth in the United States, euro area, and Japan have fallen by 0.4, 1.0 and 0.6 percentage points, respectively, from January 2022 projections. Rising prices of oil and gas, metals, and grains may have an incipient stimulative impact in those LAC economies that traditionally export them, although the overall effect will depend on the expected temporary nature of those rises in commodity prices as well as on their volatility. For net importers, higher food prices will exacerbate poverty, and higher fuel and input prices will constitute a stagflationary shock accelerating inflation and depressing output. The net effect is likely to further slow LAC's recovery by an estimated 0.4 percentage points, down from 2.7 percent in January 2022.

Markets appear to believe both inflation in advanced economies and the oil squeeze will be transitory. At the time of writing, the rates on 10-year US Treasury bills remain below 3 percent and commodity futures markets predict the wave of rising commodity prices will have crested in April and will recede thereafter. Further, Emerging Market Bond Index (EMBI) spreads after a brief increase after Russia invaded, remain stable at their recent moderate rates, suggesting that the fall-out from the Ukraine crisis is not expected to affect debt servicing capacity in the region. Whatever the case, the US Federal Reserve will raise interest rates over the next several quarters, exacerbating the monetary dilemma of LAC's monetary authorities whether to increase interest rates (aiming to reduce inflation and depreciation pressures) or to decrease interest rates (to stimulate credit and

1 Headline inflation includes energy and food prices. Core inflation does not.



economic activity). The resulting pressure on exchange rates and inflation in the LAC region will require further interest rate hikes both to mitigate depreciation-driven price pass-throughs fueling inflation, and to defend the local-currency value of international debt payments. History suggests a “cycle within a cycle,” whereby central banks will first raise interest rates to achieve these ends, but then, once inflation is moderately under control, ease up to moderate the depressive effects on the recovery.

*Guarded optimism on financial sector solidity.* World Bank Pulse Surveys in July 2021 suggested that in many countries 40 percent to 60 percent of firms are in arrears as a result of pandemic-driven falls in revenues (World Bank 2021). In addition to dampening firm investment, this overhang had the potential to undermine the banking sector as arrears suddenly become non-performing loans. In most countries, however, the forbearance policies that allowed rolling over bank loans largely ended by summer 2021 and a sudden jump in non-performing loans has not materialized. Banks have been actively provisioning. This said, a significant fraction of loans in many countries were reprogrammed, some of which will become non-performing, or “evergreened” which may divert lending from more productive activities. Governments will also need to streamline debt resolution mechanisms that are currently unwieldy and monitor systemic soundness.

*Shift from fiscal stimulus to fiscal consolidation.* Declining government revenues and extraordinary efforts to protect families and firms during the COVID-19 pandemic have led to high deficits and increased government debt. The average ratio of public debt to gross domestic product (GDP) in LAC rose sharply during the pandemic by 15 points to 75.4 percent of GDP by the end of September 2021. While this percentage has declined to 73 percent of GDP during the recovery, it will continue to act as a brake on any major investments in equity and productivity-enhancing investments. Considering the dual need to put governments’ debt on a more sustainable footing as well as to boost economic growth and productivity, it is crucial to conduct “smart” fiscal adjustments. This calls for reducing public spending waste (estimated at about 4.4 percent of GDP) and being mindful of societal and macroeconomic costs of raising taxes, especially in those countries where the tax burden is already high.

## The Changing International Context for Growth

The COVID-19 crisis came on top of another “lost decade” of low growth for LAC. From 2010 to the outbreak of the pandemic in early 2020, LAC grew at 2.2 percent per year while the world grew at 3.1 percent. As noted, the forecasts for 2022 and 2023 are similarly lackluster and are insufficient to alleviate poverty or diffuse social tensions. The previous *Semiannual Report* highlighted a list of long-recognized internal shortfalls in infrastructure, education, energy policy, firm capabilities, and innovation that have been impeding growth in the region. Green shoots have appeared during the COVID-19 period, particularly in the digital realm, and the region is currently the largest recipient of venture capital flows in the developing world. However, unless deeper structural factors are addressed, anemic growth is likely to continue and will be insufficient to make progress on poverty alleviation and relieve social tensions.

But it is also true that the international context for growth is changing. Over a medium term of unpredictable duration, Russian aggression toward Ukraine and the aftermath will have countervailing impacts, with the net impact likely to be negative. Ukraine is a major supplier of grains, and restrictions on Russian crude and metal exports are likely to lead to increases in commodity prices over the next few years. Sanctions and global disruption have already taken a toll on trade and value chains. Russia is a major exporter of fertilizer to several countries in the region and an important export market for others. Brazil’s aircraft manufacturer Embraer ceased supplying spare parts and technical assistance to the Russian aviation sector; Russia is Ecuador’s fourth largest export market. In general, the war will put pressure on a wide range of prices in both advanced economies and LAC countries, exacerbating the monetary authorities’ dilemma.

## Challenges and Opportunities for Green Growth

Potentially more significant and long-term impacts arise from the *force majeure* of climate change that is prompting increasingly insistent calls for action at all levels of governance. The UN Climate Change Conference in November 2021, as well as recent reports by the Intergovernmental Panel on Climate Change (IPCC), sound the alarm on the accelerating pace of global warming and the closing window for action to prevent irreversible damage. Chapter 2 explores LAC's position within the shifting global context: how the region contributes to global warming and its agenda for moving toward more sustainable growth; how it needs to adapt to international policy shifts that will affect businesses positively or negatively, depending on their production processes, output, and sector; and how it can seize the growth opportunities presented by its unique endowments.

LAC contributes little to global greenhouse gas (GHG) emissions; the main drivers are agriculture and land-use change and forestry. Hence, the region's recipe for mitigation is unique. The region contributes approximately 8 percent of total global emissions. Unlike most other regions, these emissions arise largely from agricultural production—especially livestock production—and land-use change and forestry.

However, climate change poses important challenges to the region's economies. To begin, the myriad consequences of climate change are likely to push 2.4 million to 5.8 million people into extreme poverty by 2030, mostly through health-related effects, including the increasing prevalence of child stunting, vector-borne diseases, and diarrhea resulting from lack of access to safe water and sanitation, excessive heat, and more frequent floods. Extreme weather events, such as cyclones and floods, will take a toll on transport networks: 60 percent of the network in Jamaica, 50 percent in Haiti, 35 percent in the Dominican Republic, and 25 percent in Bolivia are vulnerable. The cost of overall disruption of infrastructure—power, transport, and water—as a share of GDP is close to 1 percent per year for most countries but could reach 2 percent in the Dominican Republic and 3 percent in Panama. These numbers are large when compared to the average yearly investment in infrastructure of approximately 1.5 percent of GDP. Importantly, without proactive action, agriculture is likely to be hit hard, with crop yields decreasing in nearly all countries except Uruguay and to a lesser degree Chile. Further, the region's energy grid relies heavily on hydropower. Climate change is altering hydrological cycles, making precipitation more variable and less predictable, undermining the overall stability of energy generation. Finally, the European Union's progressive embrace of Carbon Border Adjustment Mechanisms (CBAM) that would tax goods intensive in carbon or other environmentally damaging effects could put a brake on the region's exports.

Lowering emissions will have important costs in some sectors. At the 2021 Climate Change Conference, many LAC governments committed to reductions in carbon emissions, pledging to phase out coal and reduce deforestation by 2030. Clearly, meeting these goals will require changing how the region does business in important ways, some of which will necessarily constrain growth in some sectors. Over the long term, petroleum production will contract and the sector will likely become a "stranded asset." Reduction in deforestation necessarily implies reduced expansion of new cropland (although not necessarily crop production) and unsustainable forestry and mining. Under existing production techniques, reducing methane emissions from livestock would seem to require reducing herd sizes. Although the region's steel, cement, and other manufacturing industries contribute relatively less to climate change, they face few easy ways of reducing carbon usage—implying that, over the short term, carbon taxes would reduce output and raise prices. Viewed through the lens of technologies currently in use, such restrictive policies will have costs and are likely to face political resistance.

These costs, however, can be mitigated by improving the region's capability to identify and adopt new, greener technologies. A central message of this report is that climate mitigation and adaptation must be seen as issues of technological adoption and innovation that place this agenda precisely at the nexus with growth more generally. New herd management technologies are generating lower emission livestock and new agricultural

technologies are improving yields and productivity in farms—but the region needs to adopt these technologies. Regrettably, at the heart of the low growth documented in chapter 1 is precisely the weak regional performance in technological adoption and innovation. This “knowledge” or “innovation agenda” needs to be placed at the center of both the growth and greening debates, and the policy synergies between the two agendas are potentially great.

However, LAC has a tremendous “green comparative advantage” offering opportunities for new industries and exports. The region has one of the greenest power grids and least carbon-intensive economies in the world. This means that its products could, in many cases, more easily meet CBAM requirements and even command an “environmental quality” “green” premium on the world market.

LAC has vast potential in renewable electricity. Argentina, Chile, and Mexico are spanned by vast deserts that can host highly productive solar farms, while the Patagonia subregion has huge potential for on-shore wind power generation, and the region has endless coastlines suitable for off-shore wind farms. Central America, the Caribbean, and parts of South America also show potential for geothermal generation. The region has been an innovator in incorporating renewable energy generation into the power mix and has a thriving market that will facilitate branding it as a green producer.

The huge potential in renewable energy generation could be a key driver in the development of green hydrogen as an alternative energy source and potential export.<sup>2</sup> Green hydrogen can be seen as a means of “storing” intermittent renewable energy. It could eventually be used to power ships, airplanes, and other transport that cannot be easily electrified, as well as fuel in industries such as steel and cement that suffer from the same problem. It can also be an input into “green fertilizers.” Numerous foreign firms are working with Chilean authorities and there is growing interest in producing green hydrogen in Argentina, Brazil, and Mexico. The industry has large-scale economies, putting a premium on rapid movement by regional first movers. Hence, coordination is probably needed with other sectors, notably local transportation systems that could provide markets in early stages.

Argentina, Brazil, Bolivia, Colombia, Mexico, Peru, and Trinidad and Tobago also have substantial reserves of natural gas, which is considered a cleaner “transition” fuel away from more polluting sources—such as oil and coal—that also facilitates renewables integration. A complicating factor is that natural gas is often a byproduct of petroleum extraction and the long-term viability of petroleum production is in doubt. Moreover, the long-lived nature of new gas infrastructure means that it is not always consistent with the need to decarbonize economies by 2050 and can lead to long-term carbon lock-in.

The region is also highly urbanized, and its density allows for economies of scale in conservation, decarbonization of urban transport, energy efficiency, waste management, and circular economy initiatives,<sup>3</sup> and more generally, lower infrastructure needs per capita.

LAC potentially has among the world’s largest resources in two ingredients key to green technologies: lithium, which is critical to battery production, and copper. Sixty percent of global lithium resources are found in Argentina, Bolivia, and Chile. The challenge for the region will be to leverage resource extraction into higher valued added knowledge clusters that can generate the domestic capabilities to keep the extractive sector at the technological and sustainability frontier and evolve along the supply chain to subsidiary industries in such areas as batteries.

<sup>2</sup> Green hydrogen is defined as hydrogen produced by splitting water into hydrogen and oxygen using renewable electricity. Hydrogen has a wide range of uses, from non-electrifiable transport to fertilizer. Other “grey” or “blue” hydrogen is produced with processes that emit carbon (natural gas), with varying degrees of carbon capture.

<sup>3</sup> The circular economy refers to an economy that embeds industrial processes and economic activities that are restorative or regenerative by design, enabling resources used in production and final goods to maintain their highest value for as long as possible, and aims for the elimination of waste. A circular economy reduces material use, redesigns materials to use resources less intensively, and recaptures “waste” as a resource to manufacture new materials and products.

Finally, LAC is blessed with vast natural capital—freshwater, trees, biodiversity—that offer the potential for new industries based on the region’s advantage of housing half of the world’s biodiversity, as well as extensive forestlands that can foster a sustainable forestry value chain and ecotourism initiatives and serve as important carbon sinks. In fact, the region is so important to the climatic trajectory that there are strong global pressures for a more limited and sustainable development of the Amazon Basin, the world’s largest carbon sink. In principle, the climatic benefits of reforestation and afforestation projects could be “exported” as environmental services through the sale of carbon credits in voluntary carbon markets.

### ***Supportive Policy Measures***

Seizing these green opportunities will require a mix of incentives, institutions, coordination, and key public investments. A critical policy tool is getting prices right so they include the costs to the environment—reforming fossil fuel subsidies and establishing carbon taxes and emission trading schemes. These steps will enable and incentivize the adoption of many existing low-carbon technologies. Also key will be the establishment of credible, third-party verification and traceability mechanisms that will facilitate access to green premiums (and avoid future taxes) on goods, allow for exports of carbon credits/offsets, and draw on the growing green finance market.

It is important to recognize that many of the adaptation and mitigation technologies also enhance productivity. Climate-smart agriculture, for example, will help countries adapt to changing precipitation patterns by using water more efficiently and applying less fertilizer (avoiding emissions)—improving overall productivity for farmers. Governments can speed up the adoption of technologies that will promote growth while adapting to and mitigating climate change by reducing uncertainty through policy commitments, designing credible long-term plans, making complementary investments, and using de-risking mechanisms that reduce perceived risks and financing costs.

Ultimately, there is an essential complementarity between the long-standing innovation agenda and the green growth agenda. The requirements for adopting low-carbon technologies are similar to adopting any other kind of technology. Adapting them to the local context requires engineering talent, research and development (R&D), and inventive capability. By not investing in these capabilities LAC has been unable to exploit opportunities for growth and diversification in the past. Hence, building up innovation capabilities—investing in the required human, physical, and institutional capital—is vital for seizing green growth opportunities and ensuring a smooth transition to a low-carbon economy.

## Growth Outlook for the Region

### REAL GDP GROWTH RATES

	2019	2020	2021e	2022f	2023f	2024f
Argentina	-2.0	-9.9	10.3	3.6	2.5	2.5
Bahamas	0.7	-14.5	5.6	6.0	4.1	3.0
Barbados	-1.3	-13.7	1.4	11.2	4.9	3.0
Belize	2.0	-16.7	9.8	5.7	3.4	2.0
Bolivia	2.2	-8.7	6.1	3.9	2.8	2.7
Brazil	1.2	-3.9	4.6	0.7	1.3	2.0
Chile	0.8	-6.0	11.7	1.9	1.5	2.0
Colombia	3.2	-7.0	10.6	4.4	3.5	3.3
Costa Rica	2.4	-4.1	7.6	3.4	3.2	3.2
Dominica	5.5	-11.0	3.7	6.8	5.0	4.6
Dominican Republic	5.1	-6.7	12.3	5.0	5.0	5.0
Ecuador	0.0	-7.8	4.4	4.3	3.1	2.9
El Salvador	2.6	-8.0	10.7	2.9	1.9	2.0
Grenada	0.7	-13.8	5.3	3.8	3.4	3.1
Guatemala	3.9	-1.5	8.0	3.4	3.4	3.5
Guyana	5.4	43.5	19.9	47.9	34.3	3.8
Haiti	-1.7	-3.3	-1.8	-0.4	1.4	2.0
Honduras	2.7	-9.0	11.9	3.1	3.6	3.7
Jamaica	0.9	-10.0	4.6	3.2	2.3	1.2
Mexico	-0.2	-8.2	4.8	2.1	2.1	2.0
Nicaragua	-3.8	-1.8	10.3	2.9	2.3	2.5
Panama	3.0	-17.9	15.3	6.5	5.0	5.0
Paraguay	-0.4	-0.8	4.5	1.5	4.1	3.8
Peru	2.2	-11.0	13.3	3.4	3.1	3.0
St. Lucia	-0.1	-20.4	6.6	7.9	5.8	3.7
St. Vincent and the Grenadines	0.4	-5.3	-2.8	4.2	7.3	4.2
Suriname	1.1	-15.9	-3.5	1.8	2.1	2.7
Uruguay	0.4	-6.1	4.4	3.3	2.6	2.5

Source: World Bank staff calculations.

Note: The cut-off date for the data is March 30, 2022. "e" stands for estimate; "f" for forecast

## References

World Bank. 2021. *Recovering Growth: Rebuilding Dynamic Post-COVID-19 Economies Amid Fiscal Constraints*. LAC Semi-annual Report (October). Washington, DC: World Bank.





CHAPTER 1

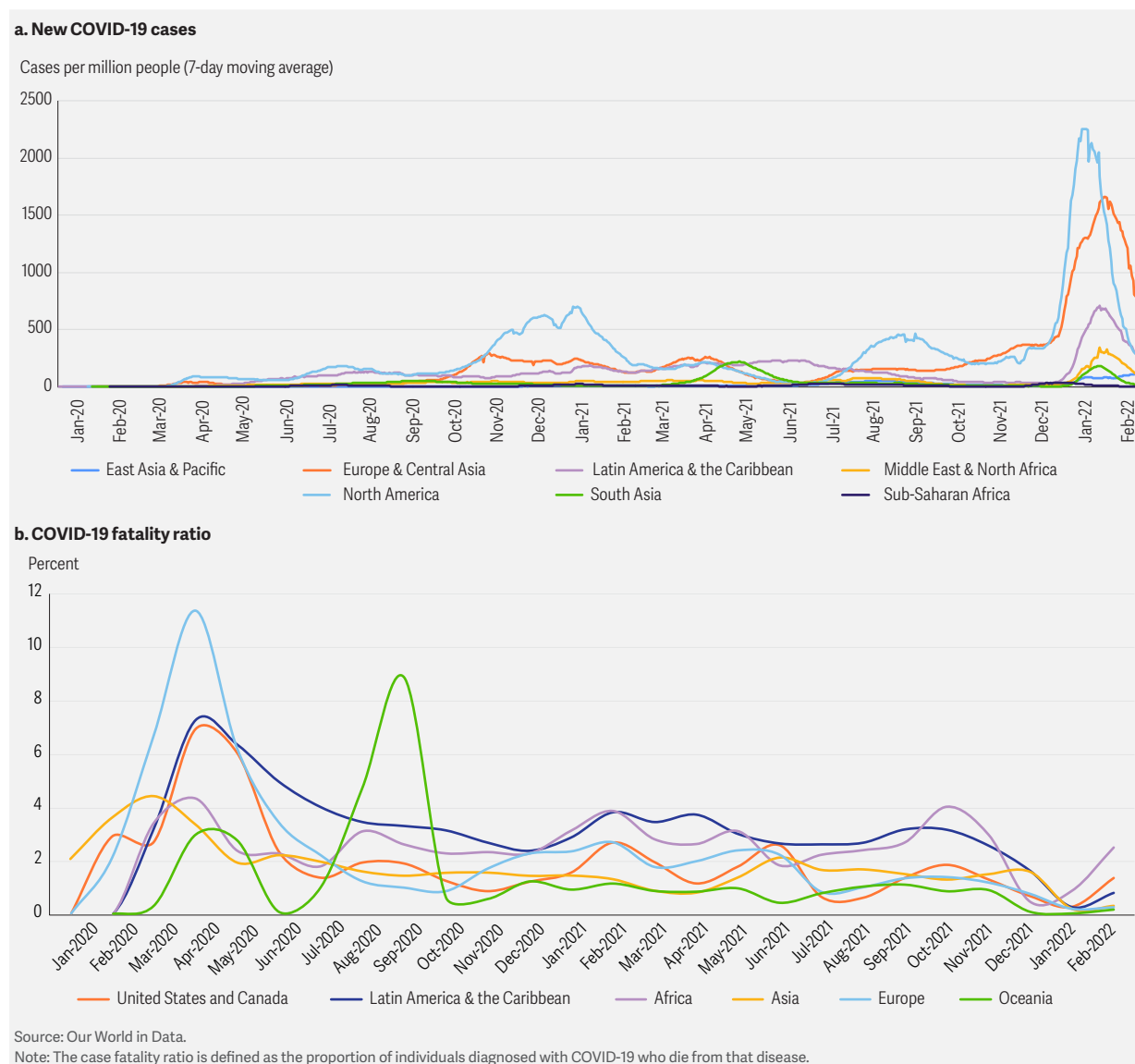
# CONSOLIDATING AN UNCERTAIN RECOVERY



## COVID-19: A Fading Threat, but Still Work to Do

The Latin America and the Caribbean (LAC) region is on track to recover from the COVID-19 pandemic. Despite record-high new cases in late 2021 and early 2022 due to the highly virulent Omicron variant (figure 1.1, panel a), the case fatality ratio has been at the lowest level in the region since the beginning of the pandemic (figure 1.1, panel b). While the pandemic cannot be said to be definitively over given that emergence of the Omicron BA.2 variant and that China is entering a new phase of lock downs, the steady fall in the case fatality ratios around the world suggests that health systems are developing tools and protocols that may eventually reduce the disease to an endemic but manageable problem.

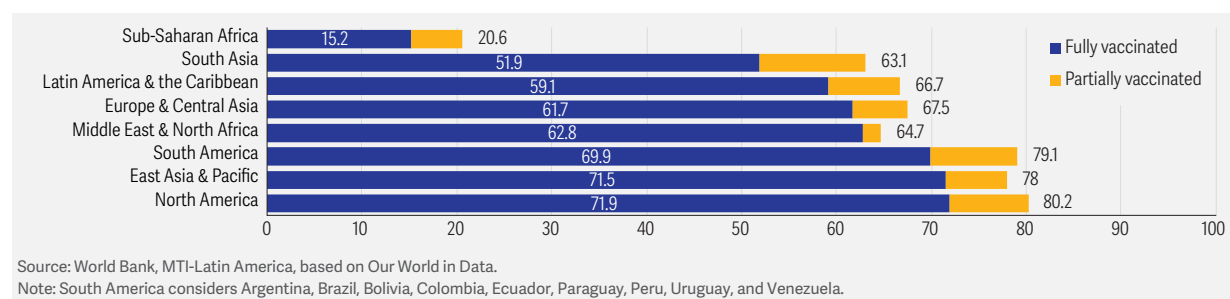
**Figure 1.1. COVID-19 New Cases and Fatality Ratios**



## Vaccination Progress: Dramatically Successful, but Mission Not Yet Accomplished

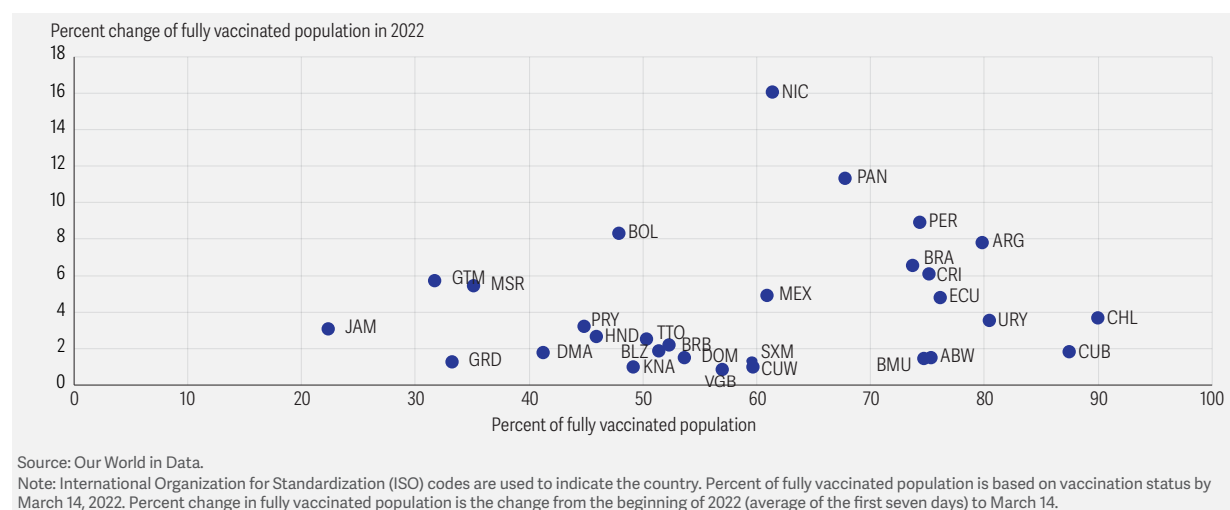
Clearly, the most critical human milestone during this pandemic has been the rapid scientific development and deployment of more than 10 billion vaccinations around the world in less than two years. In fact, taken as a whole, the region has achieved high vaccination progress (figure 1.2). Almost 60 percent of its population is fully vaccinated and about 67 percent have received at least one dosed.

**Figure 1.2. Vaccination Progress across Regions in the World (Percent of Population)**



Unfortunately, the encouraging overall vaccination rates in the region hide important variations among countries (figure 1.3). While some countries, such as Chile and Uruguay, have some of the highest complete vaccination rates in the world, many others (especially in the Caribbean and Central America) have barely begun to vaccinate their populations and show little progress. The danger is precisely that these countries will lack resilience to any new variants that may emerge, again paralyzing important sectors, particularly tourism. An illustrative example is offered in the cases of New Zealand and Hong Kong SAR, China, by the beginning of March 2022. The former had 90 percent vaccination rates against the Delta and previous strains and has experienced negligible Omicron-related deaths, while Hong Kong SAR, China, despite similar infection rates, had low vaccination rates among older people and suffers very high Omicron death rates.<sup>1</sup> The case for vaccination is clear at this point. The low vaccination rates are, in some cases, due to issues of availability, but in other cases, vaccine resistance has also impeded progress.

**Figure 1.3. Variation in Vaccination Progress among LAC Countries**

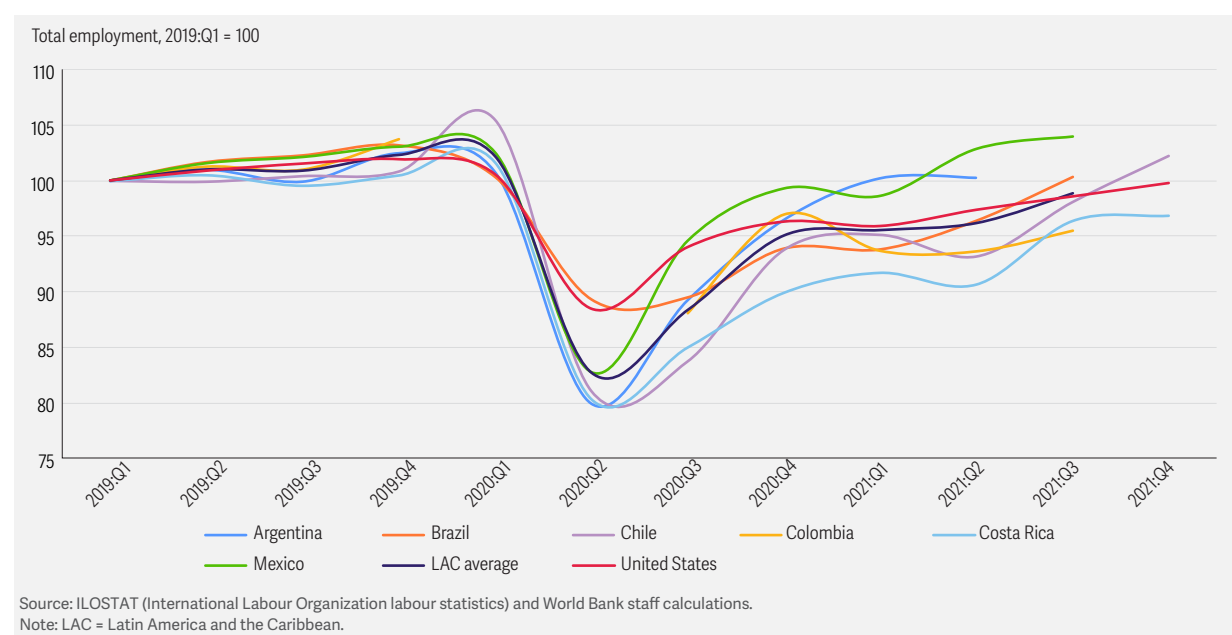


1 Johns Hopkins University, CSSE COVID-19 data.

## Labor Markets: Uneven Recovery, Persistent Setbacks among Vulnerable Groups

The sharp drops in economic activity have led to dramatic declines in employment. In Argentina, Chile, Costa Rica, and Mexico, employment fell by about 20 percent between the first and second quarter of 2020 (figure 1.4). It slowly increased to nearly recover its pre-pandemic levels by the end of 2021. However, this recovery obscures a longer-term decline in the quality of employment, and the unevenness of the recovery across demographic groups.

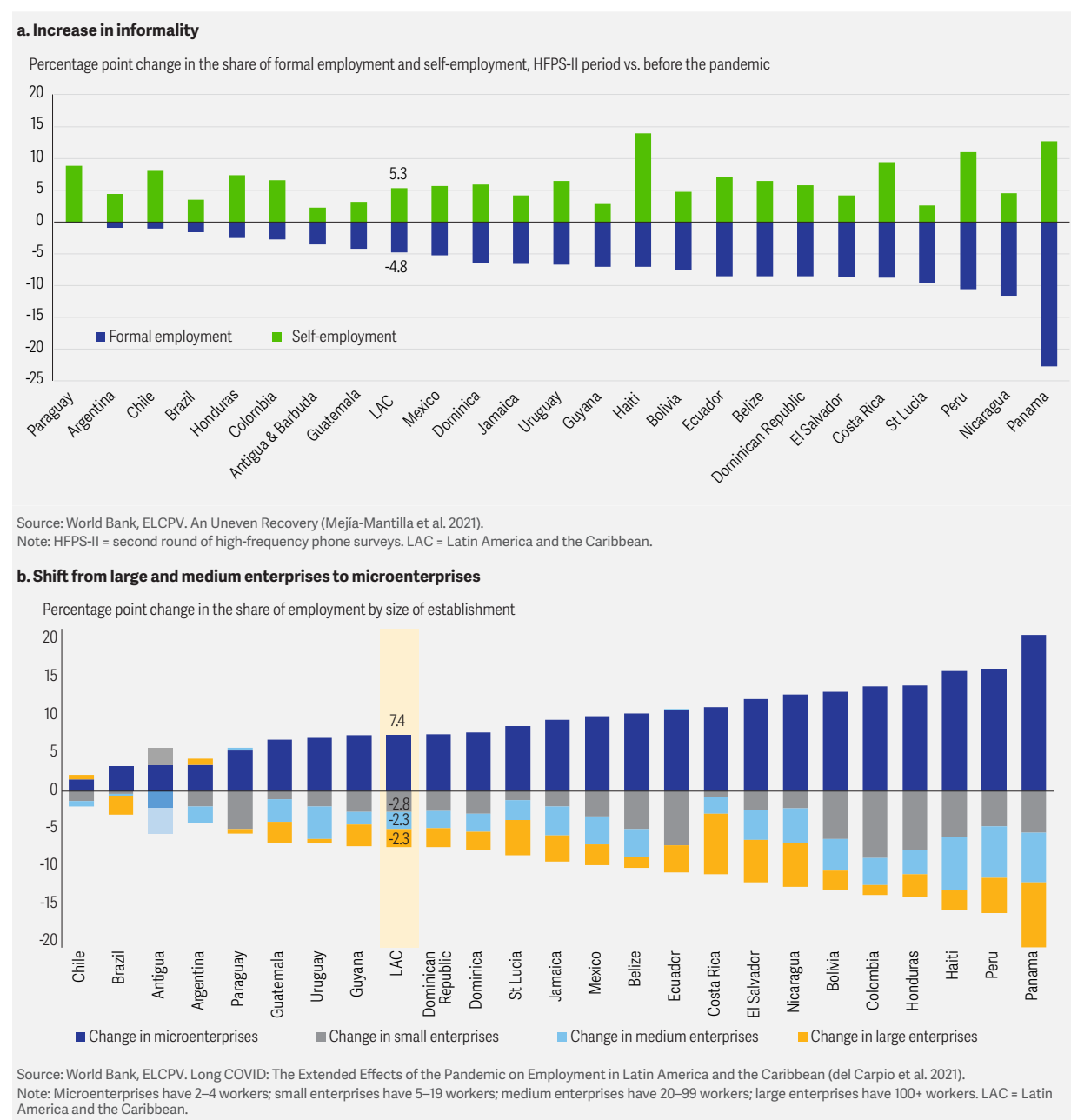
**Figure 1.4. Employment Losses Were Vast but Have Almost Been Recovered**



The decline in quality is visible in the fact that much of the recovery of employment has been in informal and small enterprises. Figure 1.5 shows that the share of formal employment has fallen by almost 5 percentage points on average (figure 1.5, panel a, from Mejía-Mantilla et al. 2021), with countries such as Panama, Peru, and Nicaragua experiencing a decrease of more than 10 percentage points. By contrast, the share of self-employed workers has risen on average by 5 percentage points in LAC, with increases greatest in Haiti, Panama, Peru, and Costa Rica. While employment in small, medium, and large enterprises has declined, on average, employment in microenterprises has increased by 7.4 percentage points (figure 1.5, panel b, from del Carpio et al. 2021). In addition, the average number of hours has fallen and income has not recovered. Nearly 50 percent of all households in the region have seen their total income drop back to pre-pandemic levels (Mejía-Mantilla et al. 2021).

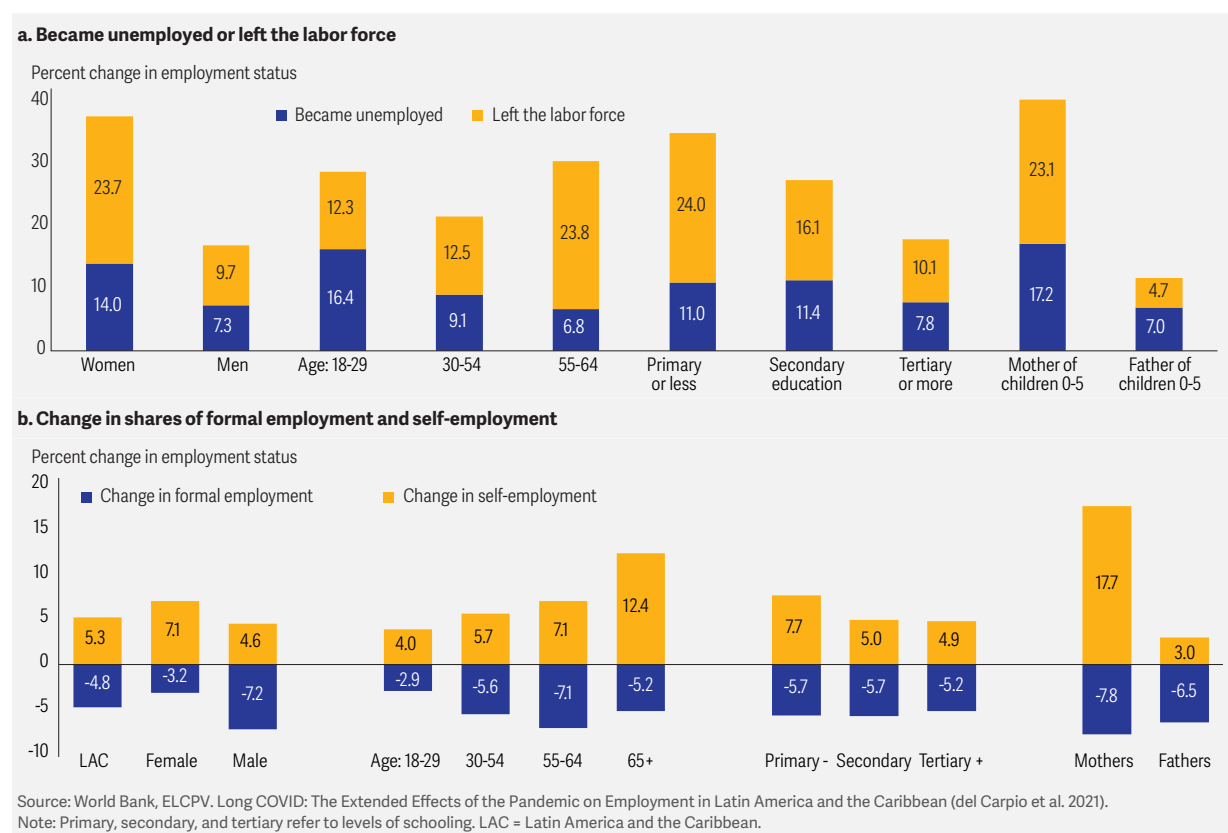
The effects of the pandemic have varied across demographic groups and the recovery has been similarly uneven. Since the onset of the pandemic, 38 percent of females have stopped working, compared to 17 percent of males (del Carpio et al. 2021). Of those women who stopped working, about 60 percent left the labor force, with mothers of children between 0 and 5 years old finding the return to work especially difficult. Young and older workers became unemployed or left the labor force at a higher rate than those between 30 and 54 years of age. Similarly, those with less education were more prone to stop working and leave the labor force than those with secondary or higher education (figure 1.6, panel a).

**Figure 1.5. Job Quality Has Deteriorated**



In the recovery, these groups not only have benefited less from the slow recovery but also have been more affected by the deterioration in the quality of employment. Women, and particularly mothers of small children, disproportionately are found in self-employment, and fewer women have returned to the labor market than men. Older workers have decreased their formal employment relative to younger workers, while self-employment has affected less educated workers the most (figure 1.6, panel b).

**Figure 1.6. Vulnerable Groups Are Disproportionately Affected**



## Education: Long-Term Scarring from COVID-19 Will Affect Earnings and Growth

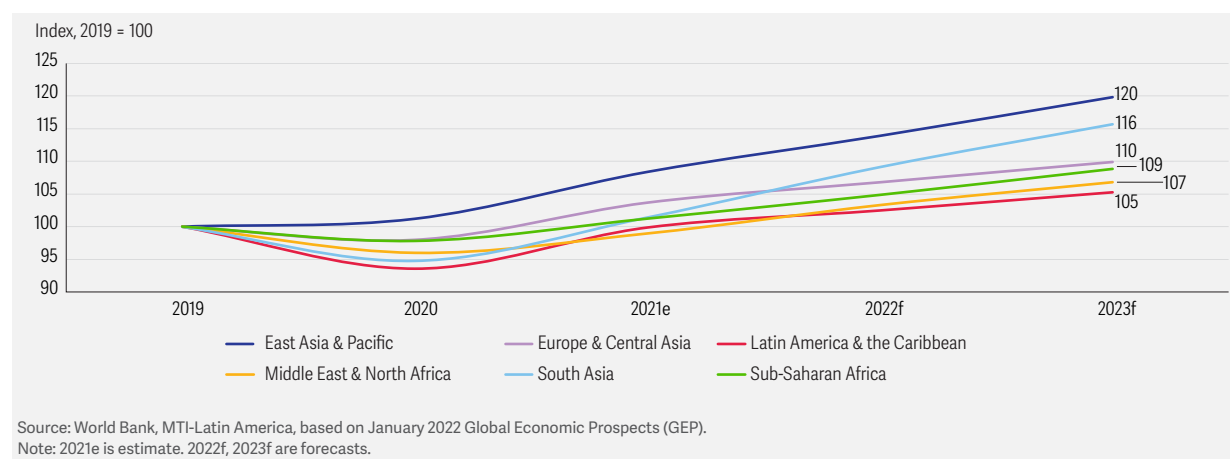
LAC was already suffering from a learning crisis, which has been severely exacerbated by the COVID-19 outbreak. Recent results from the Fourth Regional Comparative and Explanatory Study (ERCE) confirm that in 2019, on average, almost half of third graders did not reach the minimum proficiency level (MPL) and more than two-thirds did not reach it by sixth grade (UNESCO 2021). Results also show wide disparities among countries and a pervasive persistence of socioeconomic learning gaps. During the pandemic, the LAC region was affected by the longest school closures in the world, along with the South Asia region (López-Calva 2021). The learning loss of 1.3 learning-adjusted years of schooling (LAYS) is estimated to translate into a decline of more than 10 percent in the projected annual earnings of the average LAC student at school today.<sup>2</sup> Early estimates from São Paulo (Brazil) suggest that students learned on average only 27.5 percent of what they would have in face-to-face classes (Lichand et al. 2021). An update of the regional Acting Now report that provided the initial estimates of the level of scarring arising from COVID will be launched in May 2022 and will provide a comprehensive diagnostic of the disruption created by COVID-19 on the education sector 24 months after the initial massive shutdown of schools (World Bank, forthcoming). Key priorities identified include reopening and/or keeping schools open, re-enrolling and keeping children and youth in school, assessing learning losses, and devising and implementing strategies to start recovering from these losses by teaching at the right level and focusing on foundational skills.

<sup>2</sup> Based on estimates by the World Bank Global Education Team on the basis of the latest version of the World Bank's Country Tool for Simulating the Potential Impacts of COVID-19 School Closures on Schooling and Learning, intermediate effectiveness of mitigation strategies, and actual country data for the duration of school closures (assuming an intermediate scenario for partially opened schools). The LAC average is based on 15 countries for which data on standardized international learning assessments are available.

## Growth: Anemic with Increasingly Uncertain Prospects

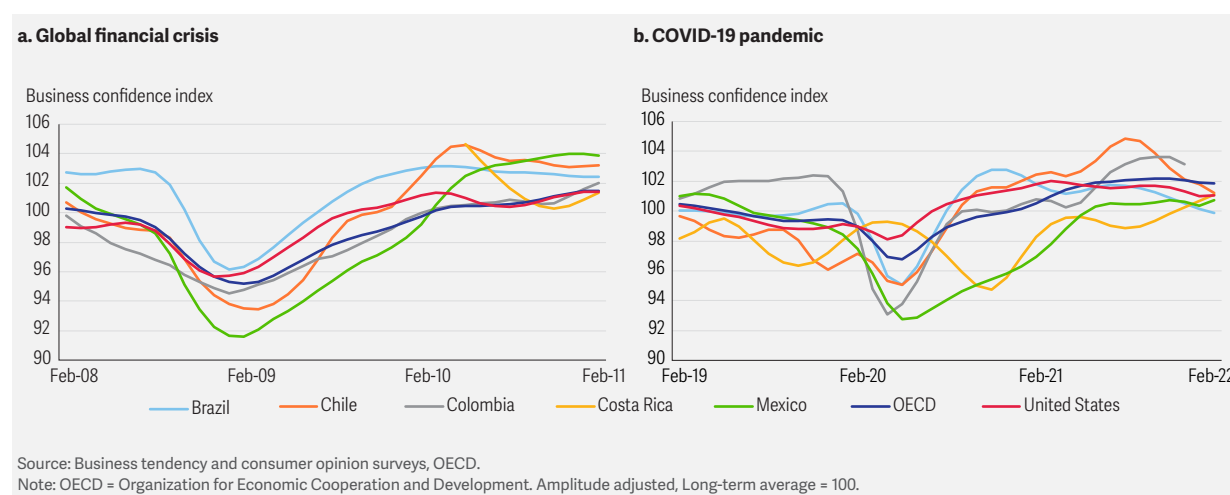
By the end of 2021, economic activity had largely recovered to its levels before the pandemic, although growth performance is forecast to remain among the lowest in the world (figure 1.7).

**Figure 1.7. Real Annual GDP Growth by Region**



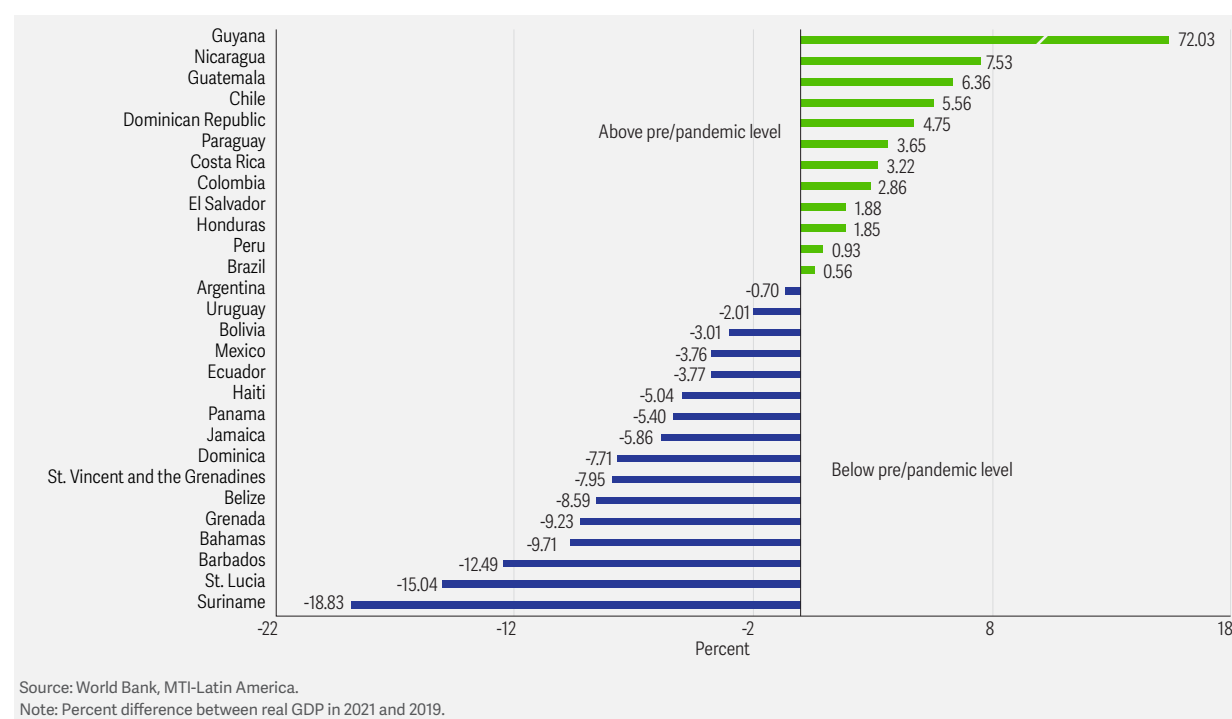
This economic recovery also shows in the recovery in the level of business confidence (figure 1.8). While varying more across countries than during the global financial crisis, business confidence seems to be returning to most countries in the region.

**Figure 1.8. Business Confidence Index during the Global Financial Crisis and COVID-19 Pandemic**



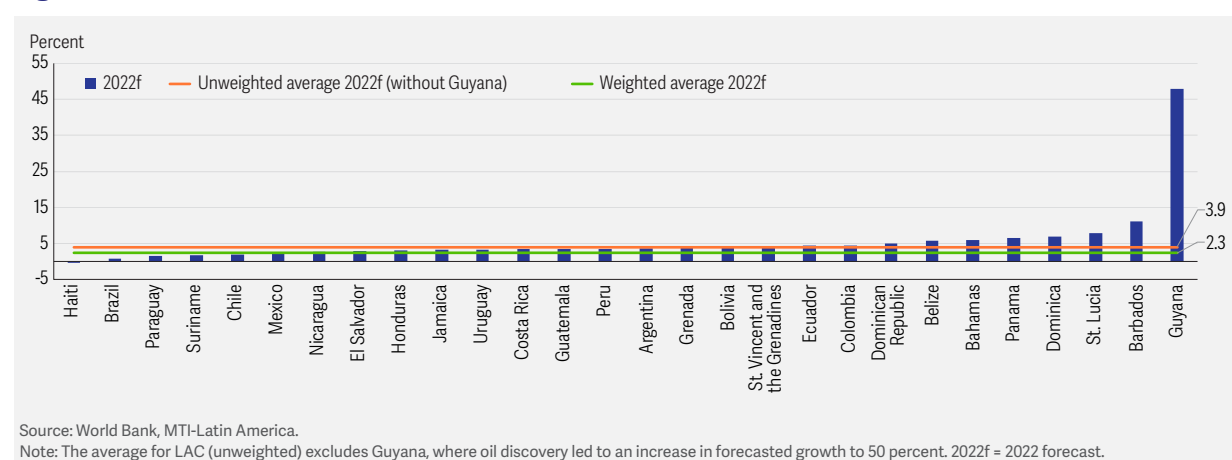
The average trajectory of regional recovery, again, hides major variations among countries. As figure 1.9 shows, by the end of 2021, Nicaragua, Guatemala, and Chile had more than recovered their previous losses and had grown above their pre-pandemic level. However, a few countries, particularly Mexico and Brazil, which are heavily weighted in regional averages because of the size of their economies, have not recovered or have just barely recovered previous levels.

**Figure 1.9. Cumulative Economic Growth since the Onset of the Pandemic**



This uneven recovery is also reflected in 2022 forecasted growth rates for the region (figure 1.10). While the region is expected to grow about 2.3 percent, the typical LAC country (not weighting by GDP within the region) is expected to grow about 3.9 percent (excluding Guyana).

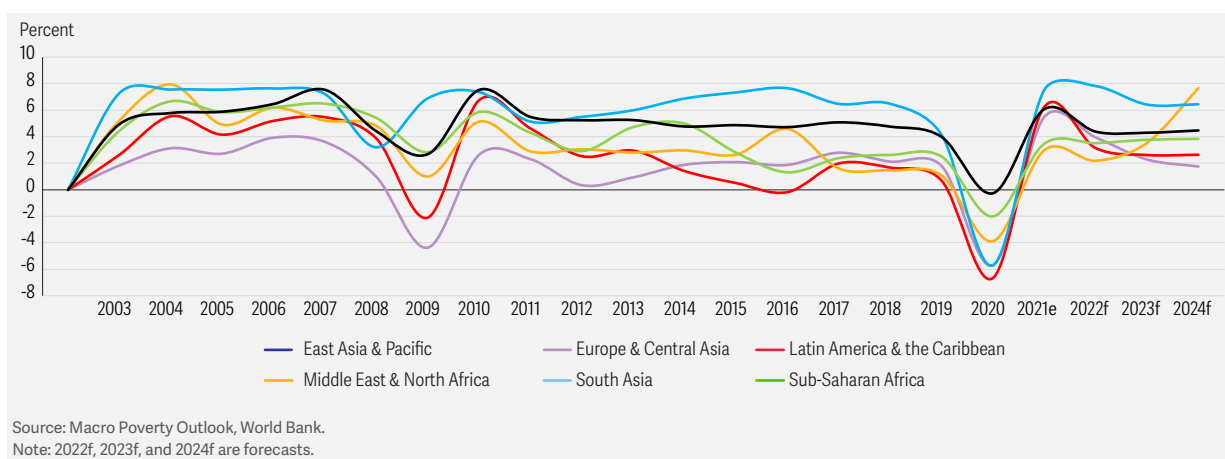
**Figure 1.10. Forecasted GDP Growth Rate in LAC in 2022**



This lackluster expected regional growth for 2022 of 2.3 percent is virtually identical to the 2.2 percent rate of the decade of the 2010s, which is well below the global average of other regions of 3.1 percent (figure 1.11).



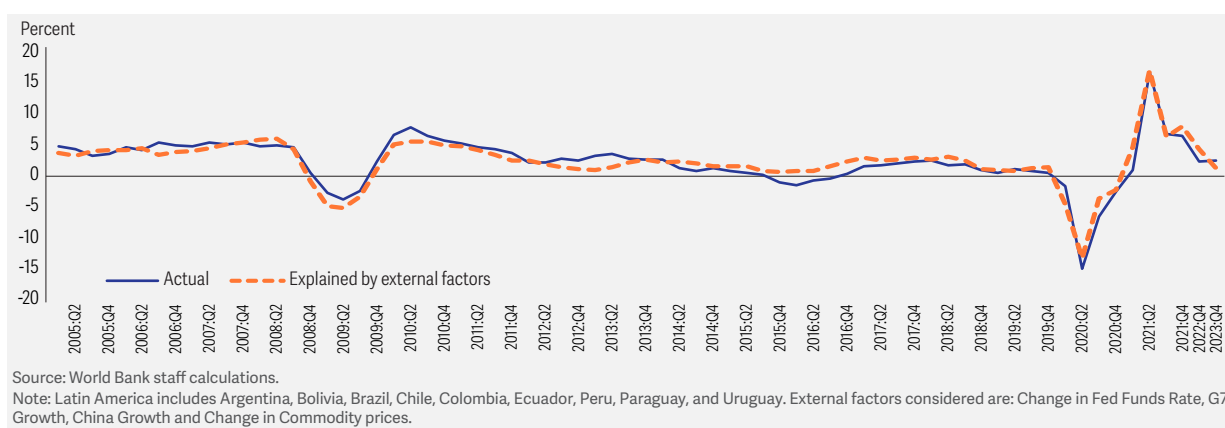
**Figure 1.11. Real GDP Growth, 2003–2024f**



## Risks to the Recovery

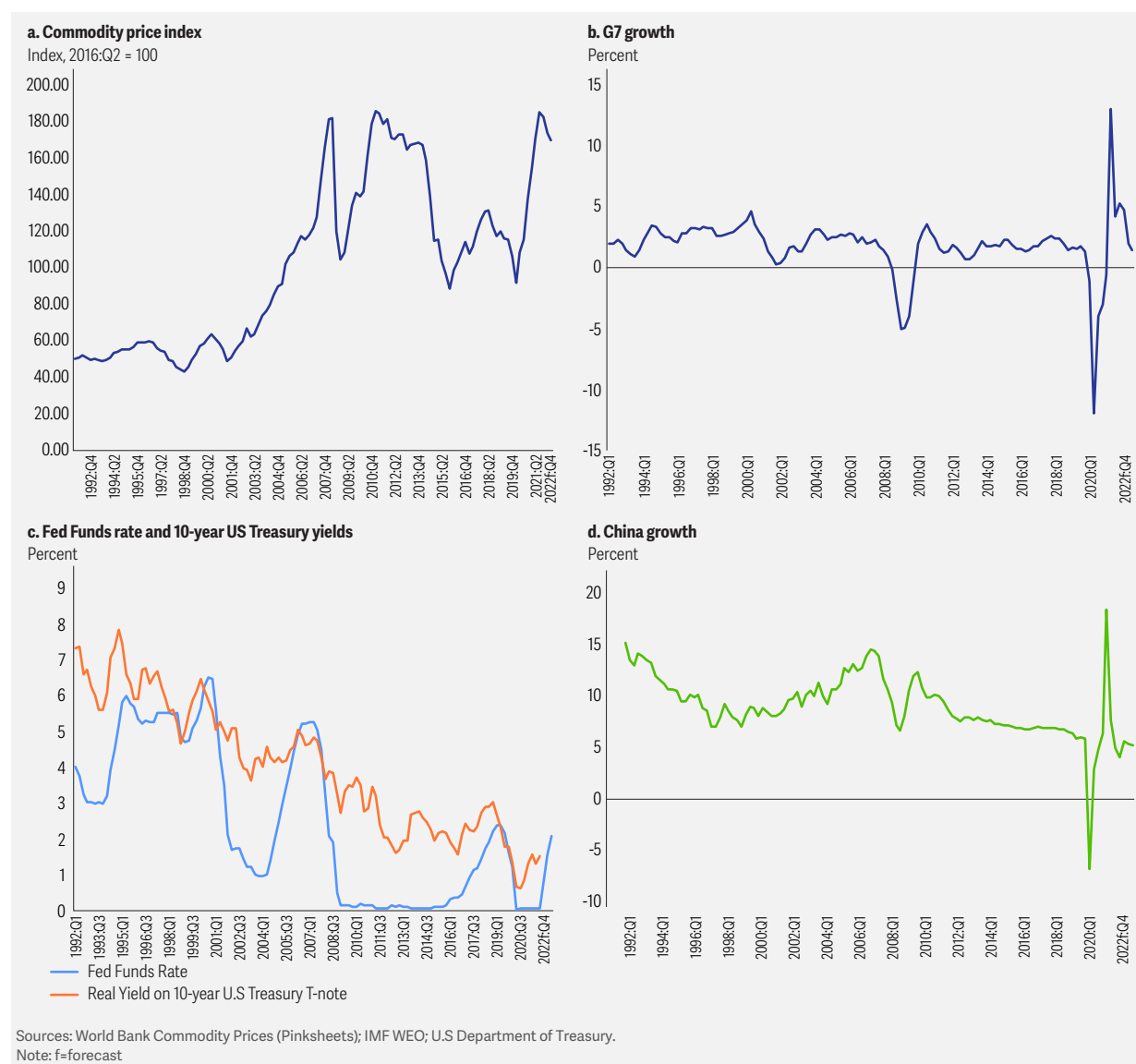
Several upward and downward risks, of both idiosyncratic and global nature, pose challenges to and opportunities for a recovery. As has been the case for most of the 2000s, LAC remains largely dependent on four external factors beyond the region that explain about 88 percent of the variance in growth rates: commodity prices, interest rates set by the US Federal Reserve, G7 growth, and China growth (figure 1.12).

**Figure 1.12. Observed versus Predicted Growth by External Factors**



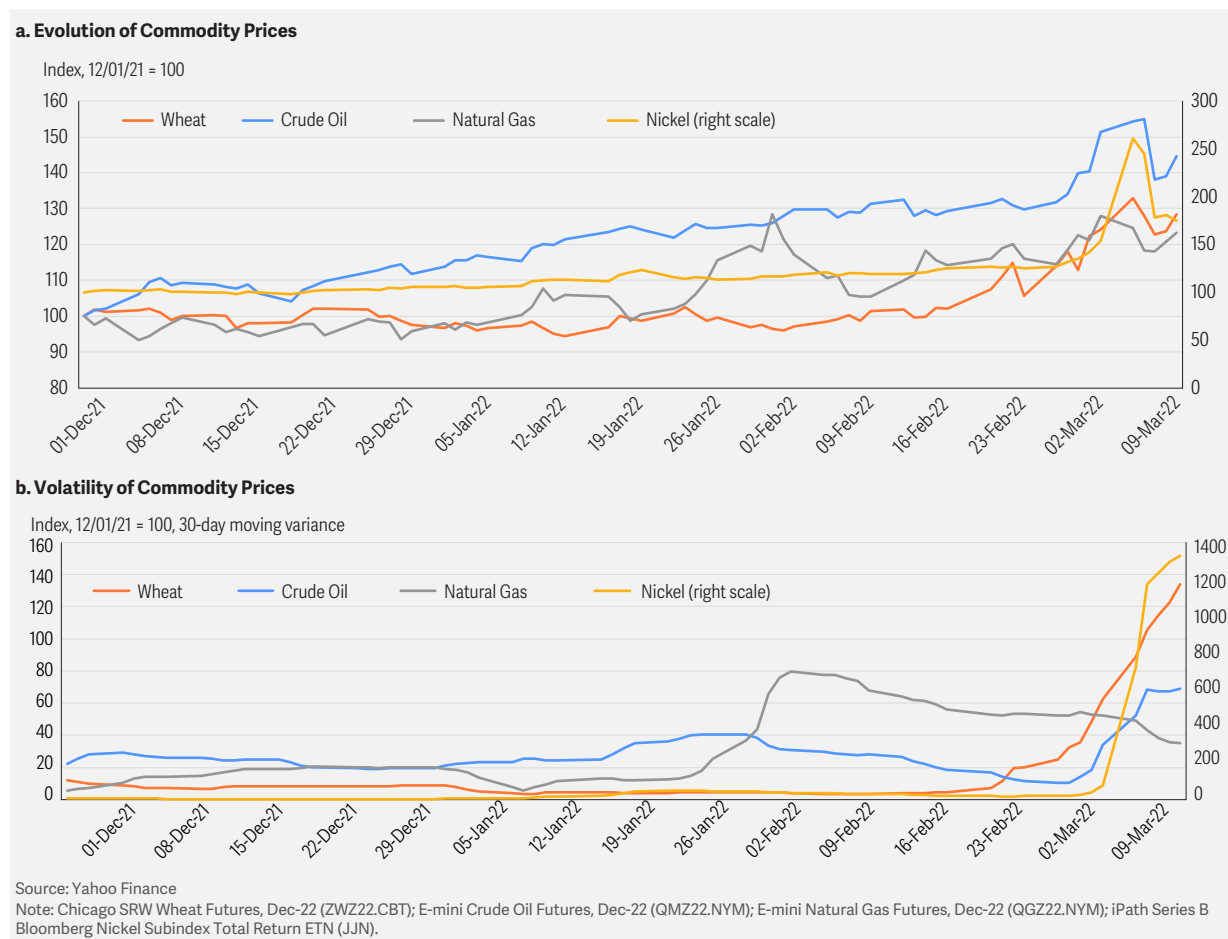
The year 2021 was marked by an impressively vigorous recovery of the Chinese and G7 economic activity (led by a United States, with an annual growth rate of 5.7 percent), high prices in commodities, and US Federal Reserve interest rates of effectively zero in real terms. Expected external global conditions for the year 2022, while still favorable from a historical perspective, are starting to become less so (figure 1.13) due to the implementation of cooling-off fiscal and monetary policies in advanced countries in reaction to rising inflation. Further, the severe lockdown in China arising from a new outbreak of COVID-19 will both slow the Chinese economy and exacerbate still-unresolved value chain backlogs.

**Figure 1.13. Tailwinds Remain Favorable from a Historical Perspective, but Increasingly Less So**



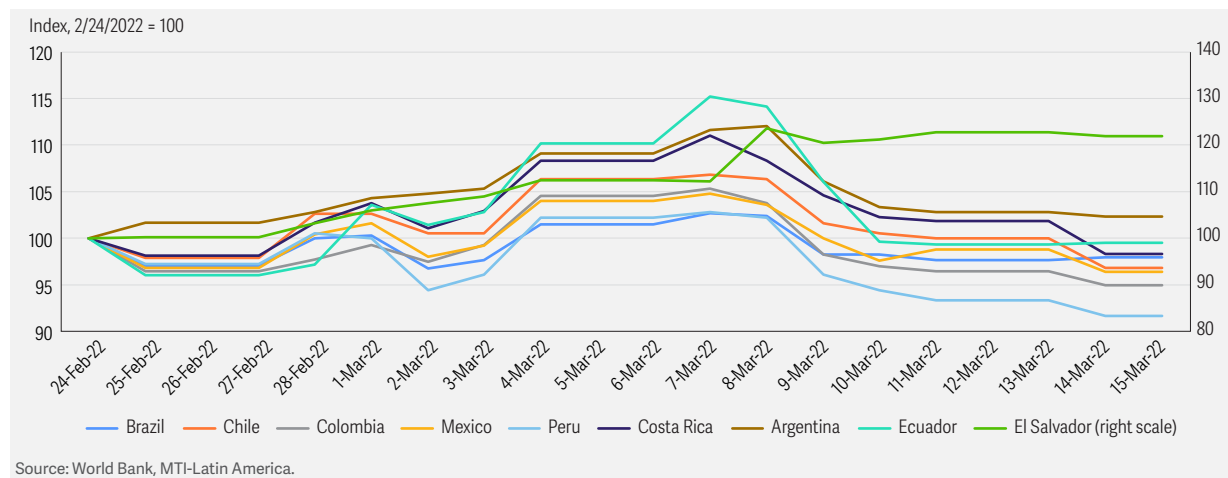
The Russian invasion of Ukraine in late-February 2022 has both imposed a drag on the regional recovery and injected vast uncertainty. Prices of wheat and energy soared in the immediate aftermath. Meanwhile, a new set of supply-chain disruptions—both arising from the war and from a new COVID lockdown in China—present stagflationary forces that will complicate the job of monetary authorities. The direct depressive effects on global output may be modest, but the increased uncertainty and the sharp (even if short-term) rise in commodity prices will have first-order effects. Figure 1.14 shows the evolution of key energy and agricultural commodity futures and their 30-day-moving variance. Panel a shows that since the beginning of the Russian invasion, prices have shown peak increases of 7 percent in natural gas, 16 percent in wheat, 19 percent in crude oil, and more than a 100 percent in nickel (given that Russia produces about 7 percent of global production of nickel, which is used to make stainless steel and batteries for electric vehicles). These high levels are not likely to be permanent and have already fallen substantially from peaks, partly in reaction to a slowing Chinese economy. Prices of oil futures suggest that the market predicts a decline to normal “high” levels going forward. However, signaling the uncertainty these movements have injected into policy making, panel b shows that the variability of prices has increased, on average, by 15 times compared to the period before the invasion.

**Figure 1.14. Evolution and Volatility of Commodity Prices**



The general increase in uncertainty in key commodity prices and concerns about global slowdown is reflected in the brief rise in country premiums on sovereign bonds (figure 1.15). Again, markets seem to be seeing the Ukraine related impacts on LAC as temporary.

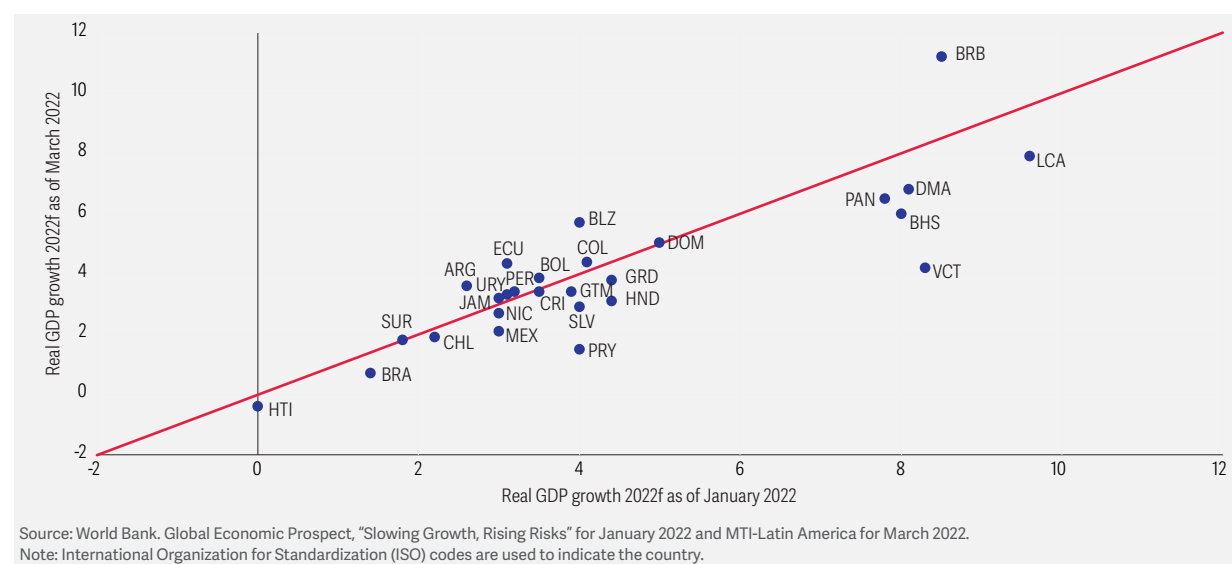
**Figure 1.15. Emerging Market Bond Index (EMBI) Global Sovereign Spreads**



While higher commodity prices usually favor the region, the net effect is likely to be depressive: rising crude oil prices punish the Caribbean and countries that do not export oil; protracted drought in Argentina, Paraguay, and Uruguay limits the supply response to grain prices and the inflationary impact; and the subsequent monetary policy response appears to dominate any potential export gains. Restrictions on trade with Russia will also surface unexpected channels through which LAC will be affected. For instance, Brazil buys much of its fertilizer from Russia. Some large manufacturers, such as Embraer, are losing large markets because they are suspending their exports and technical assistance to the Russian aviation sector. Rising feed corn prices will adversely affect the livestock sector. For some countries, such as Ecuador, Russia was a major export market.

Overall, most LAC countries are expected to grow less in 2022 now than what was expected before the Russian invasion of Ukraine (figure 1.16)—with some exceptions. Forecasts of average regional growth have been revised downward by approximately 0.4 percentage points, from 2.7 percent to 2.3 percent, mostly due to the expected slowdown in global economic activity. Forecasts for growth in the United States, euro area, and Japan have fallen by 0.4, 1.0 and 0.6 percentage points, respectively, from January 2022 projections. Again, Mexico and Brazil, the most populous countries, are both showing substantial downward revisions and heavily influence the average.

**Figure 1.16. Forecasted 2022 Real GDP growth before and after the Russian Invasion**

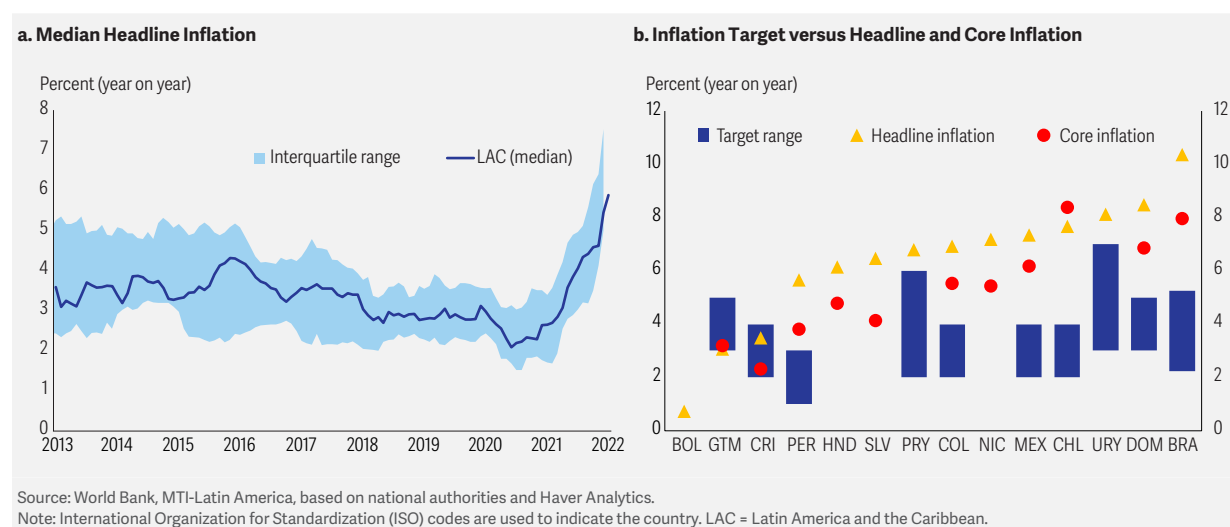


## ***The Return of Inflation and the Monetary Dilemma Facing Central Banks***

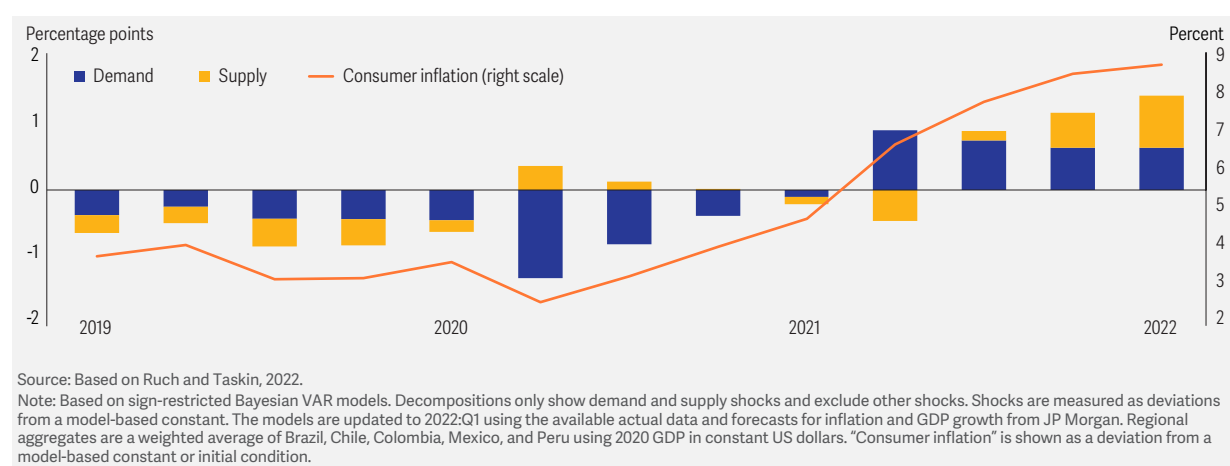
At the beginning of the year, headline inflation (including food and fuel costs) in the region had climbed to approximately 7 percent, giving rise to fears that wage contracts will build in expectations of future price rises and lead to a wage-price spiral that will be costly to repress in the medium term. Both headline and core inflation rates have exceeded central bank targets across the region (figure 1.17), and authorities have become increasingly aggressive with interest rate hikes, with concomitant depressive effects on the recovery.

This situation is exacerbated by the higher-than-expected inflation in the advanced countries, now compounded by commodities pressure and depressed global economic activity arising from the Russian invasion of Ukraine. Figure 1.18 shows that while in late 2021 and early 2022 the rise in inflation was largely driven by demand factors, reflecting perhaps the end of large fiscal stimulus packages implemented during the pandemic, increases going forward are increasingly driven by supply side factors such as oil and other commodity prices.

**Figure 1.17. The Comeback of Inflation**



**Figure 1.18. Inflation Decomposition in LAC during COVID-19 and Expected Due to the Russian Invasion of Ukraine**



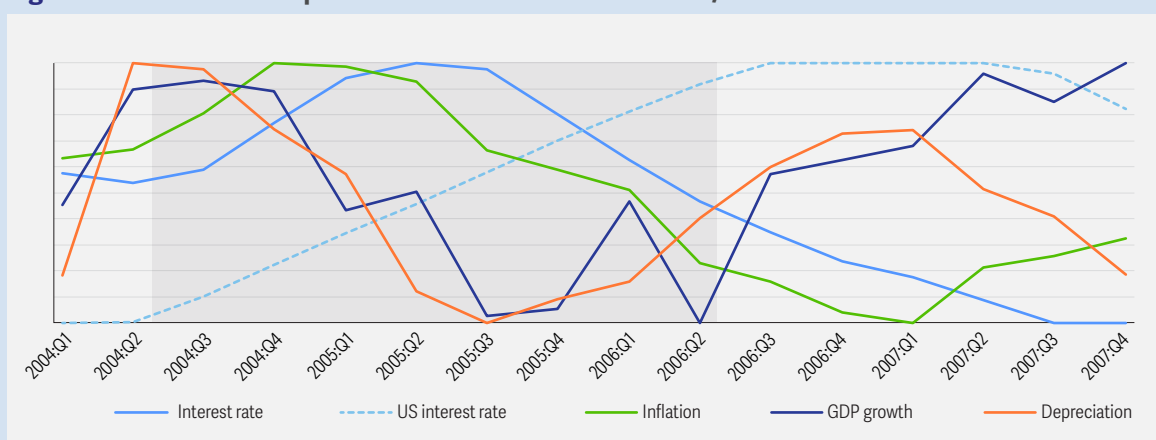
Despite these pressures, markets appear to believe that both advanced country inflation and, to a lesser degree, the oil squeeze will be transitory. Ten-year US Treasury rates, while rising, remain below 3 percent and commodity futures markets predict the wave of rising commodity prices will have crested over the next few months and recede thereafter. Whatever the case, the US Federal Reserve will raise interest rates over the next several quarters, exacerbating the regional authorities' monetary dilemma on whether to increase the rates, aiming to reduce inflation, or to decrease rates to stimulate credit and economic activity. The resulting pressure on regional exchange rates will require further interest rate hikes both to mitigate depreciation-driven price pass-through fueling inflation, and to defend the local currency value of international debt payments. History suggests a "cycle within the cycle," whereby central banks will first raise interest rates to achieve these ends, but then (once inflation is moderately under control) ease up to moderate the depressive effects on the recovery. Box 1.1 examines this monetary dilemma and the cycle within the cycle further.

## Box 1.1. Monetary Policy Dilemma and the Cycle-within-the-Cycle Phenomenon

The increase in international interest rates to combat inflation in the advanced economies, along with a deterioration in the terms of trade, provoke capital outflows, depreciation, inflation, and a slowdown in economic activity. In countries without the flexibility in taxing and spending (i.e., without fiscal space) to apply a contracyclical spending or tax policy, the central bank faces a dilemma: it can raise interest rates to fight inflation and defend the exchange rate, or it can decrease policy rates to help the recovery by stimulating the economic activity.

This type of dilemma is not new to the region, as documented in Rojas, Vegh, and Vuletin (2022). For instance, figure B1.1.1 shows how inflation, depreciation, and GDP growth behaved in Brazil during the international interest rate hikes of 2004–06. As the US interest rate tightened from 1 percent to 5 percent, the depreciation rate jumped from 2 percent to 15 percent and inflation rose by 3 percentage points, while GDP growth fell from 6 percent to 2 percent. With inflation rising and GDP growth decelerating, the Central Bank of Brazil faced the dilemma just described of whether to raise interest rates to fight inflation and defend the exchange rate or lower policy rates to stimulate the economy. As illustrated in figure B1.1.1, the central bank response was nuanced, first increasing the policy rate (from 15 percent to 20 percent) to stop the trending inflation, and then lowering rates afterward to stimulate economic activity. This pattern occurs across the region.

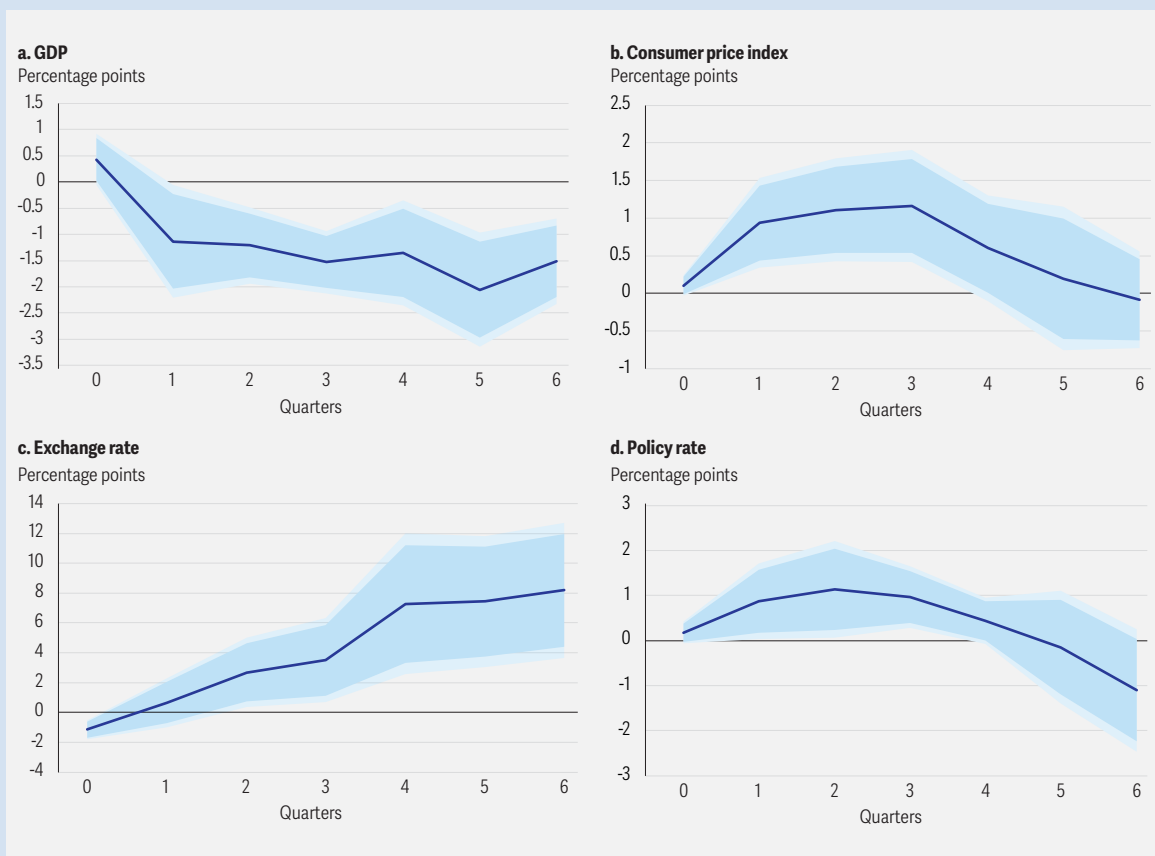
**Figure B1.1.1. Brazil's Response to International Rate Hikes, 2004–07**



Source: Rojas, Vegh, and Vuletin 2022.

This pattern can be observed more generally in figure B1.1.2, which shows the empirical estimated effects of a one percentage point increase in the international interest rate on growth, inflation, and the exchange rate. The effects are estimated via Local-Projections using data since 1998 in a panel of countries that includes Brazil, Chile, Colombia, Costa Rica, Honduras, and Mexico. An increase in international rates tends to slow growth and fuel inflation, while putting pressure on the value of the domestic currency. Figure B1.1.2 shows that often central banks follow an intermediate approach. First, they raise policy rates to control inflation and defend the currency. Then, as inflation and devaluation subside, the central banks start to decrease rates to help with the income recovery. Rojas, Vegh, and Vuletin (2022) called this inverted-U shape response of the policy rate the “cycle within the cycle”: that is, the policy cycle within the business cycle.

**Figure B1.1.2. Response of GDP, Prices, and the Exchange Rate to a One Percentage Point Increase in International Interest Rates**



Source: World Bank staff calculations.

Different variables affect the magnitude and duration of each stage of this “cycle within the cycle.” How strong and persistent the initial increase in the policy rate is depends on the strength and persistence of the hike in inflation, depreciation, and the negative response of economic activity and the weight the central bank puts on these variables, as well as how these variables respond to the policy rate, among other factors.

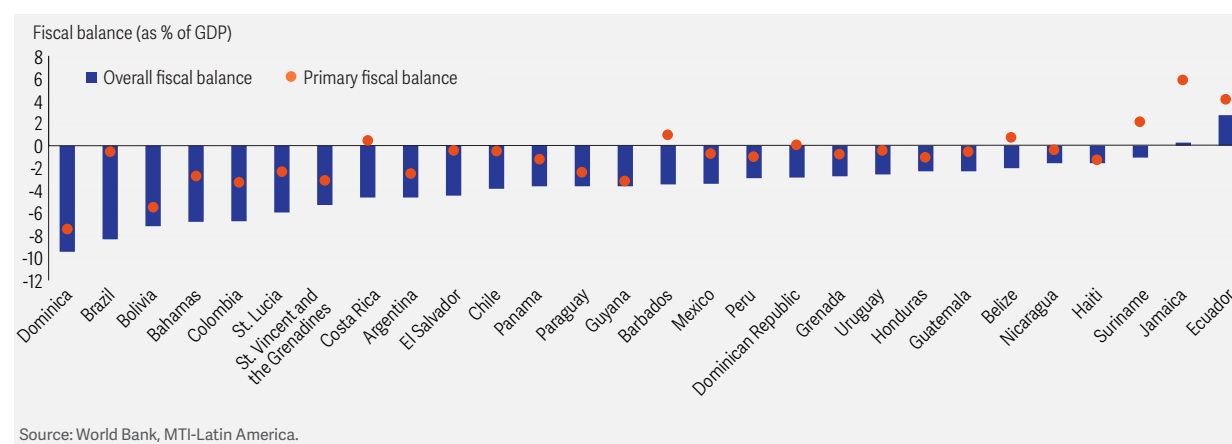
For instance, inflation diminishes what can be bought with a given amount of money. Thus, the negative effects of inflation will be greater the higher the rigidity of wages. High liability dollarization increases the importance of defending the exchange rate, and therefore the initial increase in policy rates. Similarly, conditions that induce higher and faster capital outflows also call for increases in domestic rates. Vegh and Vuletin (2012) show that the response of the interest rate is procyclical: that is, the increase in the policy rate to defend the exchange rate and mitigate inflation during a deceleration of economic activity is correlated to institutional quality, the lack of fiscal space (fiscal deficits and external total debt), foreign reserves, and current account deficits.



## From Fiscal Stimulus toward Consolidation: A Long Road toward a More Sustainable Debt Path

During 2020 and 2021, LAC countries engaged in unprecedented fiscal stimulus efforts to mitigate the devastating effects of the pandemic on economic activity. These fiscal efforts, coupled with a fall in economic activity, made public debt for the region increase, on average, by about 15 percentage points between 2019 and 2021. Country spreads widened, on average, about 50 percent during the same period. The combination of greater debt, higher costs of borrowing, and the decline in the size of the tax base (due to the fall in economic activity and increase in informality) have depleted any remaining fiscal space in most LAC countries. Governments shifted from stimulus toward fiscal consolidation, increasing their fiscal efforts on the tax front by boosting tax rates and strengthening tax enforcement and decreasing COVID-19-related spending. A nascent recovery began in the second half of 2021. This process has been slowed by the Russian invasion and the resultant down revision in growth. Most LAC countries are still expected to run significant overall and primary fiscal deficits in 2022 (figure 1.19). The average overall fiscal balance is expected to change from  $-4.1$  percent in 2021 to  $-3.7$  percent in 2022 driven by a reduction in the average fiscal primary balance from  $-1.6$  percent to  $-0.9$  percent in the same period.

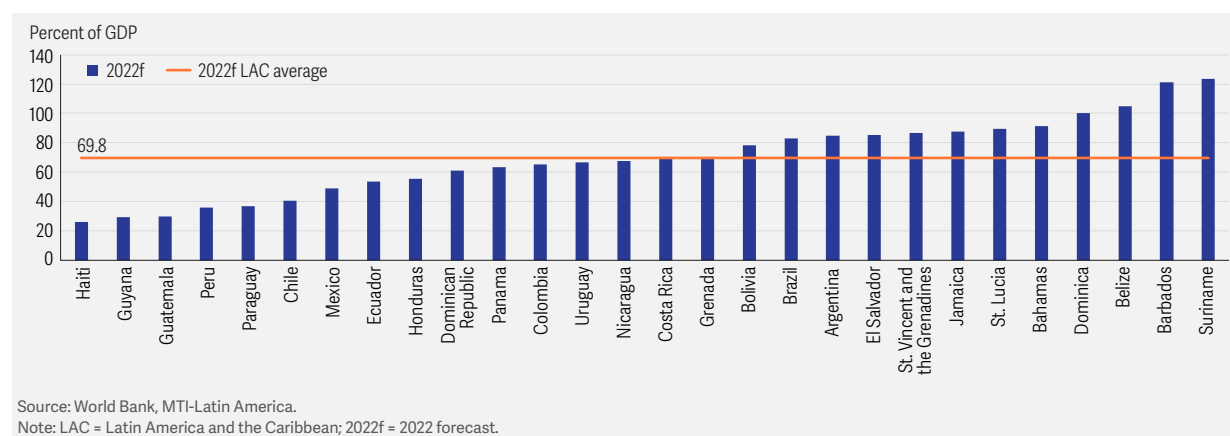
**Figure 1.19. Fiscal Balance in LAC Countries, 2022 Forecast**



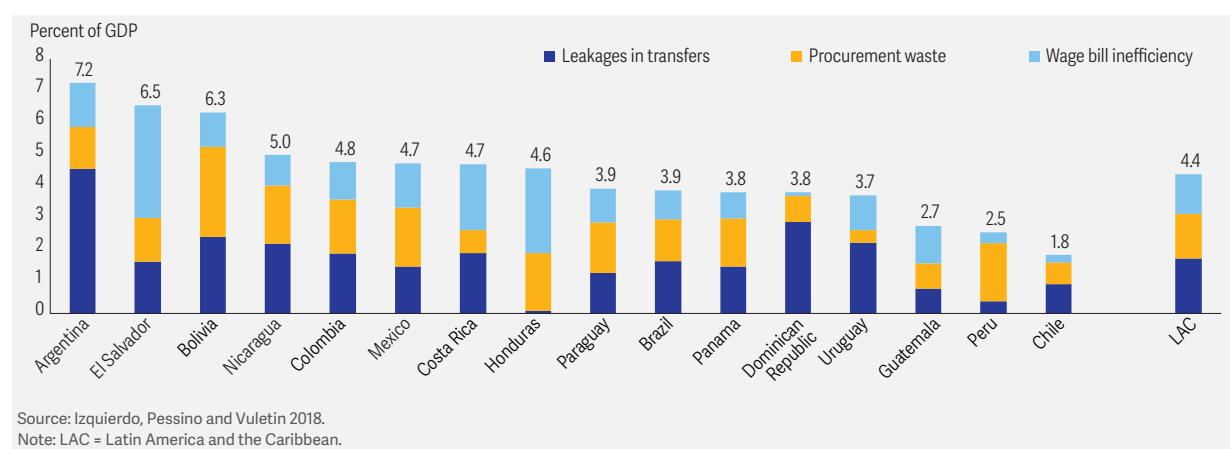
The shift toward consolidation, while incipient and varied among countries, reflects the need to move toward a more sustainable debt path. While fiscal efforts are fundamental to this effort, longer-term efforts will be required, balancing the need to reduce the current heavy debt burden (figure 1.20).

Considering the well-known short-term negative macroeconomic effects of fiscal consolidations, and as discussed in the previous LAC Semiannual Report from October 2021 in greater detail, this process calls for a scalpel rather than a butcher's knife. It is particularly important to protect public investment from cuts—especially given the longstanding large infrastructure gaps—and shield the most vulnerable segments of the population. While raising taxes is an option, fiscal authorities need to balance that against growing evidence of large short-term and long-term macroeconomic costs of raising taxes in countries whose tax rates and burdens are already high (Gunter et al. 2021), as well as in emerging markets with narrow tax bases (Venturi et al. 2022). Given generalized social discontent and lack of trust in the management of public issues, governments should prioritize increasing their spending efficiency. The high amounts of waste pervasive in the region (figure 1.21) offer a natural way of conducting fiscal adjustments in a social-friendly and rational manner. Approximately 4.4 percent of GDP is lost in poor procurement practices, inefficient human resource policy, and badly designed transfers (Izquierdo, Pessino, and Vuletin 2018).

**Figure 1.20. General Government Debt, 2022 Forecast**



**Figure 1.21. LAC Suffers from Significant Waste and Inefficiency in Public Spending**



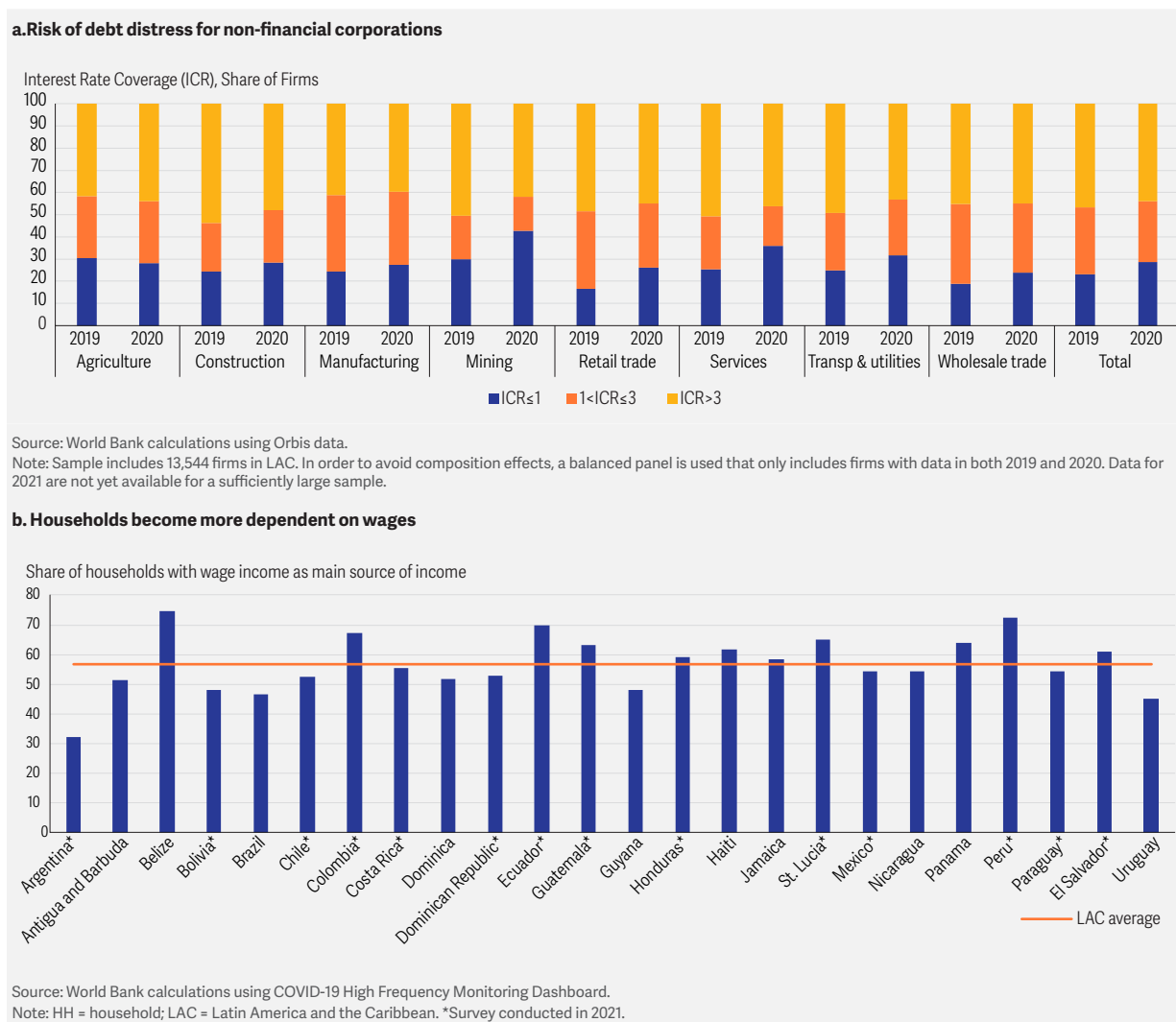
## The Risk of Banking Crisis Seems to Be Receding but Merits Vigilance

Private sector risks have increased during the COVID-19 pandemic. The health emergency and associated containment measures had a significant impact on the revenues and profitability of non-financial corporates in the region. This resulted in an increase in the share of firms at risk of debt distress (defined as firms with an interest rate coverage ratio of less than 1) from 23 percent in 2019 to 29 percent in 2020 (figure 1.22, panel a).<sup>3</sup> The risk is highest for firms in the services, mining, and retail sectors. As an alternative measure, the October 2021 LAC Semiannual Report<sup>4</sup> presented Pulse Survey data showing that for many countries in the region 40 percent to 60 percent of firms reported a likelihood of falling into arrears in the next six months. The pandemic also severely affected the financial health of the household sector, with more than half of households, on average, reporting a drop in income since the beginning of the pandemic. The possibility of higher default rates in both sectors potentially could undermine the financial sector, given that loans to non-financial corporates and households account on average for 48 percent of banks' balance sheets.

<sup>3</sup> Data for 2021 are not available yet.

<sup>4</sup> <https://openknowledge.worldbank.org/handle/10986/36331>.

**Figure 1.22. The Impact of the COVID-19 Pandemic on Non-Financial Corporates and Households in LAC**

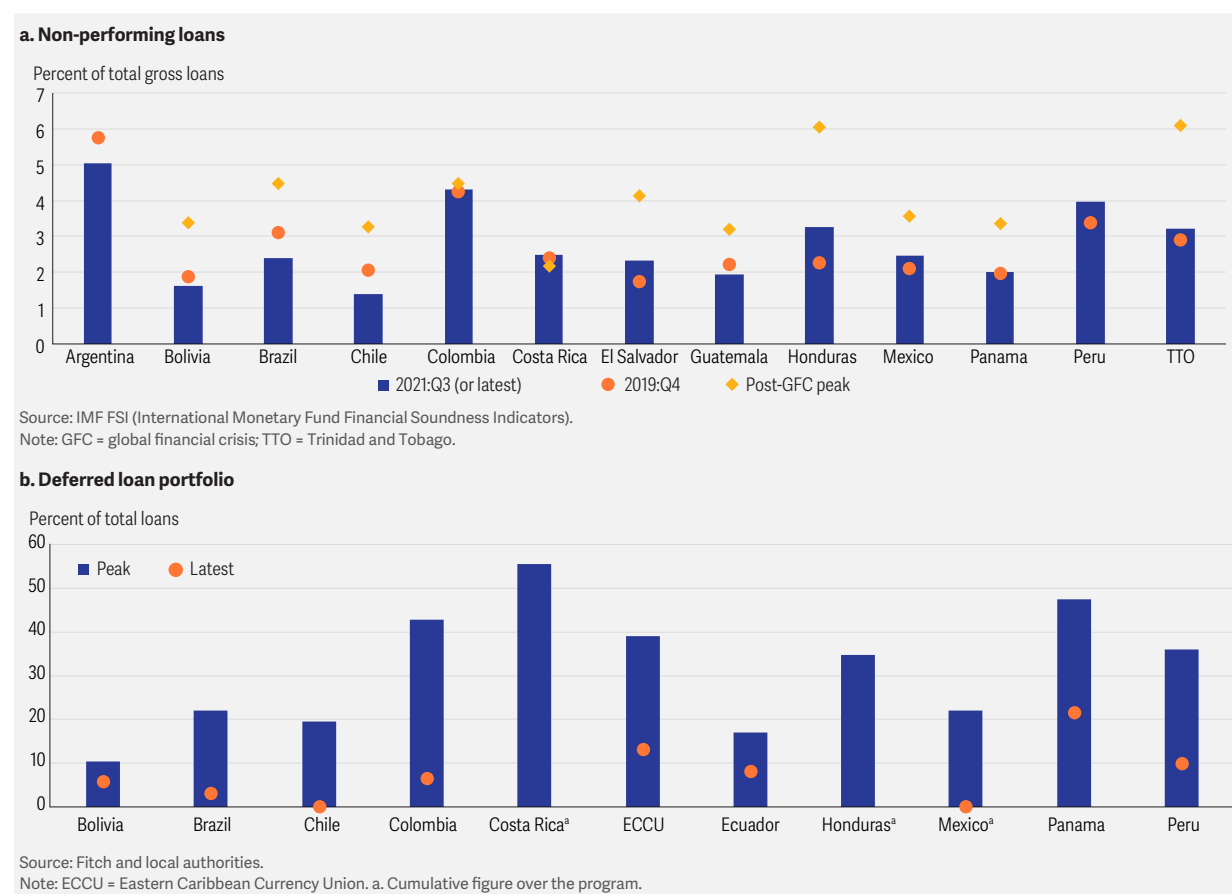


However, the financial challenges of firms and households have not yet caused a widespread visible deterioration in banks' asset quality. The financial challenges of the private sector have not yet spilled over to the banking sector. Reported non-performing loan (NPL) ratios in most jurisdictions remained close to levels before the pandemic and well below levels seen in the aftermath of the global financial crisis. As of late 2021, the NPL ratio remained below 5 percent of gross loans for all major financial sectors in LAC, as well as for 45 of the largest 50 banks in terms of assets (figure 1.23).<sup>5</sup> NPL ratios are higher in some Caribbean jurisdictions that entered the pandemic with already high levels of NPLs. Provision coverage stands at more than 100 percent of reported NPLs in almost all jurisdictions.

The resilience of the banking sectors to the impacts of the pandemic was supported by a wide range of policy measures. These include expansive monetary and fiscal policies that, by reducing borrowing costs and supporting disposable incomes indirectly, helped to reduce banks' credit risk but came at the cost of higher inflation and public debt. As figure 1.24 shows, direct government measures to support firms both supported a recovery of employment and reduced the likelihood of falling into arrears. Monetary measures included the establishment

5 Bank-level data as of Q2:2021.

**Figure 1.23. Asset Quality and Loan Deferment Programs**



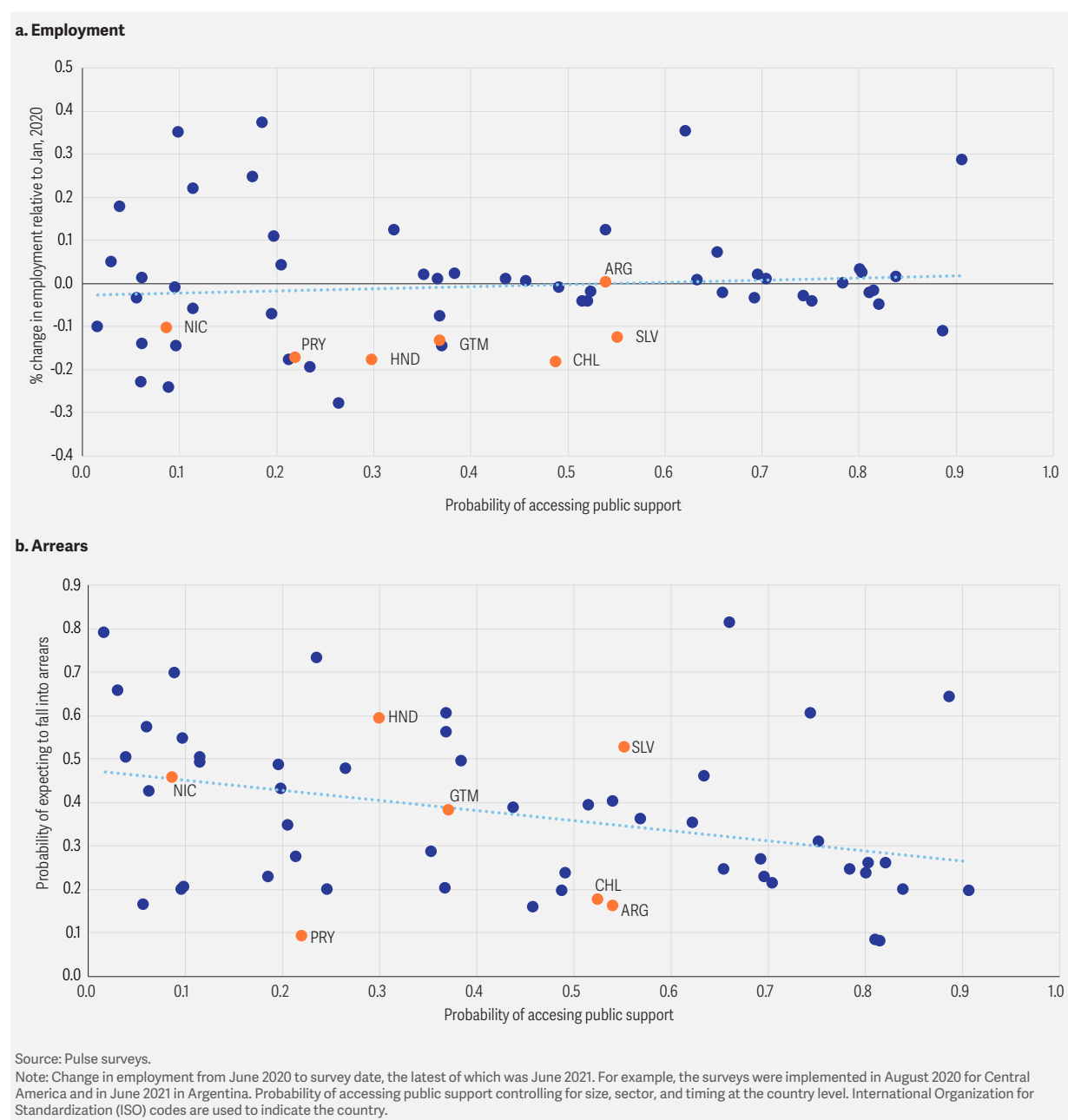
of new facilities to provide liquidity and means to hedge against exchange rate volatility. Asset quality indicators also benefitted directly from regulatory forbearance measures that facilitated loan repayment moratoria and restructurings. Such measures were implemented in at least 17 jurisdictions in LAC shortly after the outbreak of the pandemic in spring 2020.<sup>6</sup> While the exact design and scope of these measures differ significantly across countries, most regulators facilitated loan deferrals by temporarily exempting banks from changing the risk classification of renegotiated and restructured loans and from building provisions for these exposures. These measures gave borrowers more time and flexibility to meet their loan obligations amid the economic shock caused by the pandemic and protected banks from classifying these loans as non-performing (or special mention). At their peak, such deferral measures covered more than one-third of the entire loan portfolio in Costa Rica, Colombia, Panama, Peru, Honduras, and the Eastern Caribbean Currency Union (ECCU).<sup>7</sup> Some of those loans were restructured multiple times. In Costa Rica, for example, 10 percent of all restructured loans were restructured more than three times. Data from countries that report a sectoral split of the deferred loan portfolio, such as Colombia, Costa Rica, and Panama, show that restructurings were particularly relevant for economic sectors strongly affected by the crisis, such as hotels and restaurants or transport.<sup>8</sup> However, the majority of loan restructurings affected loans extended to the household sector (consumption, mortgage, credit card, and car loans), highlighting the impact of the pandemic on household's debt servicing capacity.

<sup>6</sup> See [FCI GP COVID-19 Policy Response Compendium](#).

<sup>7</sup> Because loan repayment moratoriums were implemented in different ways across countries, a cross-country comparison needs to be interpreted with caution.

<sup>8</sup> It should be noted that, while loan repayment moratoria differed significantly across countries, it was not unusual for economic activities most affected by the pandemic (such as the tourism sector) to receive relief for a longer period as these measures were unwound.

**Figure 1.24. Public Sector Support Aided Employment Recovery and Reduced Arrears**



By early 2022 most countries in LAC have unwound, or at least started to unwind, COVID-related forbearance measures and the feared cliff-effects have been avoided so far. The phase-out of the regulatory forbearance measures proceeded at different schedules across LAC jurisdictions. While Mexico started to roll back its measures in summer 2020, many jurisdictions allowed exceptional loan deferrals well into 2021. However, by early 2022 most countries in the region have at least started to lift the forbearance measures. So far, the lifting of measures has not caused the feared cliff-effects—referring to the risk that a significant share of loans is abruptly reclassified as non-performing. In Mexico, for example, the early expiration of the loan deferral program resulted in only a moderate and short-lived uptick in NPLs that has not appreciably increased in the ensuing year and a half. The increase in NPLs was highest for consumer loans, which increased by around 2 percentage points six months after the expiration of the deferral program. Total NPLs increased by 0.6 percentage points over that period.

However, the increase in NPLs was manageable for the Mexican banking sector and NPLs quickly declined back to pre-COVID levels.

While the unwinding experiences of the forbearance measures so far allow for cautious optimism, financial stability risks can still surge and warrant careful monitoring. Past crises show that NPL build-up can be lengthy. During the global financial crisis, the median lag between the onset of the crisis and the peak NPL levels was approximately 11 quarters for countries that are not members of the Organization for Economic Co-operation and Development (OECD) (see Muro 2021). Further, a significant share of loans in LAC remains refinanced or restructured. In several jurisdictions, the repercussions of just recently lifted forbearance measures still cloud the reliability of prudential indicators, given that the widespread restructurings might hide persistent solvency risks of the borrowers and underestimate banks' credit risk. Banks might also have incentives for perpetual restructurings or "evergreening" of loans, which would drain resources from productive lending opportunities.

To mitigate these risks, supervisors must ensure proper reporting and monitoring. The banking sector supervisor in Panama, for example, requires banks to provide detailed reports on the size and structured of the deferred portfolio and to perform an assessment of borrowers' repayment capacity. Such information can help to gauge the share of deferred loans that present a higher risk and anticipate potential future impacts on NPLs. It is also crucial that banks maintain sufficient capital buffers to deal with a potential deterioration in asset quality. Pockets of vulnerability remain, even though in most LAC countries system-wide capital adequacy ratios have remained stable or even increased so far during the pandemic—as banks cut dividend payouts and reduced risk-weighted assets—and a nascent recovery in bank profitability has begun. Buffers appear particularly thin in several Central American and Caribbean banking sectors. Countries in the region should also continue to improve their insolvency and debt resolution frameworks to ensure that eventual private sector insolvencies do not result in protracted procedures and inefficient outcomes that hinder an efficient reallocation of capital and curtail the re-entry of entrepreneurs to the economy.

## Conclusion

The generally rapid deployment of vaccines has bought much of the region to a position where it is on track to recover the losses in income and employment of the COVID-19 era. The social costs have been brutal and unevenly distributed across demographic groups and still need to be addressed. Further, though banking sectors so far appear in better shape than originally feared, the region still faces high debt levels and increasing international costs of refinancing, and unexpected inflationary pressures have exacerbated the monetary dilemma of choosing growth or price stability. In addition, consolidation of the recovery does not imply satisfactory rates of growth—only that LAC has returned to the unsatisfactory growth rates that characterized the period before the pandemic. A far-reaching reform agenda, including of the state, remains pending and will need to take into account important shifts in the international context. Over the medium term, the Russian invasion of Ukraine will lead to losses in output, rising inflation, and higher uncertainty. Of longer-term consequence, chapter 2 explores how the increasing demands for global action on climate change will lead to some painful adjustments for LAC, but also some opportunities for growth and improved social welfare.

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**CHAPTER 2**

# SEIZING GREEN GROWTH OPPORTUNITIES

Recovery in Latin America and the Caribbean (LAC) will take place within a global context in which concerns around climate change are giving rise to far-reaching policy changes. The sixth report (2022) of the Intergovernmental Panel on Climate Change (IPCC) sounded even more insistent alarm bells on likely damage to developing countries in terms of loss of livelihoods, increased climatic catastrophes, and ecosystem degradation, stating that “Climate Resilient Development is already challenging at current warming levels. It will become more limited if global warming exceeds 1.5°C (2.7°F). In some regions it will be impossible if global warming exceeds 2°C (3.6°F)” (IPCC 2022). The increasing frequency and power of extreme weather events—such as the dramatic drought that has affected agriculture and power generation in Argentina, Brazil, Paraguay, and Uruguay, and the devastating hurricanes of the past two seasons in the Caribbean—are the most notable and visible effects of climate change, creating billions of dollars of losses in infrastructure, lost productivity, disease, poverty, and death. However, climate change is more than a series of shocks; it is a change in trend. In LAC, that trend threatens agricultural productivity, food security, and most importantly the health and well-being of the region’s population.

Both the public and private sectors are mobilizing with increased urgency to meet the goal of keeping warming at manageable levels and correctly so. The uncertainty around these forecasts, as well as the irreversibility of the damage, dictates taking aggressive action (Pindyck 2021). At the last United Nations Climate Change Conference (COP26) in 2021 in Glasgow, countries committed to carbon emission reductions by 2030 and agreed to a basic set of rules for voluntary carbon markets that potentially will involve billions of dollars’ worth of carbon credits. Green finance continues to grow, and many more firms are pledging to go green and be sustainable.

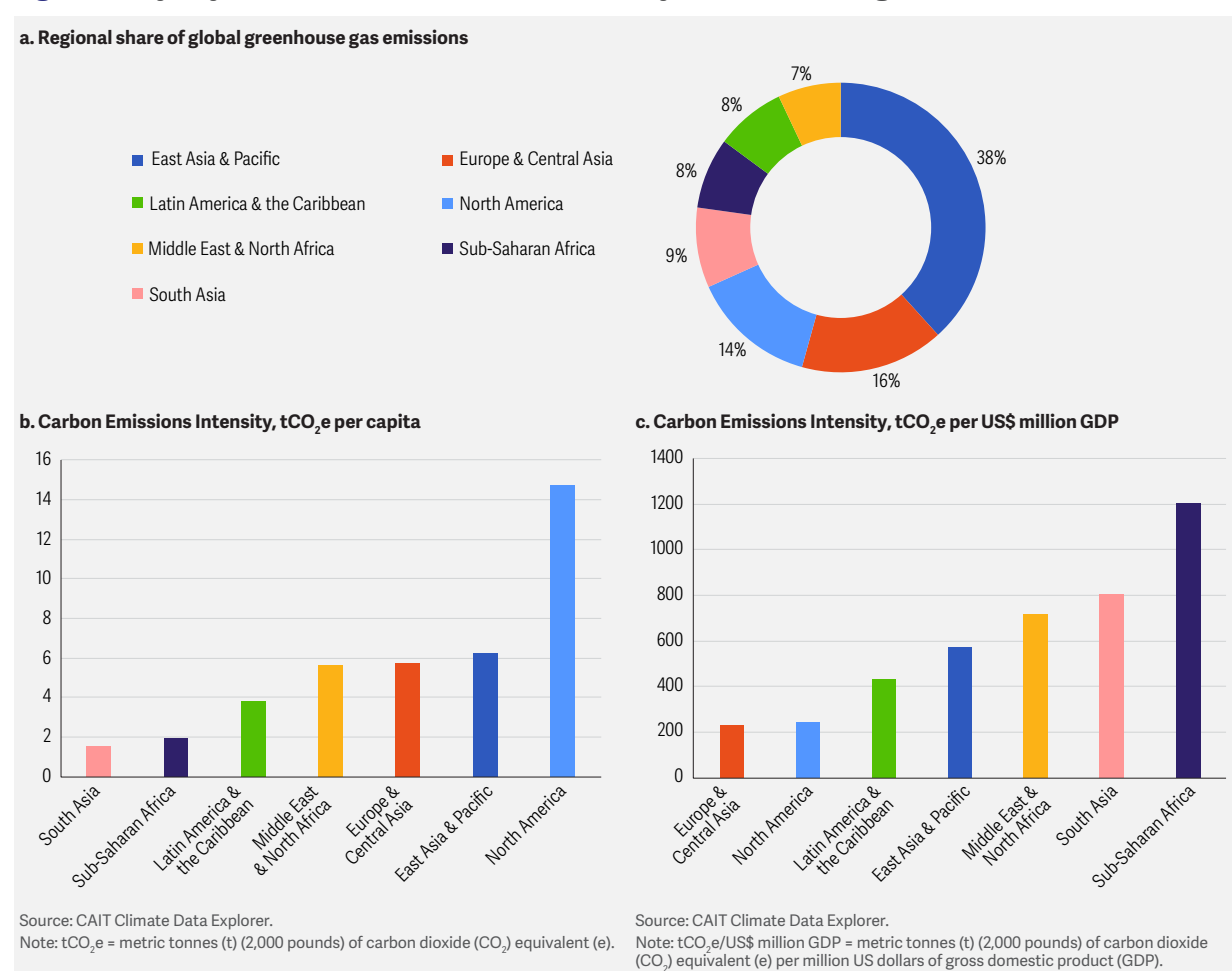
Many Latin American countries are also committed to reducing carbon emissions, phasing out coal, and decreasing deforestation by 2030. Clearly, meeting these goals will require changing how we do business in important ways, some of which will necessarily constrain growth in some sectors. Over the long term, petroleum production will contract and the sector will likely become a “stranded asset.” Reduction in deforestation necessarily implies reduced expansion of new cropland (although not necessarily crop production) and curtailment of unsustainable forestry and mining. Under existing production techniques, reducing methane emissions from livestock would seem to require reducing herd sizes. Although the region’s manufacturing sector, including steel and cement, contributes relatively less to climate change, manufacturing industries face few easy ways of reducing carbon usage, implying that, in the short term, carbon taxes will reduce output and raise prices.

Viewed through the lens of currently employed technologies, such restrictive policies will have costs and are likely to face political resistance. However, the message of this chapter is, first, that LAC is well positioned to take advantage of the emerging Green World Order. The region’s economies are already very green and offer a comparative advantage relative to competing exporters as LAC faces increasingly restrictive carbon content import requirements. But more importantly, we should not view climate mitigation and adaption through the lens of existing technologies: they must be seen as issues of technological adoption and innovation that place this agenda precisely at the nexus with growth more generally (Cirera and Maloney 2017; Cirera and Cruz forthcoming). New herd management technologies are generating lower-emission livestock and new agricultural technologies are improving yields and productivity in farms—but the region must adopt these technologies. However, at the heart of the low growth documented in chapter 1 is precisely the weak regional performance in technological adoption and innovation. This “knowledge” or “innovation agenda” needs to be placed at the center of both the growth and greening debates, and the policy synergies between the two agendas are potentially great. Further, in a context of tightening financial conditions, opportunities are opening in the green finance sector, where analysts suggest that investor appetite is growing rapidly and outstripping supply. If well managed, the tradeoffs between climate change mitigation and prosperity will have real but modest costs, while the opportunities that global greening offers the region can offer new sources of exports and growth.

## LAC Contributes Modestly to Climate Change....

By any available measure, LAC has contributed little to the compounding global crisis of climate change. Estimates indicate that LAC contributes 8 percent of current emissions (figure 2.1, panel a) and has relatively small emissions per capita (figure 2.1, panel b). In fact, LAC is a region with relatively low emissions intensity (figure 2.1, panel c), meaning that it has achieved its level of development without emitting much greenhouse gases (GHG).

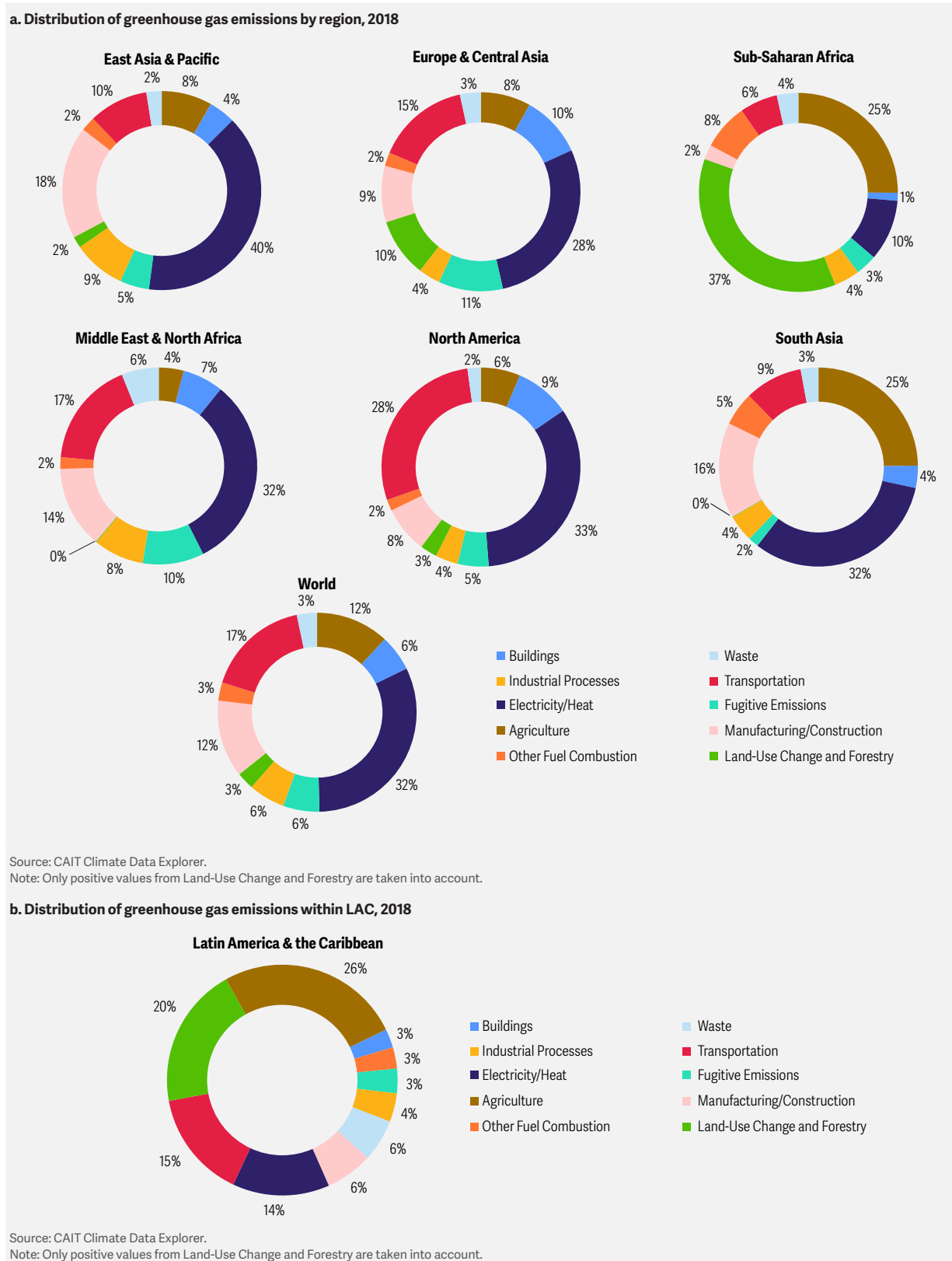
**Figure 2.1. By Any Measure, LAC Contributes Modestly to Climate Change**



Unlike most other regions, LAC's emissions come mainly from the Agriculture sector and Land-Use Change and Forestry sector (figure 2.2, panel a). In most regions of the world the main emitting sectors are Electricity/Heat and Transportation; in LAC, these sectors are third and fourth (figure 2.2, panel b). This implies that the recipe for mitigation in LAC is unique, with priorities including effectively enforcing protected areas, reducing deforestation, pursuing reforestation schemes, and adopting climate-smart agriculture (CSA) practices and technologies that can help mitigate the sector's emissions—particularly from livestock production.



**Figure 2.2. The Emissions Pattern in LAC Is Different from Most Other Regions**

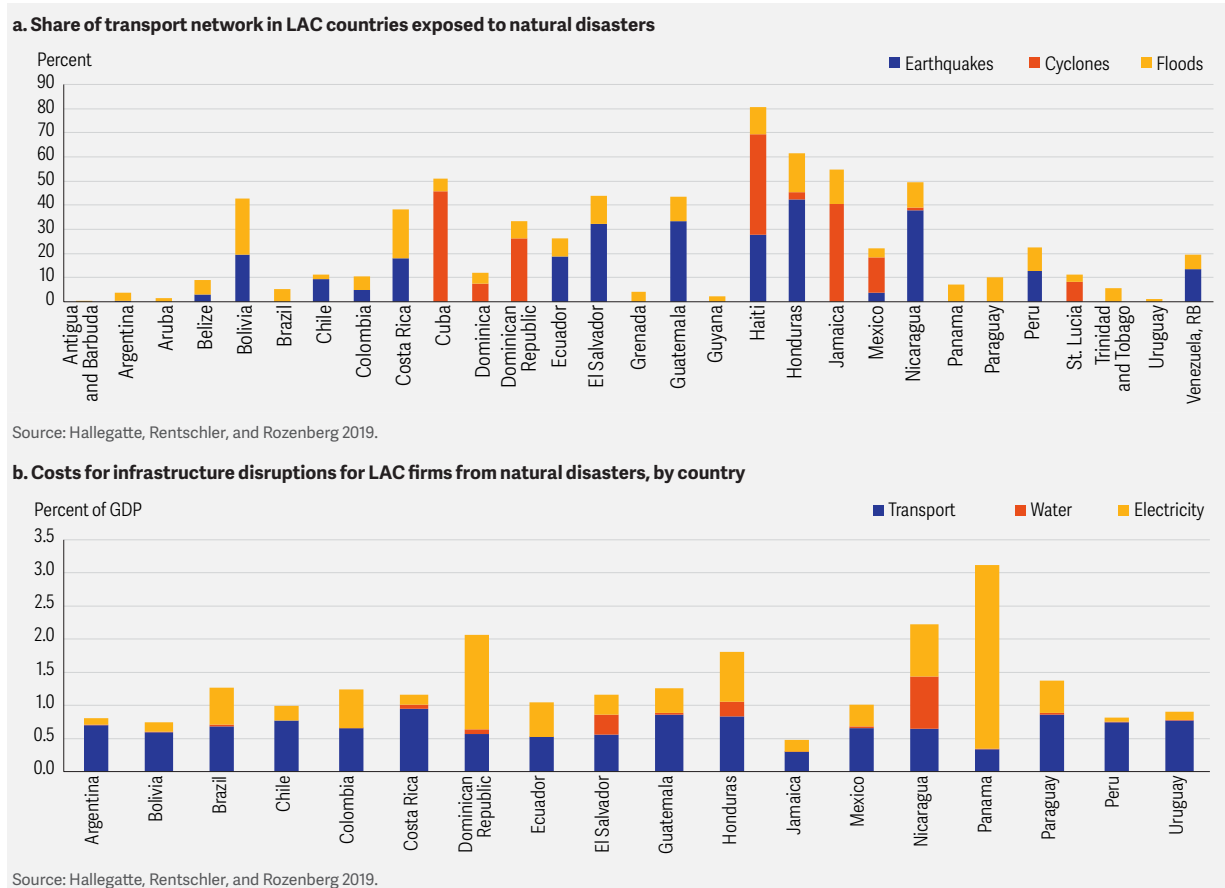


## Yet Is Highly Exposed and Vulnerable to Most of Its Damaging Effects

Climate change poses important challenges to the region's economies. On average, 1.7 percent of annual GDP has been lost in Latin American countries due to climate related disasters over the last two decades (CELAC, SRE, and Global Center on Adaptation 2021). An analysis of the impact of extreme weather events in the past two decades shows that eight Caribbean nations figure among the top twenty globally in losses as a percentage of GDP, and five in terms of deaths per capita.<sup>1</sup>

The weather-related disasters create disruptions in critical sectors such as power and transport, damaging key infrastructure and creating economic and financial losses due to interruptions in service that affect supply chains. Many of the regions' transport networks—up to 60 percent of the network in Jamaica, 50 percent in Haiti, 35 percent in the Dominican Republic, and 25 percent in Bolivia—are vulnerable to disruptions due to cyclones and or floods (figure 2.3, panel a). The cost of overall infrastructure disruption—power, transport, and water—as a share of GDP is nearly 1 percent per year for most LAC countries but could reach 2 percent in the Dominican Republic and 3 percent in Panama (figure 2.3, panel b). These numbers are large when compared to the average yearly investment in infrastructure of roughly 1.5 percent.

**Figure 2.3. LAC Is Highly Exposed to the Damaging Effects of Climate Change**



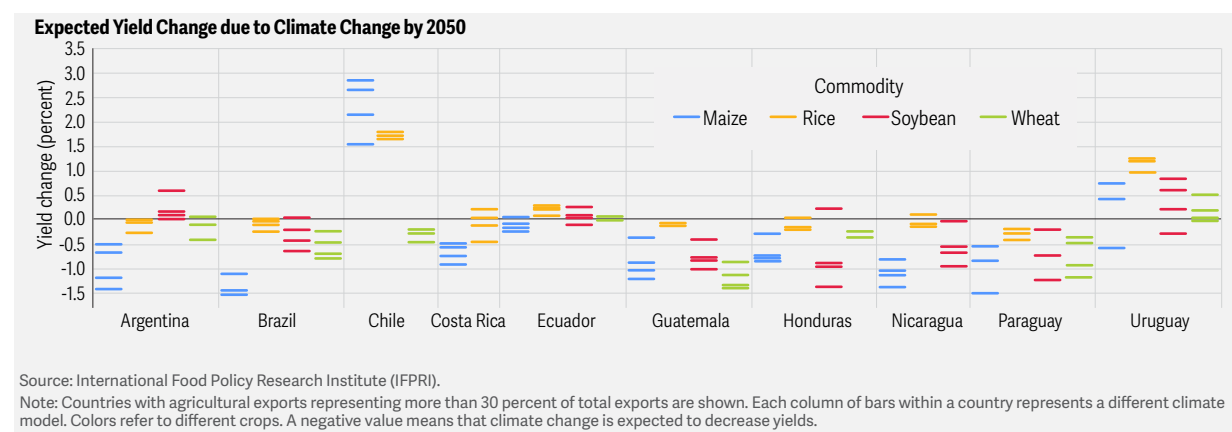
1 Germanwatch Global Climate Risk Index 2021, based on data from MunichRE NatCatSERVICE.

Beyond extreme events, some key sectors for the region will be adversely affected by the slow-onset effects of climate change. Tourism in the Caribbean is highly exposed not only to floods and cyclones but to sea level rise. Coastal cities are also threatened by sea level rise; 60 of the 77 most densely populated cities in the region are located on the coast.

Potentially, one of the most economically damaging impacts for the region may be related to the combination of higher average (and extreme) temperatures and the changing hydrological cycle, with precipitation patterns becoming more variable and less predictable. During 2020 severe drought affected many parts of the South American interior, particularly in northern Argentina, Paraguay, and the western border areas of Brazil. The Bolivian Chaco and Pantanal regions suffered the most severe droughts in the past 60 years in 2020 (Marengo et al. 2021). Estimated agricultural losses nearly reached US\$3 billion in Brazil, with additional losses in Argentina, Uruguay, and Paraguay. By July 2021, the ongoing drought caused the Paraguay and Parana Rivers to shrink to their lowest levels in half a century, hampering shipping and water security in five cities in Argentina. Paraguay and Argentina have also experienced significant drops in energy output from hydropower disrupting the constancy of baseload power, increasing the need for gas imports, and reducing export earnings from electricity trade. This has resulted in direct and substantial fiscal impacts in both countries.

Without proactive action, agriculture—one of the region’s main exporting sectors—is likely to be hit hard. Current estimates indicate that without strong investment in adaptation measures crop yields will decrease in virtually all countries except Uruguay and to a lesser degree Chile (figure 2.4). Reduced yields of wheat, soybean, maize, and rice could result in significant negative economic impacts and jeopardize food security and nutrition across the region.

**Figure 2.4. Without Adaptation Measures, Agricultural Production May Be Hit Hard**



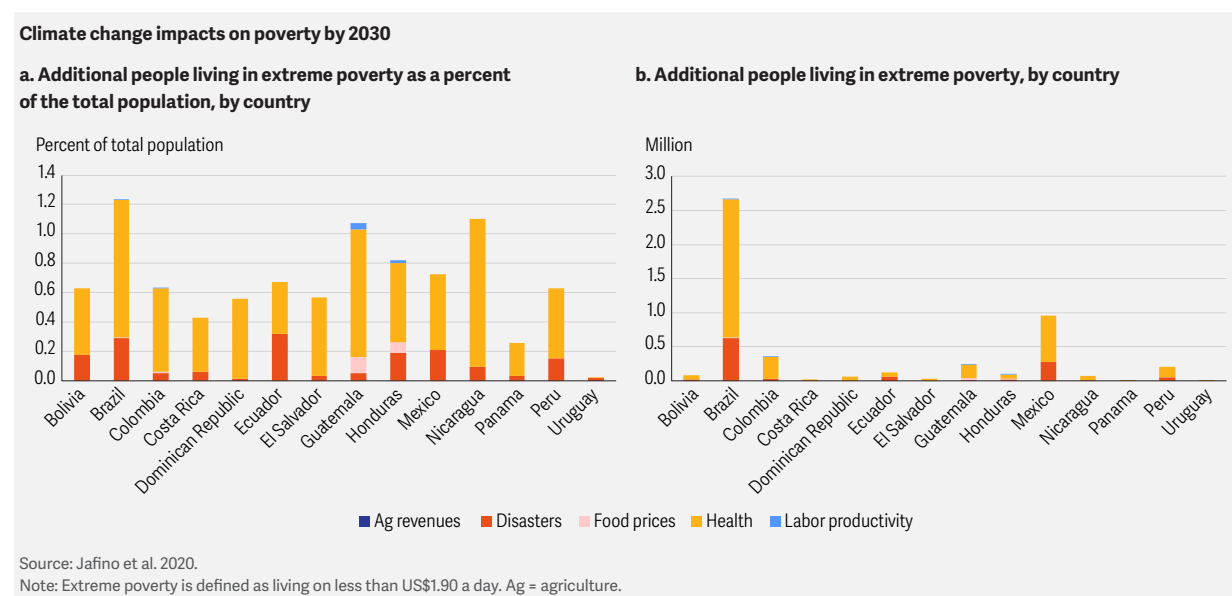
Changing precipitation patterns and shifts in the availability of water resources also affect the stability of electricity generation in the region. The region is highly exposed to hydro-climatological variability, given its high dependance on large hydropower for electricity generation. Prolonged and severe droughts reduce the water available for power generation, thus triggering the use of expensive and carbon-intensive (often oil-fired) supply substitutes. This results in exponentially higher electricity prices that are either passed on to consumers (reducing their disposable income) or absorbed by states (deteriorating their fiscal positions). For example, the 2012 drought in Uruguay resulted in expensive imports of oil, with a record cost of US\$1.4 billion to the public utility (UTE).

At the same time, rising temperatures are increasing demand for electricity-consuming cooling appliances. Estimates indicate that air-conditioning unit stocks will increase more than sixfold in LAC by 2050 (Bayer 2021).

Moreover, it is expected that changes in demand will increase peak electricity consumption, affecting the stability of power systems as well as generation capacity requirements.

All in all, the combined effects of climate change in LAC are projected to push between 2.4 million and 5.8 million people into extreme poverty by 2030 (Jafino et al. 2020), mostly due to health-related effects—the increasing prevalence of child stunting, vector-borne diseases, and diarrhea—resulting from lack of access to safe water and sanitation, excessive heat, and more frequent droughts and floods (figure 2.5).

**Figure 2.5. Climate Change Could Drive Millions of People in LAC Back into Extreme Poverty**



Moreover, without concrete adaptation and mitigation actions, estimates suggests that more than 17 million people in LAC (2.6 percent of the population) could be forced to migrate within their own countries to escape the slow-onset impacts of climate change. This is particularly concerning if climate-migrants are forced to the poorest and informal settlements in cities. These areas are often the most exposed to flooding and landslides, which are expected to become more frequent and severe because of climate change.

Finally, the region's exports could be reduced by the EU's progressive embrace of Carbon Border Adjustment Mechanisms (CBAM) that would tax goods that are intensive in carbon or that have other environmentally damaging effects.<sup>2</sup> The introduction of the pilot CBAM tariffs comparable to the EU Emissions Trading System (ETS) on cement, iron and steel, aluminum, fertilizers, and electricity imports from 2023 will probably have a limited effect on the region. Iron and steel sector exports from Brazil are likely to be the most affected. As the tax expands to agricultural products, however, the effects could be more widespread. Thus, it is increasingly important to decarbonize quickly to ensure the competitiveness of regional exports. Opportunities also exist for LAC exports, which are less emission-intensive than those of export competitors from other regions.

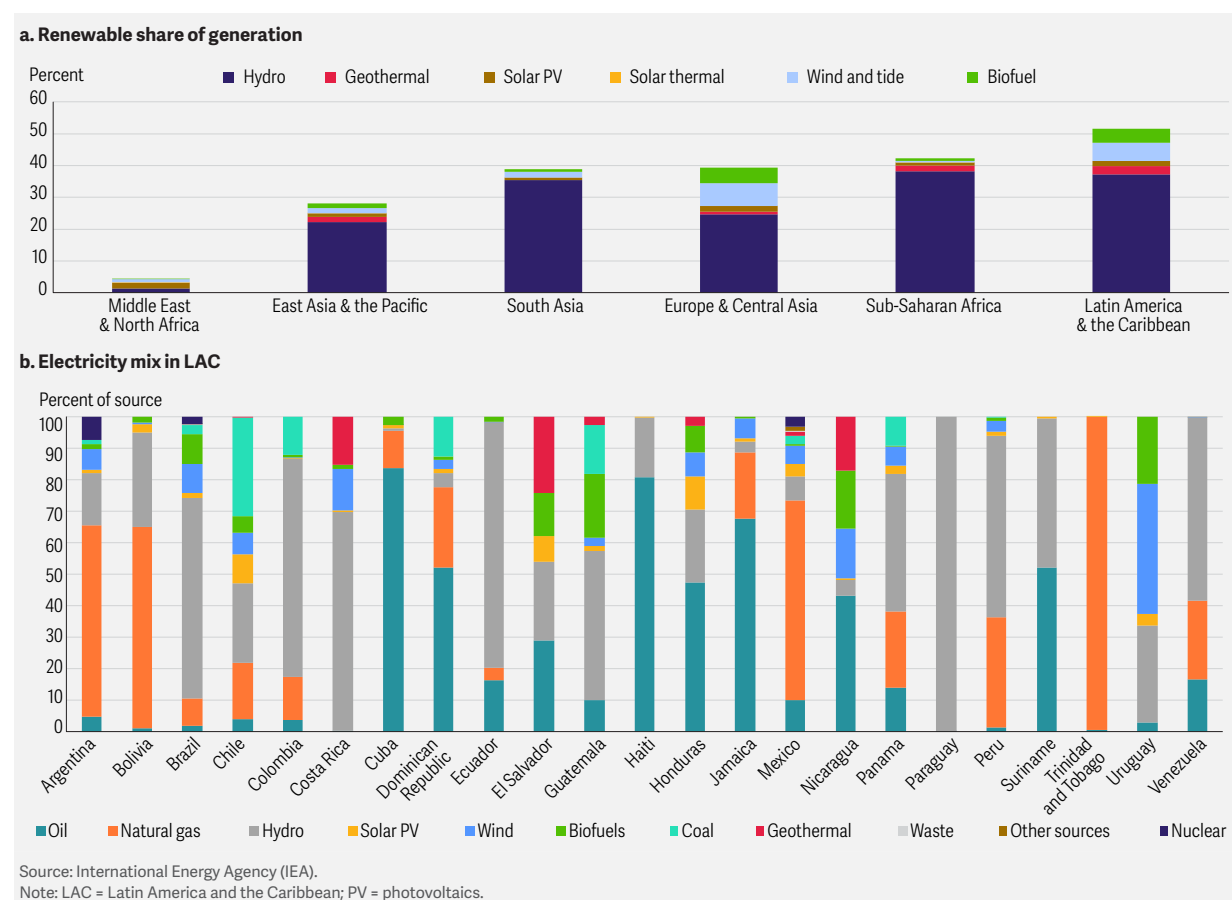
2 The WTO compliance of CBAMs is at present uncertain (see Hufbauer 2021).

## LAC's Green Comparative Advantage

LAC has a comparative advantage in the green economy, thus opening the door for new growth and export opportunities. Fully embracing green policies can enable producers to capture green premiums on their products, expand to new markets, and avoid carbon border adjustment taxes. Many adaptation and mitigation policies aim to improve efficiency and productivity—thereby promoting growth as well as sustainability. Ultimately, building the capabilities and institutions that facilitate low-carbon technology adoption will allow for the region to approach the technological frontier and become an innovator itself—laying the foundation for future growth.

The region begins from a favorable starting point to manage the energy transition toward a low-carbon system. With an electricity generation matrix based mostly on large hydropower and complemented with natural gas, the region already has one of the greenest electricity grids in the world (figure 2.6, panel a). There is significant variation in the region, however, with the Caribbean having energy generation matrices that are intensive in fossil fuels (figure 2.6, panel b). This implies that many of LAC's products and exports will have a low carbon content relative to potential competitors in the immediate future. This said, with the effects of climate change threatening the availability and reliability of water for electricity generation, it is important for policymakers to promote and incentivize water efficiency programs—such as irrigation systems for agriculture, and water storage and retention solutions for hydropower—and prioritize investments in water infrastructure. Moreover, policymakers will need to develop demand-management and energy efficiency programs as key components of their energy planning.

**Figure 2.6. LAC's Electricity Generation Matrix Is Already Very Green**

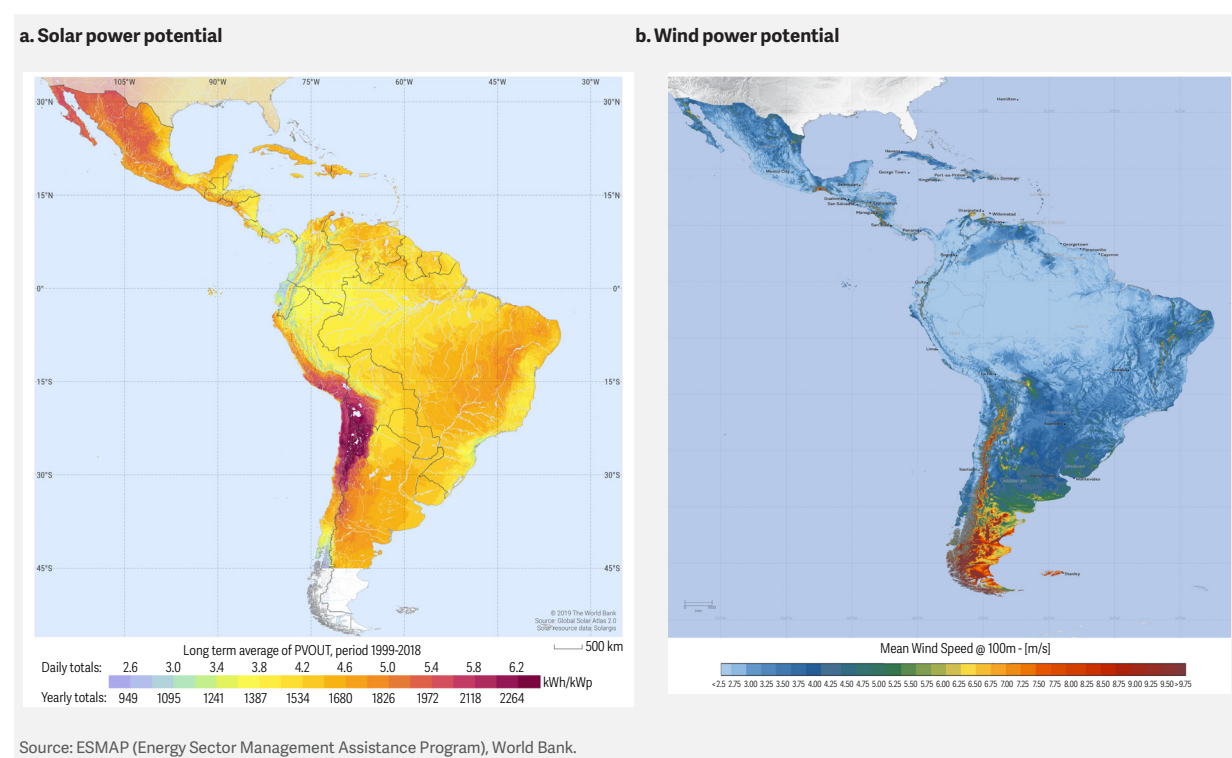




LAC has great potential for abundant, reliable, green electricity. The region has a great starting point and energy efficiency programs have great potential, but in the end electricity demand is projected to rise dramatically, as electrification of end-uses—mainly heating, transport, and some industrial processes—is a key component of de-carbonizing the economy. Thus, incorporating more sources of clean energy is a must for the region. Fortunately, the region is blessed with vast potential in non-conventional renewable energy (NCRE), potentially including geothermal, wind, solar, tidal, wave, biomass, and small hydroelectric plants.

The region has vast untapped potential in wind, solar, and geothermal energy. Mexico, Chile, and northwest Argentina are spanned by deserts that have some of the highest solar radiation in the world (map 2.1, panel a). Northern Colombia and the Patagonia region have huge potential to generate large amounts of wind energy (map 2.1, panel b). As for geothermal energy generation, while Central America and Mexico are more advanced, there is also potential in the Caribbean and some parts of South America. Moreover, agricultural refuse and waste from cities can be sources for biomass power generation plants.

**Map 2.1. The Region Has Vast Potential for Solar and Wind Power Generation**

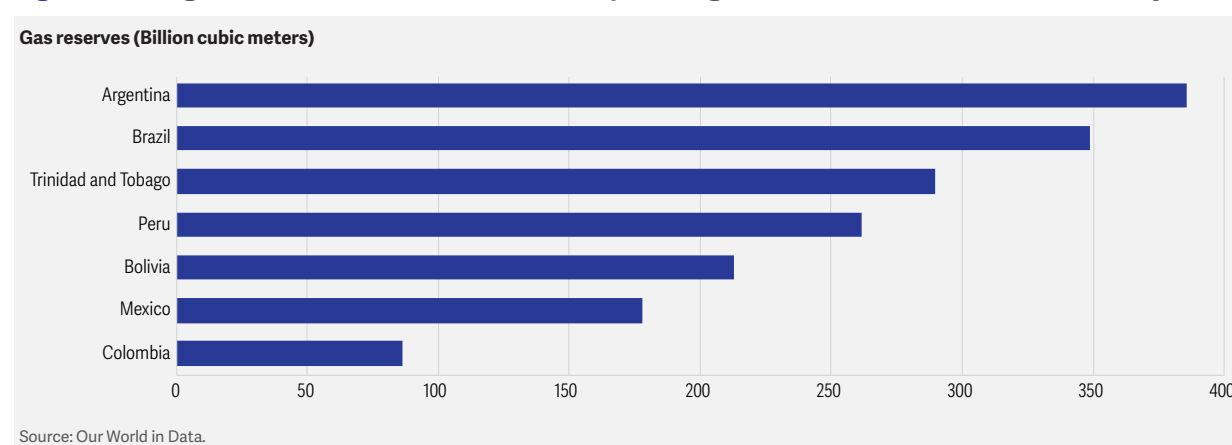


Innovative mechanisms in several LAC countries have added large amounts of NCRE and have created some of the most dynamic renewable energy markets in the world. Argentina, Brazil, Chile, Mexico, and Peru have all incorporated NCRE generation, promoting large private investments through renewable energy auctions that help keep costs down.

In addition, Argentina, Bolivia, Peru, and Trinidad and Tobago in the Caribbean have vast reserves of natural gas (figure 2.7), which, due to its lower carbon content, can serve as a relatively clean transitional energy source displacing more polluting sources (coal, diesel, oil) and facilitating higher rates of renewables integration. Moreover, gas-fired plants are quite competitive in midcycle and peak demand applications because they can quickly and efficiently be started up and turned off, helping to balance the system. For this reason and until long-duration

electricity storage becomes economically viable, they can be an important complement to integrating intermittent energy sources such as wind and solar, accelerate the transition away from more polluting sources and improve the resilience of hydro-dominated systems. If the cost of carbon capture and storage technologies comes down enough, natural gas power plants could also become a net-zero electricity producer. In the short term, producers in the region can immediately reduce their impact on climate change by minimizing flaring and fugitive methane emissions in production and transportation. Looking forward, the region could develop the necessary capabilities to innovate in large-scale, long-duration energy storage solutions—such as hydro pumped storage and large batteries—as well in carbon capture and storage (CCS) technologies.

**Figure 2.7. Large Reserves of Natural Gas Can Help the Region Transition to Net Zero Electricity**



Yet, policy needs to take account of the high uncertainty surrounding oil and gas demand forecasts in the future. Moreover, the long-lived nature of new gas infrastructure means that it is not always consistent with the need to decarbonize economies by 2050 and can lead to long-term carbon lock-in. Estimates indicate that to limit warming to 1.5 Celsius, the region may face between US\$37 billion and US\$90 billion of carbon-intensive stranded assets before the end of their useful lifetimes. An additional complicating factor is that natural gas is often produced jointly with the extraction of oil. Moreover, in the power sector, about 60 gigawatts (GW) and 128 GW of fossil-fuel power plants—representing about 15 percent to 33 percent of total installed capacity in the region—could also be retired before the end of their physical lifetimes before 2050. Therefore, it is critical to manage the risk of stranded assets, carbon lock-in, and declining fiscal revenues if oil demand decreases significantly as countries adopt emission abatement policies.

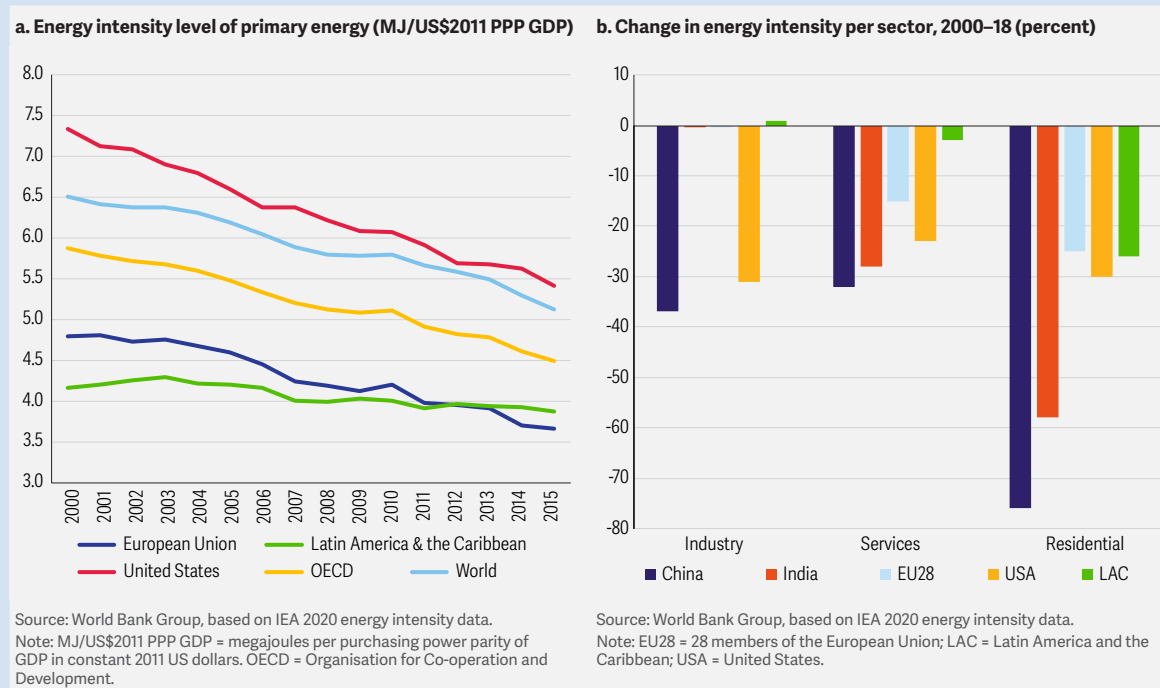
Energy efficiency is another promising area to reduce emissions. Energy efficiency measures are among the most cost-effective means to achieve reductions in emissions, potentially contributing 40 percent of total emissions savings through 2050 (IEA 2015). In the fiscally constrained environment that LAC is facing, making the most of existing energy assets while reducing (or avoiding) emissions seems like an optimal strategy. Unfortunately, the region has made little progress over the last two decades (see box 2.1).

## Box 2.1. Slow Progress in Improving Energy Efficiency in LAC

Energy efficiency can help mitigate climate change, improve energy security, create jobs, and contribute to economic growth. To meet global climate and sustainability goals, energy efficiency (measured indirectly through primary energy intensity) needs to improve at a rate of 3 percent annually globally by 2030 (IEA 2019). Wasteful energy consumption in industrial processes reduces economic competitiveness and contributes to climate change. At the same time, households are increasing their energy consumption due to increased adoption of appliances and cooling and heating devices. Investing in energy efficiency is key because many energy-efficient products and services are cost effective, and existing programs can be ramped up in the near term. Further, many of these projects are labor intensive—meaning that most of the costs are related to labor—and thus can help create new jobs quickly. These projects can also be inclusive, providing jobs for displaced workers, as skill barriers in some sectors are minimal.

The region is lagging its peers in reducing its energy intensity. Benchmark countries (EU28, United States, India, China) have made much more progress in reducing energy intensity than LAC countries (see figure B2.1.1, panel a). While some of the improvements can be attributed to the changing composition of a country's production structure (that is, a shift from more energy-intensive to less energy-intensive economic sectors), LAC appears to have made relatively little progress in the services sector and has actually increased energy intensity in the industrial sector (figure B2.1.1, panel b).

**Figure B2.1.1. Progress in Reducing Energy Intensity**



Lack of long-term planning, instability in policy implementation, and lack of access to financing has translated into inconsistent funding and abandonment of successful initiatives to promote energy efficiency. Many of the programs that were instituted were based on international grants or technical assistance programs and did not have continuity over time despite having achieved good results. Most local governments lack the capacity and budget to provide continuity and scale up pilot programs.

Recent evidence suggests that energy prices that reflect true economic and environmental costs, access to consistent financing, and enhanced technology adoption are key determinants for improving energy efficiency (World Bank forthcoming).

Substantial progress is needed in critical areas, including developing building codes, setting minimum energy performance standards, and developing financial mechanisms to support investments. For example, Argentina, Chile, the Dominican Republic, Ecuador, Guatemala, Nicaragua, Panama, Peru, and Uruguay have implemented Energy Efficiency Funds/Trusts and Energy Efficiency Credit Lines. This institutional setup and know-how could be leveraged to scale up financing. The COVID-19 economic reactivation programs represent an opportunity to reinvigorate the energy efficiency agenda in the region. The World Bank has identified more than 290 energy efficiency measures across 22 countries that could serve as a basis to scale up efforts in the Latin America region.

While existing technologies can support de-carbonizing the power sector, further innovations in energy generation and storage are needed for deep de-carbonization of the transport and manufacturing sector. To support the transition of the transport and industrial sectors toward low-carbon futures—most likely by electrifying many end-uses—it will be necessary to incorporate much more capacity into existing power systems. It is thus imperative to build the innovation capabilities now and invest in the research and development (R&D) that can deliver more—and more reliable—renewable and clean electricity. Given the extensive coastlines of the region, for example, innovation in offshore wind farms and tidal and wave generation may prove particularly valuable.

Partnering with the private sector is crucial to accelerate the transition. On the one hand, attracting private sector investment without draining public resources requires cost-recovery tariffs and smart regulations that incentivize the reduction of technical and nontechnical losses in distribution. On the other hand, most NCRE projects have high upfront capital expenditures. Thus, innovative financing, de-risking mechanisms and market-based instruments are required to leverage private sector participation. In Argentina, for example, the Renewable Fund Guarantee Project (FODER) leveraged the World Bank Group's credit rating and mitigated the risk perceived by financiers, thus allowing for the “crowding-in” of private sector investments that might not have participated otherwise. Successful geothermal development in St. Lucia was possible due to government investments in the high-risk stage of exploration, with private sector investors coming in once the resource risk had been mitigated.

### ***Bright Prospects for Alternative Fuels (Green Hydrogen)***

A second comparative advantage for the region is in producing “green hydrogen.”<sup>3</sup> Green hydrogen is receiving progressively more attention from governments and investors as a viable alternative energy source that is clean, storable, and transportable. In fact, hydrogen already has several applications—with a market estimated to be worth \$US150 billion<sup>4</sup>—mostly for the production of ammonia and other fertilizers, and various other chemicals, as well as in the refining of oil products. Most hydrogen today is produced with natural gas—known as grey hydrogen.<sup>5</sup> Green hydrogen can be understood as a means of storing intermittent renewable energy—removing a significant barrier to widescale adoption of solar and wind generation. It is expected that it could eventually be

3 Green hydrogen is defined as hydrogen produced by splitting water into hydrogen and oxygen using renewable electricity. Hydrogen has a wide range of uses, from non-electrifiable transport to fertilizer. Other “grey” or “blue” hydrogen is produced with carbon-emitting processes (natural gas) with varying degrees of carbon capture.

4 Financial times, <https://www.ft.com/content/7eac54ee-f1d1-4ebc-9573-b52f87d00240>

5 If emissions of natural gas were eliminated through CCS technologies, then it would be considered “blue hydrogen.”

used to power freight ships, airplanes, and other transport vehicles that cannot be easily electrified. Moreover, it can be used as a fuel in industries such as steel and cement where carbon emissions are hard to abate and electrification is not technically feasible. Clearly, it would also green hydrogen's current uses, thereby producing green fertilizers, ammonia, and chemicals, helping to de-carbonize other sectors of the economy.

Estimates indicate that the green hydrogen market could reach US\$2.5 trillion by 2050<sup>6</sup>. LAC countries with abundant renewable energy resources could produce green hydrogen locally, creating jobs and generating economic opportunities while reducing exposure to oil price volatility and supply disruptions, and thus increasing energy security and stability. Chile, for example, is estimated to have the potential to produce 160 million tons per year—earning the International Energy Agency's designation as the “Hidden Champion” of 2019. Chile's electricity regulator indicates that in optimal sites, wind and solar have a levelized cost of energy of US\$25/Megawatt-Hour (MWh),<sup>7</sup> which would allow Chile to be one of the most competitive countries in the world to produce green hydrogen. Numerous foreign firms are working with Chilean authorities and there is growing interest in producing in Argentina, Brazil, Mexico, and Uruguay.

However, the region must move quickly. Green hydrogen has large-scale economies, putting a premium on rapid and widespread adoption by first movers. While green hydrogen is not currently competitive with grey hydrogen or traditional fuels, significant cost reductions are expected as the electrolysis industry scales up and the technology improves. It is important for governments to coordinate with local transportation systems and the industrial sector—mostly steel and cement—to foster demand, providing markets in the early stages. As the technology improves and proves viable, further opportunities will arise throughout the entire value chain: for example, by producing the machines (electrolyzers) that separate water molecules (H<sub>2</sub>O) into hydrogen (H) and oxygen (O) (or some of the parts of electrolyzers) or becoming exporters of green fertilizers and chemicals, as well as hydrogen itself. Effecting these downstream linkages will require increasing innovative capabilities, in both research and development efforts and human capital.

While there is a huge opportunity for the region, it must be carefully planned, coordinated, and regulated. As some parts of the transport sector are electrified and the other will potentially shift toward green hydrogen or one of its derivatives (ammonia, synthetic fuels),<sup>8</sup> this will have a dramatic impact on electricity demand. Moreover, the higher share of variable renewable sources in the generation mix will increase variability in the system. Thus, new technologies and the digitalization of processes will be needed to better synchronize supply and demand, increasing overall flexibility and stability of energy systems. A robust legal and regulatory framework will also be needed to ensure the appropriate governance of interconnected sectors; support grid expansion; coordinate energy systems covering the operation of power generators, grids, and storage devices, and the adequate management of power flows; and implement demand-side management strategies. The development of green hydrogen, for instance, requires enacting safety standards for sustainable production, storage, transportation, and commercialization. Innovative co-financing and concessional funds could support first-of-a-kind green hydrogen projects in LAC countries such as Argentina, Brazil, Chile, Colombia, Costa Rica, or Uruguay. Investors could use commercial financing to fund renewable power projects such as wind and solar assets dedicated to producing green hydrogen, while benefiting from blending with concessional funds to reduce the financing cost of the electrolysis plant.

<sup>6</sup> Hydrogen Council (2017)

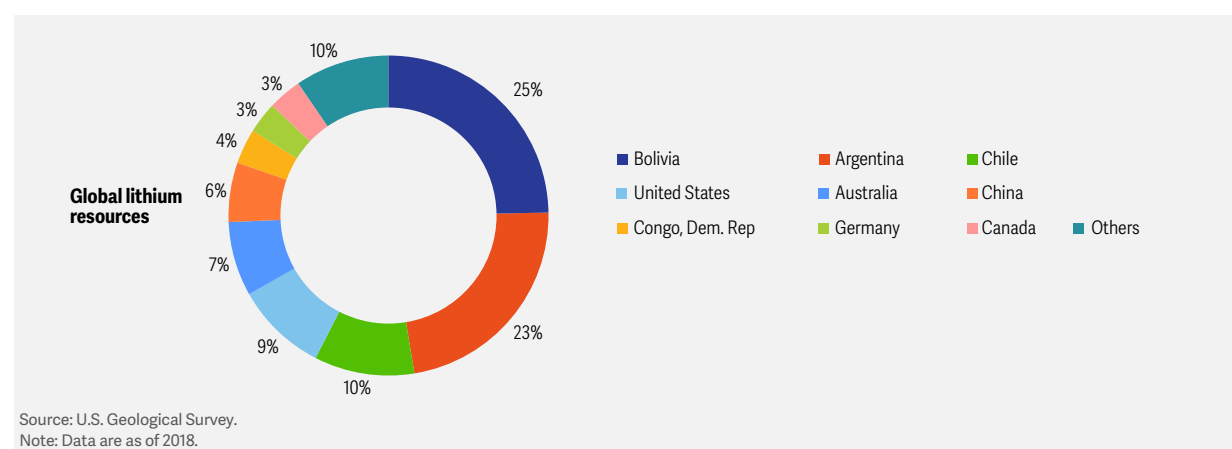
<sup>7</sup> Levelized costs are the measure through which different electricity technologies are compared. They include the capital investments plus operational costs and normalize that by the generation capacity. See [https://en.wikipedia.org/wiki/Levelized\\_cost\\_of\\_energy#:~:text=The%20levelized%20cost%20of%20energy,generation%20on%20a%20consistent%20basis](https://en.wikipedia.org/wiki/Levelized_cost_of_energy#:~:text=The%20levelized%20cost%20of%20energy,generation%20on%20a%20consistent%20basis).

<sup>8</sup> Synthetic fuels are those produced with hydrogen and captured carbon.

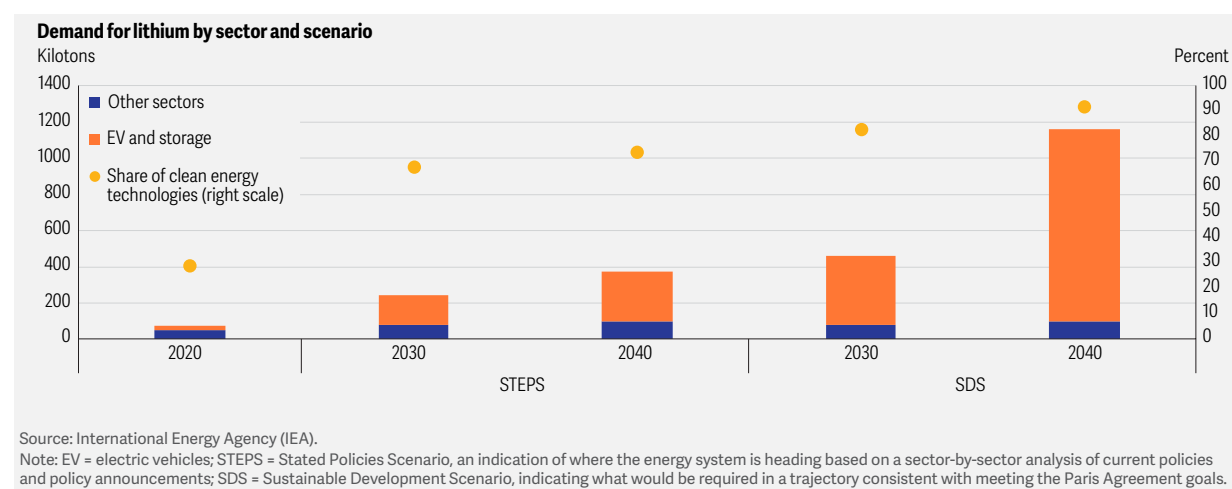
## LAC Is Rich in Minerals Critical for the Energy Transition

The lithium triangle of Argentina, Chile, and Bolivia holds 60 percent of global reserves of lithium, a key component of battery-based energy storage (see figure 2.8). Most electric vehicles (EVs) use lithium ion (Li-ion) batteries. Since 2010, the price of batteries has dropped by 80 percent. Given the high investment levels in battery R&D, costs are expected to continue falling, supporting a continued increase in demand (see figure 2.9). While not currently viable economically, large-scale batteries are also expected to be a part of future energy systems, facilitating the integration of intermittent sources and the grid. While Argentina and Chile are more advanced in the extraction, processing, and export of lithium, increasing supply will be challenging given that mining generally has long lead times and significant environmental and social impacts.

**Figure 2.8. The Region Has Huge Reserves of Lithium—A Critical Mineral for Batteries**



**Figure 2.9. Demand for Lithium Is Expected to Increase Dramatically in the Coming Decades**



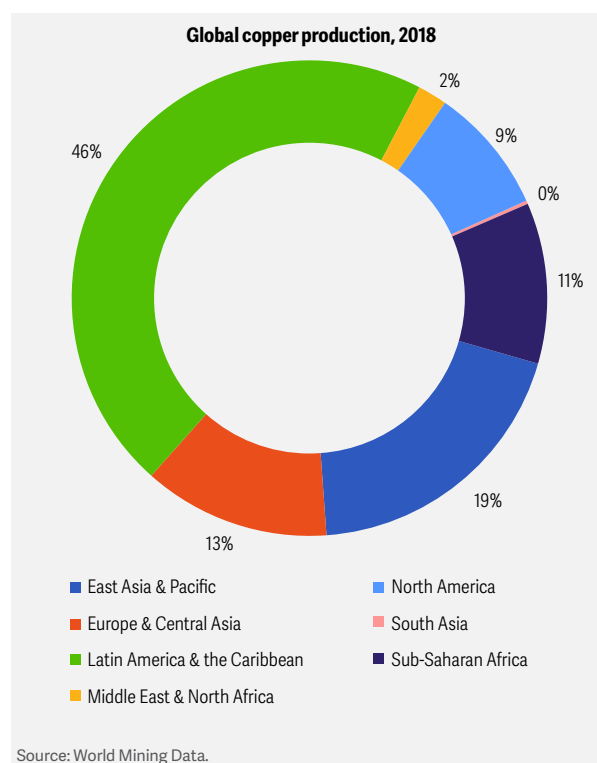
While lithium makes the headlines, demand for other minerals produced in the region—such as copper and nickel—will also increase significantly. Copper is used extensively in electricity networks and is essential in all electricity-related technologies. Analysts expect that in the short and medium term, demand growth will outstrip supply, thus putting pressure on prices. This could benefit some countries in the region that are the main producers of copper in the world (see figure 2.10).



Taking advantage of this natural endowment, however, will require careful balancing between streamlining approval of mining operations and environmental and social concerns. Mining projects can be controversial due to their environmental impacts. Extraction of lithium, for example, is highly intensive in the use of water and some of its processing can be highly contaminating. Moreover, new mining projects may foster social tensions if they impinge on indigenous lands or use their resources (mostly water), or if the benefits to local communities are perceived as low.

Beyond the short-term export possibility for the region lies the opportunity to create knowledge clusters that can produce higher value-added products and processes. The current dynamics in mineral and metal markets suggest that the region will potentially benefit from increased export revenues. To lay the foundations for growth in the long term it is crucial for governments to invest these additional revenues in the human and physical capital that will create the domestic capabilities, both to keep the extractive sector at the frontier of technology and sustainability—Australia exports services in environmentally sound mining for instance—but also to evolve along the supply chain, from a raw materials exporter to a producer of higher value-added manufactured inputs and goods, such as batteries. Emphatically, this does not occur automatically, and it cannot be dictated by fiat. Mandating that a certain fraction of inputs be integrated into the production process leads to inefficient production. Developing the entrepreneurial and technical talent and innovation ecosystems at both the local and national levels requires a sustained effort. By not doing this in the past, the region forewent the possibility of leveraging its natural resource base for diversification and growth that other countries, such as the United States and Japan, did very successfully (Maloney and Valencia Caicedo forthcoming; Maloney and Zambrano 2021).

**Figure 2.10. Demand for Copper Will Also Greatly Increase**

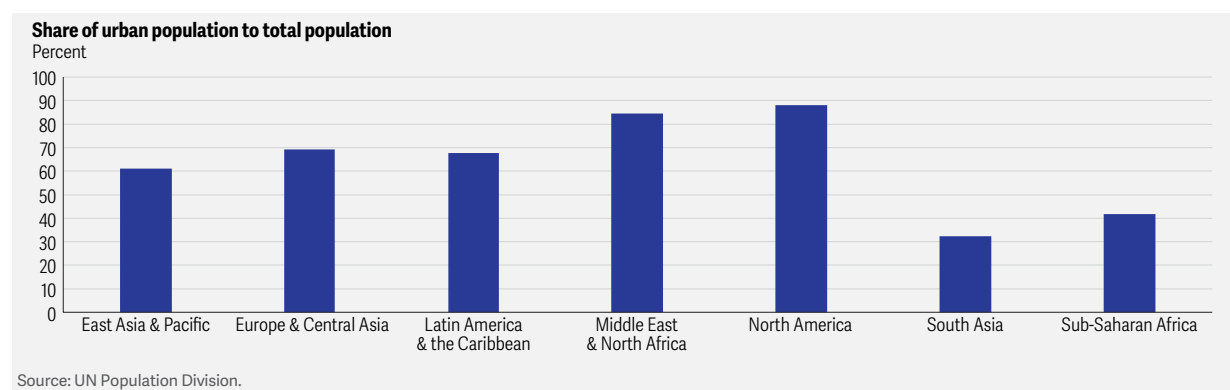


## ***The Advantage of Being Highly Urbanized***

Another green competitive advantage for the region is that it is highly urbanized (see figure 2.11). Agglomeration benefits of urban concentration offer economies of scale that can make investments in urban emission reductions more cost effective than in rural settings.<sup>9</sup> With urbanization expected to increase in the region, smart urban planning and investments in decarbonizing transport, green building codes with energy efficiency in mind, and emission-reducing strategies in waste management, the region could significantly reduce emissions from cities and make them more resilient to climate-related disasters, while also improving productivity, creating jobs, and maximizing health and quality-of-life co-benefits.

<sup>9</sup> See Grover, Lall, and Maloney (2022) for a recent treatment of agglomeration benefits, urban policy, and why developing countries get little productivity benefit from urban agglomerations.

**Figure 2.11. The Region's High Levels of Urbanization Can Be an Asset**



While cities are major contributors to greenhouse gas emissions, they are important players in the fight against the causes and effects of climate change. According to IPCC reports, about 80 percent of the region's energy consumption takes place in cities. Urban transportation systems contribute greatly to urban emissions, with estimates ranging from 61 percent of emissions in São Paulo, Brazil,<sup>10</sup> to 38 percent in Bogotá, Colombia,<sup>11</sup> to 30 percent in Buenos Aires, Argentina.<sup>12</sup> Rapid and unplanned urban expansion reduces green cover and increases vulnerability, particularly because many informal settlements are located in high-risk zones prone to flooding or landslides, jeopardizing marginalized communities. The International Finance Corporation (IFC) estimates that there is potential for US\$5 trillion of climate investments in LAC cities to 2030 (see table 2.1). Green buildings, covering both new construction and retrofits, have the largest potential (IFC 2018). Considering the imperative need for affordable housing to accommodate growing populations and the large urban population already living in informal settlements, there is huge opportunity to develop a green housing construction market. An additional co-benefit is that green building and retrofitting are estimated to have the largest job creation potential.

**Table 2.1. There Is Huge Potential for Climate Investment in LAC Cities**

	East Asia & Pacific	South Asia	Europe & Central Asia	Middle East & North Africa	Sub-Saharan Africa	Latin America & the Caribbean	Total
Waste	\$82 billion	\$22 billion	\$17 billion	\$28 billion	\$13 billion	\$37 billion	\$200 billion
Renewable energy	\$266 billion	\$141 billion	\$88 billion	\$31 billion	\$89 billion	\$226 billion	\$842 billion
Public transportation	\$135 billion	\$217 billion	\$116 billion	\$281 billion	\$159 billion	\$109 billion	\$1 trillion
Climate-smart water	\$461 billion	\$110 billion	\$64 billion	\$79 billion	\$101 billion	\$228 billion	\$1 trillion
Electric vehicles	\$569 billion	\$214 billion	\$46 billion	\$133 billion	\$344 billion	\$285 billion	\$1.6 trillion
Green buildings	\$16 trillion	\$1.8 trillion	\$881 billion	\$1.1 trillion	\$768 billion	\$4.1 trillion	\$24.7 trillion
TOTAL	\$17.55 trillion	\$2.5 trillion	\$1.2 trillion	\$1.7 trillion	\$1.5 trillion	\$5 trillion	\$29.4 trillion

Source: IFC 2018.

10 PLANCLIMASP—Plano de Ação Climática do Município de São Paulo 2020–2050. Prefeitura do Município de São Paulo, 2021.

11 Proyecto de implementación de un sistema de transporte de bajas y cero emisiones para Bogotá y la región, [https://www.movilidadbogota.gov.co/web/sites/default/files/Paginas/20-05-2020/proyecto\\_de\\_implementacion\\_de\\_un\\_sistema\\_de\\_transporte\\_de\\_bajas\\_y\\_cero\\_emisiones\\_para\\_bogota\\_y\\_la\\_region.doc.pdf](https://www.movilidadbogota.gov.co/web/sites/default/files/Paginas/20-05-2020/proyecto_de_implementacion_de_un_sistema_de_transporte_de_bajas_y_cero_emisiones_para_bogota_y_la_region.doc.pdf).

12 Plan de Acción Climática 2050, Ciudad de Buenos Aires, 2020.



Urban planning can improve resilience, reduce emissions, and improve productivity, health, and quality of life. Density and compactness in cities reduce the per capita needs for infrastructure (roads, electricity transmission lines and equipment, pipes, waste collection, and so on). Higher density around mass transit hubs and lines promotes the use of public transportation, making it more viable and reducing the need for private vehicles and thus emissions, congestion, and other pollutants. Mixed-used neighborhoods reduce the distance between jobs, shops, and residences and when developed jointly with nonmotorized infrastructure, promote walking and biking and avoid the use of motorized vehicles all together. Green urban spaces can beautify cities while improving resilience by combating the urban heat island effect and increasing water retention. Whenever possible, policy-makers should favor nature-based solutions—such as revegetation to stabilize steep slopes, creation of urban wetlands and porous green spaces for water retention to buffer flooding, and re-establishment of mangroves and other coastal vegetation to protect against storm surges—due to their cost-effectiveness and multiple health and environmental co-benefits.

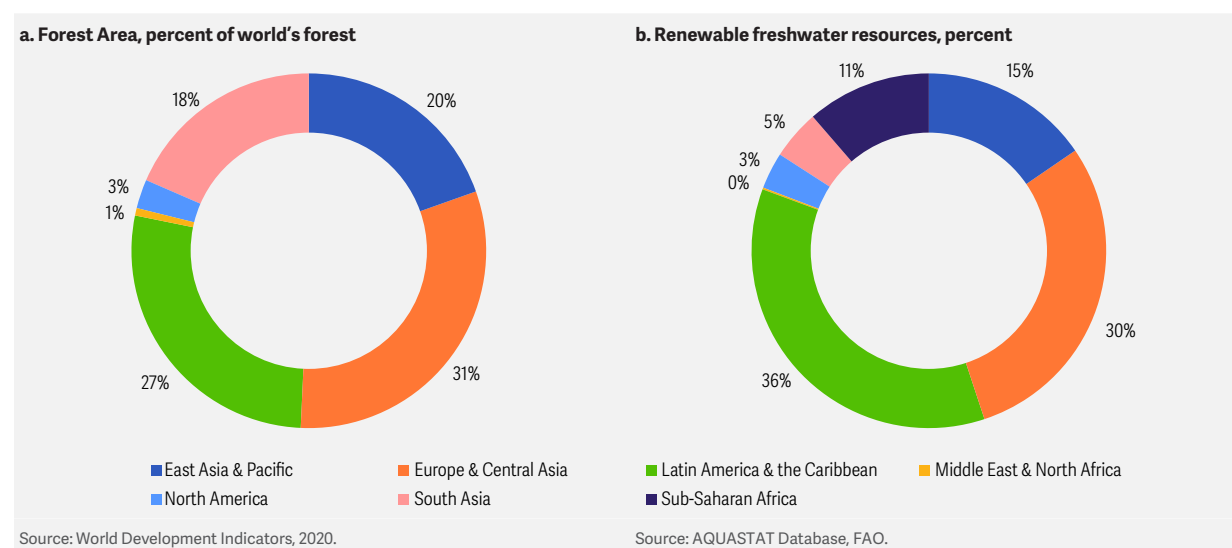
Cities provide the scale necessary for investments in better waste management, wastewater reuse, and circular economy initiatives. Circular economy initiatives based on reducing, reusing, recycling, reprocessing, redesigning, and recovering resources can save valuable material, energy, and water, and cut waste, helping to mitigate climate change while creating jobs—particularly for marginalized communities. Less waste and improved management may raise the value of adjacent land and are also likely to benefit the health of surrounding communities—often the poorer and more vulnerable.

Investments in improving and expanding public transportation systems have large social and environmental benefits; low-carbon mass transit can also be economically profitable due to its fuel-related savings. Despite its high rates of urbanization, LAC only has 10 kilometers (km) of mass transit system for every 1 million habitants, while the regional average in Europe is 35 km per million. Improving the efficiency of public transportation systems would reduce emissions significantly, increase road safety, and promote social inclusion of vulnerable groups such as women, the elderly, and indigenous people. Electrifying public transportation systems would further reduce emissions and generate fuel-related savings. Public-private financing modalities have proven successful in the electrification of the public transport fleet. For example, in Santiago, Chile, 700 electric buses have been incorporated into the system. Investment in mass public transport should also extend beyond city boundaries to become a core element of metropolitan and regional mobility (Mehrotra et al. 2020), including the development of commuter rail and long-distance passenger rail services, supporting low-carbon regional spatial growth. Innovative risk-sharing mechanisms and business models are promoting the participation of the private sector in the provision of public urban transportation services, from public-private partnerships (PPPs) to concessions, as well as guarantees and temporary subsidies. On the demand side, education and public awareness campaigns can support the shift toward more sustainable transport systems. There are also opportunities to create regional supply chains to produce and export electric buses: from battery production in Argentina, with auto-part producers throughout the region, to Brazil, which already has a thriving industry producing and exporting buses.

## ***Natural Capital and Agricultural Productivity***

One of the biggest advantages in LAC is its high levels of natural capital. It has more than one-quarter of the world's forest area (see figure 2.12, panel a), possesses some of the highest levels of renewable freshwater resources (see figure 2.12, panel b), and holds about half of the world's biodiversity (UNEP 2016). Managing these resources is critical to slowing global climate change, but also for the region to maintain its dominant position in agricultural and food products.

**Figure 2.12. High Levels of Natural Capital Need to Be Managed Efficiently to Ensure Future Productivity**



Clearing of forests to expand agricultural production is rapidly approaching its natural limits and could trigger irreversible feedback loops. Of particular concern is the threat of “savannization” of the Amazon rainforest. It is the largest rainforest in the world (around 7.3 million sq. km) and influences atmospheric dynamics and circulation patterns both within and outside the tropics via its “flying rivers.”<sup>13</sup> The impact of transitioning from rainforest to savannah-like vegetation would be felt at the local, regional, trans-continental, and global scales. Due to change in rainfall patterns and its effect on agricultural yields, Brazilian agribusiness could lose up to US\$2.2 billion annually (Strand et al. 2018) and the livelihoods of people who depend on forests and rivers—mostly indigenous communities—would be harmed. Regionally, change in the Amazon would affect agricultural production as far away as the Rio de La Plata basin and the Argentina Pampa, as well as hydroelectric power throughout the South American continent. Globally, such change would contribute to climate change by turning the rainforest from a carbon sink to a carbon source (Gatti et al. 2021). Some models indicate that it could affect important agricultural areas of the United States, potentially resulting in 20 percent less rain in the northwestern United States, and 50 percent less snowpack in the Sierra Nevada (Medvigy et al. 2013).

To sustain its position as a net exporter of food and agricultural commodities, LAC’s agricultural sector will need to adapt to the effects of climate change and work to prevent its worsening. Fortunately, evidence suggests that many climate-smart agriculture (CSA) technologies and practices (see table 2.2) can help the region adapt to climate change and mitigate adverse effects while improving yields and reducing costs, benefitting the bottom line for producers (see figure 2.13). For example, transitioning toward electrically powered farming machinery and equipment, fed by renewable sources, can save millions in fuel costs while abating emissions (McKinsey & Company 2020).

<sup>13</sup> The canopy cover reduces extreme temperatures and maintains soil moisture, and the vegetation and soil are capable of recycling up to 75 percent of the moisture of the westward-moving airmass that heads from the Atlantic toward the Andes (Lovejoy and Nobre 2019). This sustains the “rainforest.” The precipitation resulting from the Amazon supplies water to nearly every country on the continent.

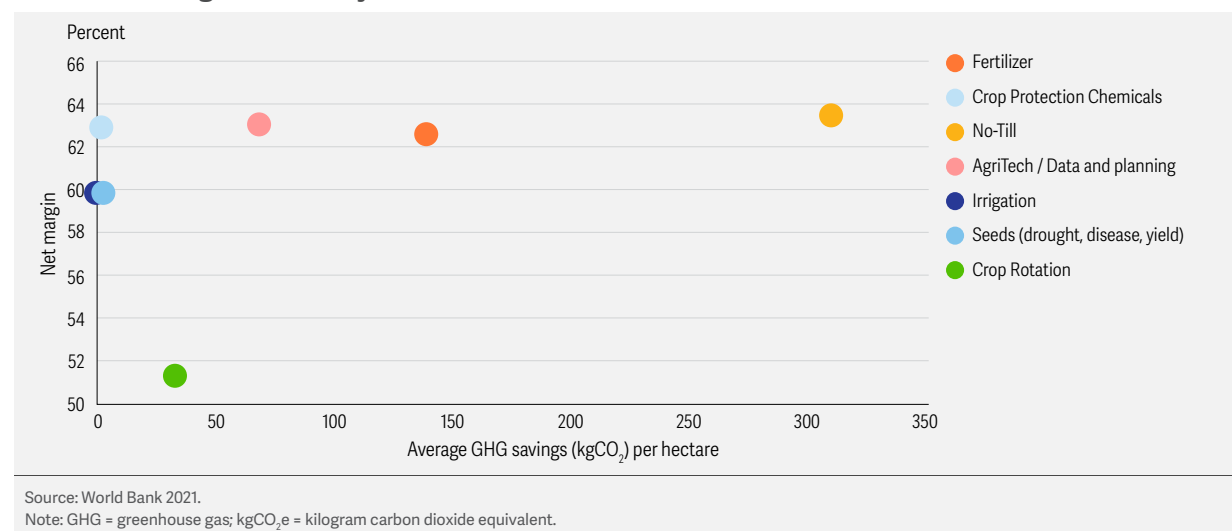
**Table 2.2. Climate-Smart Agriculture Technologies Can Increase Productivity and Help the Region Adapt to Climate Change**

CSA Type	CSA Measure	Description	Benefit
Nutrient smart	Fertiliser	Soilsampling and mapping	Improved yields/ lower input costs
		Type of fertilizer	
		GPS application following scouting/ drone/ satellite/ tractor data	
	Crop protection chemicals	Types of protection	improved yields/ less crop losses
		GPS application following scouting/ drone / satellite / tractor data	
	Crop rotation	Rotation of crop types to increase soil nutrition	Preserve soil nutrients/ less fertiliser
Water smart	Irrigation	Irrigation of crops when required	Produce crops on unproductive land where there is low precipitation
Knowledge smart	AgriTech / Data & planning	Weather Station / Precipitation records	Efficiencies across farm inputs (e.g. rertiliser, fuel)
		Production and yield records	
	Seeds	Drought, disease resistant or yield increasing	Improved yield/ less crop loss
Energy smart	No-till	No-till / low till, seeders, cover crops	Less inputs(fuel, fertiliser)

Source: IFC  
Note: CSA = climate-smart agriculture.

With 90 percent of agricultural land fed by rainfall, the region is highly exposed to changing precipitation patterns (Wani et al. 2009; Spera et al. 2016). Incentivizing water efficiency in agricultural production, investing in irrigation systems and water storage solutions, and promoting landscape restoration to slow runoff and recharge aquifers are necessary adaptation mechanisms that can improve productivity and efficiency in farms. There is, however, a gap between large and small producers in responding to climate challenges. While large agricultural producers can afford state-of-the-art production equipment, smaller producers face more barriers in adopting climate-friendly and climate-adaptive technologies. Thus, governments may want to create specific information and financing mechanism that can be more inclusive.

**Figure 2.13. Evidence from Ukraine Shows that Climate-Smart Agriculture Can Help Abate Emissions while Increasing Productivity**



Innovating in the management of livestock production is key to reducing methane emissions. Enteric methane from ruminant livestock is the principal source of agricultural emissions, followed by livestock manure management and manure left on-pasture. Adding these sources to the effects of land-use change to expand pasture and cropland for cattle feed is estimated to have emitted more than one-third of total LAC emissions—almost 1.6 gigatons of CO<sub>2</sub> equivalent in 2005 (Gerber et al. 2013). Approaches to reduce the impact of livestock production include the implementation of silvopastoral system (successfully applied in Colombia, for example), which combines trees and managed pasture to improve animal and grassland productivity and contributes to carbon capture and biodiversity recovery. Uruguay implemented a different approach, improving feeding and breeding together with rangeland restoration and afforestation. These practices are expected to increase meat productivity in intervention areas by more than 50 percent while sequestering more than 5 million tons of carbon dioxide equivalent over 20 years (World Bank 2021). Other measures include GHG-focused breeding<sup>14</sup> and selection, improvements in livestock health monitoring and illness prevention, and the use of innovative animal feed mixes and additives. Ranchers and dairy farmers could open additional revenue streams by using anaerobic manure digesters and selling the captured methane to power and heating systems as biogas. In essence, most technologies and practices that help abate methane emissions are based on improving the productivity of beef production and thus reducing the amount of emissions per kilogram of protein produced.

Reforestation, afforestation, and the recovery of degraded land can help ecosystems adapt and abate emissions, but they can also create jobs and develop new markets, particularly in sustainable forestry. Planting new forests, reversing deforestation, and recovering degraded land can help with water retention, protect against heavy rainfall events, avoid soil erosion, and improve overall soil productivity. In Brazil, for example, more than half the forest lands cleared for livestock have later been abandoned due to diminishing returns from raising cattle on soils that degrade constantly as a result of unsustainable cattle ranching practices. Beyond land practices lie opportunities in developing sustainable forestry value chains that may command green premiums in some important markets as firms increasingly invest in greening their supply chains. Chile is a good example, having reversed its historical deforestation trends. More than 70 percent of Chile's forest plantations are now certified through the Forest Stewardship Council (FSC) and the Program for Endorsement of Forest Certification (PEFC), which require companies to improve plantation management practices and prohibit deforestation of native forests. Eco-tourism initiatives may also become attractive as tourists become more concerned about their environmental impacts. Governments may be particularly interested in developing these initiatives with inclusion in mind, engaging marginalized groups, such as indigenous peoples and women.

The nascent voluntary carbon markets and Payments for Environmental Services (PES) schemes also provide an avenue to monetize reforestation, afforestation, and land restoration efforts. With the appropriate, credible mechanisms to certify, monitor, and verify projects—so as to avoid perception of “green-washing”—the region has the natural capital to become an exporter of environmental services through the sale of carbon credits to international firms and governments (see box 2.2). For example, the Sustainable Amazon Initiative in Brazil monetizes carbon credits as an asset class, ensuring profitability for producers of forest products and byproducts, while supporting local communities. Costa Rica, through its now-famous Payments for Environmental Services (PES) Program,<sup>15</sup> which provides incentives for forest conservation and rehabilitation, has recovered most of its original forest cover. By 2015, forest cover was back to 61 percent of the country's land surface, from 21 percent of land area in 1987 (FONAFIFO 2001).

One of the main obstacles that prevents carbon markets from taking off are fragmented, heterogeneous standards. To be scalable, carbon markets need generally agreed baseline standards and definitions that allow for consistent monitoring, reporting, and verification (MRV) and processes to qualify, quantify, and monetize carbon emissions reductions. To fully tap into the export potential of carbon markets, the region would greatly benefit from homogenizing regional schemes and aligning them to international standards.

14 According to expert estimates, breeding is important because about 20 percent of a ruminant's methane emissions rate may stem from genetics alone (McKinsey 2020).

15 The program was established in 1996 when the government adopted Forest Law No. 7575.

## Box 2.2. Carbon Credit Schemes

Carbon credits are issued by relevant agencies to initiatives that reduce or remove emissions by a quantifiable amount. Projects involving energy efficiency, renewable energy, waste management, reforestation, carbon capture and storage, and other carbon capturing methods could all qualify for carbon credits. The organization that implements the activity can use the credits received to offset tax bills or they can sell them to other interested third parties.

Carbon credits associated with mitigation outcomes are an emerging asset class already in use in some developed markets. The three major schemes—the EU Emissions Trading Scheme, the Regional Greenhouse Gas Initiative in the northeastern United States, and the Cap and Trade Program in California—traded more than US\$250 billion in emissions certificates in 2019. A recent study by Vivid Economics (2020) predicts that the carbon offset market could reach US\$1.4 trillion annually within 20 years.

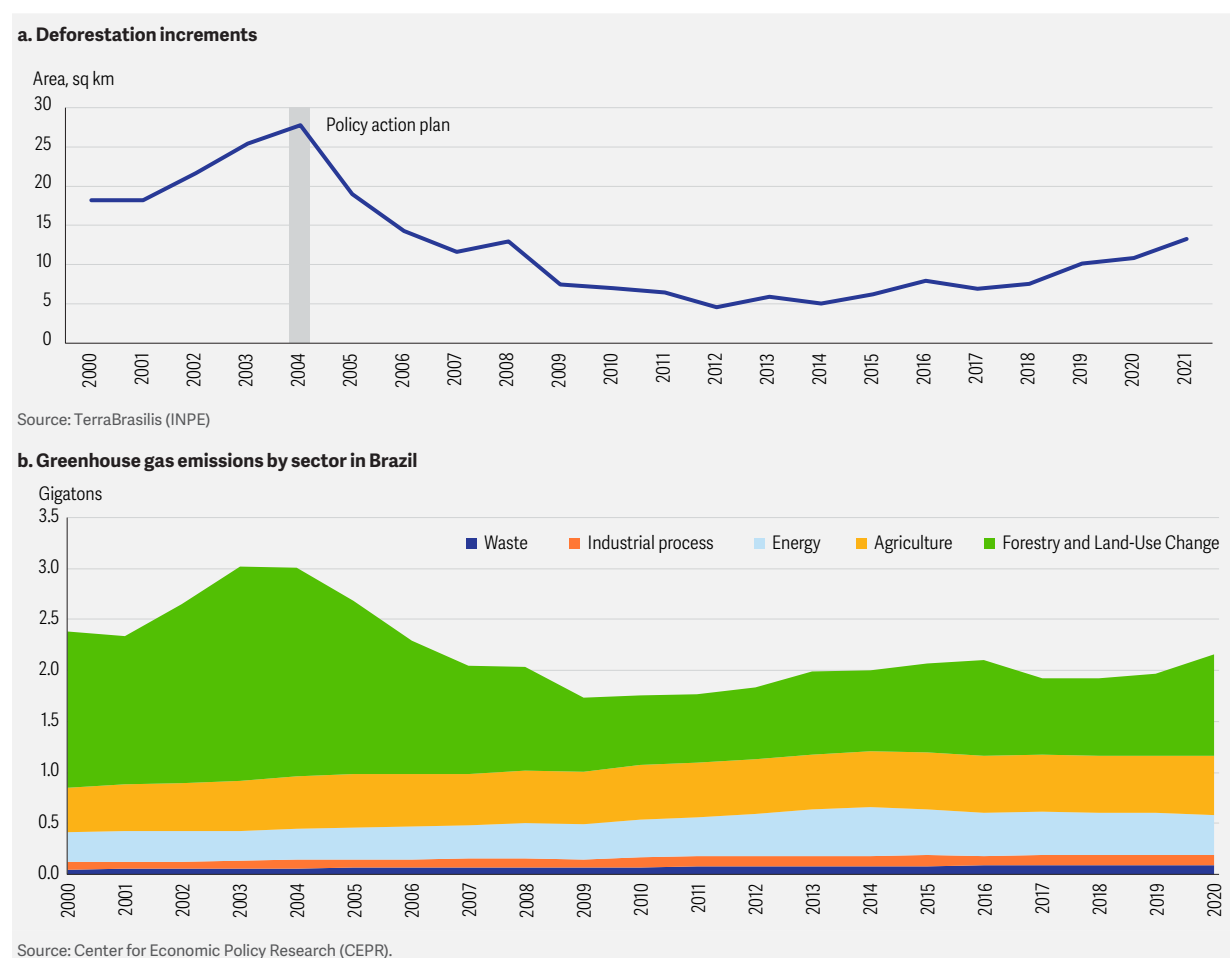
One of the main challenges is the lack of uniform standards with agreed baselines and definitions that allow for consistent monitoring, reporting, and verification. Moreover, regulating agencies need to build the capacity to quantify and verify the amount of emissions reduced.

Carbon credit schemes have many potential benefits. First, they can attract financing for projects in poorer areas within a country and when connected to global certification schemes they can attract resources to countries in the region. Effectively, this would mean the export of environmental services. Second, they can greatly improve the efficiency of global abatement efforts by redirecting resources to the most effective projects. Third, they can incentivize investments in energy efficiency equipment and other infrastructure. Lastly, they can stimulate innovation in new carbon capture technologies and low carbon technologies and practices.

Several countries in LAC are establishing crediting schemes and they are becoming common in other parts of the world. In LAC, these include Colombia and Mexico where companies can offset a share of their carbon tax bills by purchasing these credits from approved projects. Several other countries, including Chile and Peru, are considering such schemes. Countries in the region would greatly benefit from standardizing and homogenizing the definitions, standards, and verification and quantification of emission abatement and aligning them to those used by international standards and certification agencies. This would facilitate the trading of carbon credits nationally and regionally and with their counterparts in advanced economies.

Climate change will force countries to adapt and change the way we grow our food—particularly by constraining the expansion of farmland by means of deforestation. Reducing deforestation is by no means an impossible task, though it requires integrated, multi-sector action along the supply chain. Regulatory protection (such as zoning and property rights), financial support to disincentivize deforestation, incentives for recovery and restoration of degraded agricultural land, improved traceability and verification for ecolabelling (deforestation-free and sustainably produced), and increased enforcement capabilities (including remote monitoring systems) can have a significant impact on curbing deforestation. In fact, when the political will exists, evidence shows that deforestation can be severely contained. The experience of Brazil is a prime example. From 2004 to 2012, deforestation in the Amazon fell sharply (see figure 2.14, panel a). The annual rate of forest clearing fell by more than 80 percent. This had a huge impact on curbing Brazil's total emissions, which fell by 45 percent—1.5 gigatons (see figure 2.14, panel b). In 2004, the Brazilian federal government enacted a policy action plan that proposed several innovative strategic measures that required inter-ministerial planning and coordination. One key aspect was the development of satellite-based monitoring systems that strategically targeted law enforcement operations in forest clearing hotspots. The increased monitoring and efficient use of law enforcement resources increased the probability of catching environmental offenders and applying binding penalties, key elements of the success of the program (Assuncao et al. 2019).

**Figure 2.14. Deforestation Can Be Stopped and Have an Important Impact on Total Emissions**



## Policies to Meet Challenges and Overcome Obstacles

While LAC is well positioned to take advantage of the emerging Green World Order, there are many challenges and obstacles it will need to overcome. The shift to a low-carbon economy requires long-term planning, credible policy commitments, and strong institutions and enforcement, as well as building the necessary human, physical, entrepreneurial, and managerial capital. It is crucial for the region to have the technical literacy and capabilities to adopt new technologies and innovate in policy, finance, business models, and scientific research and development.

Getting prices and incentives right—reforming fossil fuel subsidies and establishing carbon taxes and emission trading schemes—are essential tools to mitigate emissions. While some countries in LAC—Argentina, Chile, Colombia, and Mexico—are implementing or have scheduled carbon taxes, they tend to be low (often in the range of US\$3 to US\$5 per ton) and partial, covering only some economic sectors. Reforming energy subsidies by improving their targeting and reducing their fiscal costs is an essential step in getting prices and incentives right. If firms and consumers face the “correct” prices, many investments in energy efficiency and electrification of end-uses become cost-efficient. Careful policy design of incentives is also needed to promote the adoption of



electric vehicles and promote distributed generation.<sup>16</sup> Policymakers should also consider innovative “feebate” schemes that can incentivize adoption of low-carbon technologies while remaining revenue-neutral—and thus may be more politically acceptable. Feebates are the fiscal analogue of regulations and involve a set of charges levied in proportion to the difference between the emissions intensity of a particular product or activity and the corresponding industry-level or market-level emissions rate.<sup>17</sup>

Developing credible, trustworthy certification, verification, and monitoring systems is key to tap into many green opportunities. Certified products in agriculture and forestry can command premiums from consumers who are changing their preferences toward “sustainable,” “low-carbon,” and “deforestation-free” products. By producing such products and services, firms in LAC may be able to access new markets, given that firms around the world are increasingly concerned with greening their supply chains and they may avoid export barriers as some markets, such as the EU, impose increasingly restrictive carbon content import requirements.

Homogenizing green certification and verification standards and definitions and aligning them with international criteria can open up new financing opportunities. Aligning rules, definitions, criteria, and regulations with international standards will facilitate access to the growing green finance market and will enable LAC firms to export environmental services through the sale of carbon credits in international voluntary carbon markets and emissions trading schemes.

Governments have an important role to play in generating and disseminating accurate information about new technologies and products, and the effects of climate change. Importantly, governments need to develop early warning systems that can quickly and effectively communicate climate-related risks, particularly adapted to small producers and landholders that may not have access to expensive subscription services. Similarly, innovation is needed in agricultural insurance products that are designed specifically for small producers and marginalized communities. Information on zoning risks for real estate development is also important in urban areas.

To increase the adoption of new low-carbon technologies, governments will also need to make credible policy commitments, undertake or support complementary investments in infrastructure, and innovate in financing and de-risking mechanisms. Strong regulatory frameworks—with effective enforcement—are needed in the water, energy, agricultural, and forestry sectors. Coordination between actors is needed to promote the development of green hydrogen value chains and allow the industry to achieve the necessary economies of scale to become competitive. Similarly, the electrification of end-uses requires close coordination between sectors to ensure the reliability and stability of energy systems. Governments will also need to be creative in designing de-risking mechanisms that will reduce perceived risks by financiers and entrepreneurs and hence reduce financing costs.

Crucially, major investments are needed in the innovation capabilities of people, firms, and organizations in LAC to accelerate adoption of existing low-carbon technologies (LCT) and invent new ones. The adoption of new technologies can reduce the restrictive impact of carbon pricing policies. Effective technology transfer requires physical hardware and technical know-how and capabilities to understand, operate, and maintain new technologies, as well as institutional and policy arrangements that facilitate technological uptake and encourage local innovation. Human capital is one of the strongest predictor of high performance in LCT trade and innovation, and is among the most important factors for accelerating LCT transfers within countries (Pigato et al. 2020). In the short term, countries can strengthen their regulatory frameworks to balance intellectual property rights with low-cost transfers of technology, reduce import tariffs on LCT, support the creation of patent pools and cooperative intellectual property rights agreements, and introduce environmental provisions into trade and investment agreements that accelerate LCT transfer. To develop the necessary sophisticated national capabilities

16 Distributed generation refers to a variety of technologies that generate electricity at or near the location where it will be used, such as solar panels and combined heat and power. When connected to the electric utility’s lower voltage distribution lines, distributed generation can help support delivery of clean, reliable power to additional customers and reduce electricity losses along transmission and distribution lines.

17 For a conceptual discussion on feebates, see IMF (2019, Annexes 2, 3).

for absorbing, imitating, adapting, and innovating LCT, countries need to build up their human, institutional, organizational, and physical capital, invest in intermediaries such as technology centers and accelerators that help firms and workers, have well-connected and well-functioning national innovation systems, and generally improving the environment for accumulating “knowledge capital”(see Cirera and Maloney 2017; Cirera and Cruz forthcoming).

Ultimately, the green and growth agenda are intimately intertwined. The low growth of the past decade and the low growth prospects the region is facing now are related to the low levels of technological adoption and innovation. This “knowledge” or “innovation agenda” needs to move front and center of both the growth and greening debate and policy. The synergies between the two agendas are potentially huge.

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