Building a New Future

Transformative Recovery with Equality and Sustainability

2020

Thirty-eighth session of ECLAC

26–28 October

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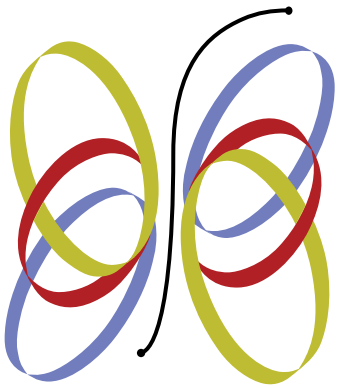

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- Three dots (. . .) indicate that data are missing, are not available or are not separately reported.
- A dash (-) indicates that the amount is nil or negligible.
- A full stop (.) is used to indicate decimals.
- The word "dollars" refers to United States dollars unless otherwise specified.
- A slash (/) between years (e.g., 2013/2014) indicates a 12-month period falling between the two years.
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Foreword

The coronavirus pandemic has generated the largest contraction in GDP and trade worldwide since the Great Depression of the 1930s. Times are highly uncertain, with clarity on neither the route out of the crisis nor the speed at which it may be achieved. The uncertainty is exacerbated by the possibility of fresh outbreaks in Europe and Asia and indeed some countries of the region that have begun to ease lockdowns as their epidemic curves have slowed, together with the fact that many other countries in the region have become major focuses of the virus.

Crisis periods can also be periods of intense learning and major transformation. This is particularly true in the crisis caused by coronavirus disease (COVID-19), which has made the structural problems that have long strained the world economy all the more evident. The pandemic has transformed the chronic issues of global economy's development pattern into an acute condition requiring an immediate response.

The evolution of the international system was already showing growing imbalances that testified to the unsustainability of the prevailing production, distribution and consumption patterns, as well as their institutional and political underpinnings. The pandemic is battering that structure to such an extent that governments and the international community must inevitably respond with a new sense of urgency. This urgency has led to a pragmatic rethinking of politics and role of the State, freed of the preconceptions and myths that stymied use of the instruments to which a democratic State may legitimately resort. Transforming this momentum into action and emergency responses into a consistent and sustained effort to build a new development pattern, surmounting the imbalances of the one before, is the task that governments, civil society and the international community must undertake in the coming years.

The structural problems facing the world economy occur in three areas, each with their own but interrelated dynamics: slower and more unstable growth of global output and trade, rapidly increasing inequality in the world's major economies, and environmental destruction and climate change. The pandemic has hastened what most analysts already perceived as a change of era. Especially in the past five years, the global and regional political economy had been undergoing substantial changes.

The ways in which countries and societies react to a context of crisis are not pre-defined. In situations of fear and uncertainty, countries and national stakeholders may resort to unilateral responses and uncooperative moves to shift the blame and costs of the crisis onto other players, whether domestic or external, while fuelling xenophobia and discrimination and curtailing rights. In a highly integrated world, with complex interactions and interdependencies in politics, trade, finance, migration and global security, such responses only exacerbate conflicts and imbalances.

The increase in political and geopolitical tensions in recent years reflects this picture of growing mistrust and rivalry. A consistent and lasting response must be based on a collective quest for new accords that will give legitimacy to the —now increasingly challenged— international system and domestic political systems.

Latin America and the Caribbean has suffered greatly from the economic, social and health impacts of the pandemic, despite the efforts made by the countries of the region to mitigate them. The pandemic has laid bare and exacerbated the region's wide structural gaps, such as high levels of inequality, informality, low growth, balance-of-payments constraints and low productivity. This has been compounded by acute vulnerability to climate change and natural disasters, aggravated by a growing loss of biodiversity.

The costs of inequality in the region have become unsustainable and a transformative recovery requires a change in the development model. Equality helps to sustain incomes and aggregate demand and to foster growth with higher productivity through broad access to education, health and opportunity for all people —particularly women— and by preventing the concentration of economic power that captures and distorts policy.

For that reason, rebuilding with equality and sustainability is the way forward for the region.

This will require a social compact to ensure that these objectives become State policy, engaging communities, businesses, women and young people. In turn, new forms of global governance are needed to provide global public goods, such as universal health (a coronavirus vaccine for all), climate security and protection of the atmosphere, financial stability, peace and protection of human rights.

That is what this document is about. It aims to contribute to that reflection and to offer a development proposal that is based on the welfare State, technical change and the transformation of production and bound up with environmental stewardship. Such development will strengthen equality and democracy (a decades-long tenet of ECLAC) as the most precious legacy of modernity.

First the crisis of 2008 and, to an even greater extent, the crisis of the pandemic, have debunked myths that hemmed in ideas and the public policy space. Keynes said long ago that the difficultly of change was escaping the old ideas that tie the hands of policymakers. The accumulation of structural problems and the impact of the crisis brought many of these old ideas tumbling down.

The 2008 crisis shattered the myth that financial markets were efficient and that expansionary monetary and fiscal policies in recession would lead to a surge in inflation; the subsequent crisis in Europe shattered the myth of austerity and the hypothesis of "expansionary fiscal contraction", and the emergency measures adopted by governments to avoid the deepening of the current crisis demolished the myth that increased public spending during a recession would trigger a catastrophic loss of confidence and capital flight.

Other major changes have occurred in mainstream economic thinking about the dynamics of growth and distribution. Some years ago, equality and economic efficiency were seen as contradictory: it was one or the other, went the argument. Today, there is a growing consensus that inequality is an enemy of productivity, learning and innovation. Not many years ago, industrial policy was anathema; today, there is broad agreement that it is key to reducing technology gaps, diversifying exports and decoupling GDP from emissions. Intellectually, there has been a convergence towards the positions that the Economic Commission for Latin America and the Caribbean (ECLAC) and many Keynesian economists have long advocated. Moreover, it is a propitious moment for the discipline of economics to overcome the conceptual rigidity of a single prevailing line of thinking. Economics faces the challenge of renewing methodologies and analytical frameworks. The change of era to which we have referred occurs in the world of ideas, theories and conceptual frameworks, in the social sciences and, notably, in economics.

In the past, governments could be called upon to intervene massively in the economy only if necessary to save the financial system and avoid a systemic crisis. The COVID-19 crisis was born systemic, so governments are called upon to act with the utmost urgency to prevent the total collapse of the economy with nefarious political consequences. This is a completely unprecedented situation, in which the broadest margins for public action must be channelled towards a transformative recovery, combining the intensity of the short-term response with long-term objectives. The need to respond to the health crisis must be channeled towards a universal health system; the need to prevent the loss of jobs and income of the most vulnerable must be channelled towards full employment and poverty eradication; the need to avoid bankruptcies, especially of micro, small and medium-sized businesses, should be channelled into strengthening their technological capabilities in a world of accelerating technical progress; the need for increased investment must be channelled onto a low-carbon path that does not depend on the destruction of natural resources.

The implementation of a new policy agenda also requires new political coalitions (domestic and international) and new forms of international cooperation to support the change in the development pattern. These coalitions are being forged, but they are still too weak to impress a new dynamic upon national economies and upon the global system.

Multilateralism must be rebuilt on new foundations, to expand policy spaces on the periphery and correct the recessionary bias of the international economy. The disarray of international rules and the rise of unilateralism has led many analysts to propose a new multilateralism. ECLAC and the United Nations have produced arguments and valuable studies in this direction, built on the Sustainable Development Goals and the 2030 Agenda for

Sustainable Development. At the same time, the integration strategies of the Latin American and Caribbean nations must be revived, with their potential to promote common processes of productive transformation and technological development, and their potential to strengthen the region's voice in the multilateral arena.

At the domestic level, the challenge in the region is to build a welfare state that has been too long deferred, and to promote international competitiveness and productive transformation based on the opportunities opened up by environmental investment and innovations, regearing the system of investment incentives towards equality and sustainability. Greater policy space implies a greater regulatory and investment role for the State. To be effective, public action needs social compacts to endow it with the necessary political support, ensure the transparency of that action and strengthen the functioning of democracy. Recognition of the need to expand public policy spaces and of the State's role as a driver of development must go hand in hand with strengthening civil society, democratic oversight and more effective market regulation. The the more complex and ambitious the task governments have to perform, the more important government transparency and accountability become.

As we stand before the prospect of epochal change, more than one-off measures are called for. Economic structures and patterns of behaviour must be reshaped, and the culture of privilege must be replaced by a culture of equality that guarantees rights, builds citizenship and spreads skills and opportunities. This document represents a contribution to policymaking and the new economic thinking on development at a particularly sensitive time, given the social, political and economic upheavals across the international system. The energies of our societies and the learning generated by the crisis must be channelled constructively, in a direction that leads towards a new pattern of development that is sustainable socially, economically and environmentally. Only thus will it be possible to achieve inclusive social well-being, protect the ecological integrity of the planet and build a fairer world.

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Introduction

The COVID-19 pandemic is impacting a global economy that is already traversing three structural crises: a crisis of instability and low output growth, a crisis of growing inequality and the environmental crisis that threatens to destroy the natural systems that sustain life on the planet. The construction of a new development model must focus on how to overcome them. These three crises are interrelated, linked by the common elements of a political economy and a State-market-society-environment equation that has systematically curtailed governments' ability to promote development and guide the action of markets. As a result, imbalances have been growing and geopolitical and political tensions are mounting, heightening conflicts and weakening the multilateral system at the international level, in addition to eroding rights and the legitimacy of democracies at the domestic level.

The three crises of the global economy and political tensions

Since the early 1980s, the international economy has been redefining its rules, mainly on the basis of the expansion of market forces and the reduction of State's policy spaces, especially of the weakest nation States. Trade and investment agreements have sought to minimize barriers to the movement of goods and capital (but not labour) and to maximize capital's freedom of action, both domestically and internationally. This system of "hyperglobalization" was associated with rapid financial liberalization, which amplified the impacts of speculation in foreign exchange, commodities and real estate markets on economic performance (financialization). The result has been greater instability, higher volatility of some key prices, more frequent financial crises and lower average growth rates.

In turn, the world of work has been increasingly weakened by a system in which capital (because it is highly mobile, among other factors) has gained power to veto or impose policies, as is clearly reflected in the growing inequality in the world's major economies. The capacity of democratic governments to provide public goods and adopt progressive tax policies has gradually been eroded, and with it their ability to sustain the welfare state. This process was heavily influenced by the predominance of an ideology that saw State intervention in markets as a source of inefficiency and the bargaining power of workers' unions as a source of labour market "rigidity".

Paradoxically, liberalization in the name of efficiency and growth ultimately compromised both objectives. The instability generated by hyperglobalization, the barriers to pro-expansionary fiscal policy coordination, growing inequality, the spread of employment insecurity and social vulnerability, the deterioration in the functional distribution of income and household debt all combined to stifle aggregate demand. The political coalition behind hyperglobalization argued that inequality would be more than compensated for by growth, but it only generated higher levels of inequality with growth rates well below expectations, and clearly below those of the era of greater State intervention and control of capital movements, the "glorious thirty" (1945–1975).

The blind confidence in market efficiency led to neglect of multiple market failures or, more broadly, of the undesirable endogenous outcomes of markets operating without limits that balance power between capital and labour, and between private and public interests. One area in which these problems have had a particularly dramatic impact is the environment. The inability of markets to internalize the costs of environmental destruction has resulted in cumulative costs that are today putting the development possibilities of future generations at risk. The environmental crisis is exacerbating the economic and social crises and can be seen in the destruction of natural resources, water, land and air pollution, the decline in biodiversity and the loss of global common goods. Climate change is perhaps the most acute manifestation of this crisis and its global reach.

Even before the pandemic, there was a perception that the prevailing development path was unsustainable and had reached its limits, and that the time was ripe for change. The domestic and external tensions caused by the three crises —low growth and instability, inequality and the environmental crisis— were engendering responses that, in themselves, were shaping a new scenario that profoundly altered the political and institutional underpinnings of hyperglobalization. Examples of this are Brexit, the United States' abandonment of the

Trans-Pacific Partnership (TPP) and renegotiation of the North American Free Trade Agreement (NAFTA), the difficulties in reaching binding agreements on environmental issues, the weakening of multilateralism in contexts that demand more, not less, global coordination, as well as the resurgence of nationalism and, in many cases, xenophobia and the loss of confidence in democracy.

The world order established in the aftermath of the Second World War, with all its inadequacies and limitations, had, at least, an ideal framework (albeit limited progress was made in that direction), which was to build international cooperation institutions based on multilateralism. This framework has been undermined in international relations: multilateral international cooperation has given way to unilateralism and economic, technological and military rivalries. The absence of multilateral cooperation mechanisms is particularly evident with regard to issues that, by definition, are global in scope and require global action, such as the environment and, more recently, the pandemic.

National political and economic systems are plagued by similar problems to the international system, amid greater uncertainty and divisiveness. Efforts to build the welfare state and the quest for full employment, which were central to post-war economic expansion in Western Europe and the United States, and the inclusion of workers in that expansion, have either stagnated or lost ground. However limited the inclusion process may have been in the past, greater job insecurity and the loss of labour rights are evidence of backsliding in that regard. The instability and lack of rules in the world order further undermine national political systems, which in turn makes those problems more acute. There is a tangible breakdown of the social compact that laid the economic, political and social foundations for the spread of global capitalism in the aftermath of the Second World War. The promise that prosperity would follow the deregulation of the capitalist system that had its heyday in the 1990s, was clearly disavowed after the 2008 crisis. There is a clamour for profound transformations to which States have not known how to respond or have been unable to do so.

Insecurity and apprehension trigger isolationist responses and "beggar-thy-neighbour" policies, in a manner reminiscent of the 1930s. Fear leads to treatment of those who are in some way different (because of their gender, religion, race, ethnicity or nationality) as a threat. This type of response exacerbates divisions in a highly interdependent world. Alternatives responses need to be provided, based on due consideration of the factors underlying the imbalances in global capitalism, and public policy proposals must be developed to redress these imbalances.

Development and cooperation must be returned to the centre of national and international discussions, with equality as the guiding principle and the values of democracy as the most precious legacy of modernity (ECLAC, 2010). In the tradition of the thinking of the Economic Commission for Latin America and the Caribbean (ECLAC), this means shifting the development pattern towards a more egalitarian model capable of decoupling growth from environmental destruction and closing domestic and external gaps in income and productivity. As ECLAC has argued, this productive and social transformation is what is needed if the Sustainable Development Goals are to make the leap from an ambitious proposal to an operational policy agenda.

The technological challenge in the face of external constraints and environmental sustainability

In most developing countries, and in Latin America and the Caribbean in particular, the economic, social and environmental crises are rooted in a system of inequalities and a rigid culture of privilege, in both the international sphere and national economies. At the international level, this inequality is expressed in a centre-periphery system with sharp differences between countries and regions in technological and productive capacities and political and financial power. These differences jeopardize the stability of the system and the growth of trade and investment.

The Latin American and Caribbean region lags behind the developed economies in terms of technology and tends to specialize in the production of low-technology, natural-resource-intensive or lower-skilled-labour-intensive goods. The region has failed to achieve technological convergence with the economies at the technological frontier and the gap will widen if it fails to keep pace with the acceleration of technical progress in those economies. Over time, in the absence of policies to correct it, the periphery's specialization pattern

leads to fewer skills and lower productivity gains. With international demand for them weak and unstable, exports from periphery countries grow less than the imports that these countries' growth demands. This leads to current account imbalances, exacerbated by income imbalances, which curb growth. The external constraint is not always binding, but over the long term its impact tends to prevail. The growth rate of the periphery that is compatible with the equilibrium of its basic balance is the maximum growth rate compatible with the external constraint (y^E).

The core message of structuralism remains true today: the periphery must apply industrial and technology policies in order to build endogenous technological capabilities, diversify its productive structure, change its pattern of specialization and thus overcome external constraints by diversifying into exports that are increasingly knowledge- and innovation-intensive and have greater value added. These capabilities must come from both the dissemination of existing technologies and strong innovation policies.

The external constraint is also associated with financial asymmetries in the international system. The peripheral countries do not issue currencies that the international system accepts as reserve currencies. For this reason, an external deficit forces the periphery to borrow in foreign currency: the so-called "original sin". If the deficit persists and the ratio of external debt service payments to foreign-exchange earnings from exports worsens, then the periphery's growth rate must fall to avoid a foreign-exchange and financial crisis. This dynamic engenders a strong recessionary bias in the international economy, as the adjustments are borne entirely by non-reserve-issuing countries that are in deficit and thereby lead to economic contraction in those countries. Situations of high external debt, when the burden of adjustment falls solely on the debtor through austerity policies, aggravate this recessionary bias.

A less dynamic, less diversified economy based on less technology-intensive sectors tends to generate a smaller increase in formal employment, as well as lower-quality jobs, with limited worker bargaining power. All this combines to worsen the functional distribution of income and, with it, aggregate demand.

Meanwhile, the structuralist tradition has afforded greater importance to environmental issues since the 1970s. The work of Sunkel (1979) drew attention to the ecological dimension of the development pattern. Prebisch (1980) warned that fossil-fuel-based growth was a "falsity" insofar as there was "prodigious growth of productivity at the expense of the biosphere". He also pointed out that "in the periphery, as it pursues its design of developing in the image and likeness of the centres, the same problems have arisen that the biosphere is posing in the centres themselves". The early warnings of various analysts of development problems went unheeded and, in many cases, the critical limits regarding the contamination and degradation of ecological systems have been exceeded.

These limits can be expressed in terms of a maximum rate at which the world economy can grow without endangering ecosystems' stability, given the evolution of emissions per unit of GDP. The latter is a function of the intensity and direction of technological progress, as well as of production and consumption patterns. For each growth rate of the centre, all else being constant, it is possible to calculate the maximum rate at which the periphery could grow so as not to exceed the environmental limits. That maximum rate defines the centre-periphery environmental frontier.

In other words: the maximum rate at which the periphery can grow without compromising the stability of the planet's biophysical system, given the growth of the centre and the rate of technical progress, is the growth rate for environmental sustainability (y^A). This will be higher if the centre grows less, if technical progress generates environmental innovations more quickly, and if changes in production and consumption patterns help to reduce emissions and environmental degradation for every unit of GDP growth.

The rate at which the centre grows must form part of wide-ranging environmental negotiations, based on the principle of common but differentiated responsibilities. Developing countries must necessarily have more space for growth than developed countries. If there is, broadly speaking, a limited global "carbon budget", priority in allocations should be given to countries with lower per capita income. A key aspect in pushing back the environmental sustainability frontier is the direction of technical progress. Incentives and public investment must be aligned so that innovation and efforts to disseminate technology are directed towards promoting a less carbon-intensive, less natural-resource-intensive growth path, compatible with the planet's carrying capacity.

The rate of growth required to achieve equality

The improvement of income distribution has always been a crucial element of the work of ECLAC and part of the analytical framework of structuralism. As early as the early 1960s, the Commission took a stand against the idea —prevalent in the economic orthodoxy of the time—that inequality was necessary for growth. It stressed the need for agrarian and fiscal reforms that would improve the distribution of assets and income, and thus lead to increased land productivity and expansion of the domestic market. However, growth and equity were mainly linked through the demand side. A mass market that could absorb the growing Latin American manufacturing output needed to be built up through distributive policies. Meanwhile, economic integration in the region was to bolster this effort to expand markets and production scales.

In the 2010 decade, ECLAC went beyond income equality to embrace a broad concept of multidimensional equality with a rights-based agenda, which came to occupy a central place not only in the policy debate, but also in a broad analytical framework. The new approach differs from the previous one in at least two key respects: first, the normative recommendations; and second, the analysis of the determinants of productivity and growth.

On the normative side, equality is seen as a core value not only in terms of income, but also as a multidimensional rights agenda encompassing equality of opportunity and access, and the recognition of people's differences and dignity. According to ECLAC (2010), it means "the abolition of privilege and the firm establishment of equal rights for all individuals, irrespective of their origins and of their gender, nationality, age, territory and ethnicity. (...) It crystallizes in an idea of citizenship" and reinforces the need for the consolidation and expansion of political democracy. Equality must be considered a component of the concept of development itself.

On the analytical front, it is argued that equality is a key contributor to capacity-building, and therefore a driving force for technological learning, productivity growth and economic growth. ECLAC argues that inequality is inefficient. Indeed, access to education, health and social protection should be seen as investments in capacities and as means of realizing rights for the achievement of the greatest possible well-being for all. The orthodox view of social policies is that they are purely compensatory or instrumental measures that seek to prevent the losers in a competitive environment from reacting in a manner that hinders the efficient functioning of markets. ECLAC does not view social policies as palliative measures, however, but as key pieces for realizing rights, expanding well-being and building the capacities required to integrate all stakeholders into higher productivity formal employment and innovation, thus accelerating technical progress.

In addition to the direct effect of inequality on capacities, there is an indirect effect on productivity, since inequality acts as a social and political brake on the design and implementation of development policies. The quality of policies changes substantially between an unequal society and an egalitarian society, for political economy reasons. Unequal societies concentrate economic power and political power, and one type of power is used to increase the other. Oligopolistic and privileged positions are defended with more resources and effectiveness in unequal societies, creating an environment where mistrust prevails among stakeholders, barriers to cooperation become insurmountable and policy design and implementation is more costly. Conversely, in egalitarian societies, cooperation tends to be greater because there is more trust among stakeholders and the outcomes of cooperation are expected to benefit everyone. It is easier to coordinate stakeholders to provide public goods —whereas in highly unequal societies the wealthiest prefer to privately finance their consumption rather than pay the taxes needed to finance the public goods that society demands— and there is less risk of public policies being captured and distorted by the most powerful actors.

The rate of growth for equality is the minimum rate required to eradicate poverty, increase decent formal employment and implement social policies for a strong and lasting reduction of inequality (y^S). Growth helps to reduce inequality by absorbing workers from the informal sector or low-productivity areas into higher-productivity activities. It strengthens the bargaining power of workers relative to capital and generates income that can be redistributed according to social policy. The two-way causality between equality and growth is highlighted in this approach: technological and productive lags feed inequality because they limit growth and the creation of higher productivity jobs; but inequality in turn limits growth because it builds economic and political barriers to the dissemination of technology to the entire production fabric.

The three sustainable development gaps facing Latin America and the Caribbean

The previous discussions have been framed in the broader terms of a centre-periphery system; the analysis in this document focuses on Latin America and the Caribbean.

On the basis of previous discussions, there is a maximum rate at which Latin America and the Caribbean can grow without breaching the external constraint, y^E; a maximum rate at which Latin America and the Caribbean can grow (given the growth of the centre and the rate of technical progress in favour of a less carbon-intensive path) without compromising ecological systems, y^A; and a minimum rate of growth to achieve equality objectives, y^S. Given the considerable inequality in the region and the weight of informality in the labour market, along with the weak specialization pattern and recurrent external crises, the rate of growth for equality is bound to be higher than that compatible with the external constraint. In turn, given the characteristics of the prevailing production and consumption patterns on the planet and the available environmental technologies, the maximum growth rate compatible with the external constraint is bound to be higher than the maximum rate compatible with the stability of the ecosystem. In sum, $y^S > y^E > y^A$.

The three rates mentioned above determine three gaps: the gap between the growth required for equality and the growth consistent with external equilibrium, which will be called the social gap ($y^S - y^E$); the gap between growth consistent with external equilibrium and growth compatible with the stability of the planet, which will be called the environmental gap ($y^E - y^A$); and the gap between the rate of growth for equality and the growth rate compatible with the stability of the ecosystem, which will be called the sustainability gap and which is the sum of the social gap and the environmental gap ($y^S - y^A$).

As the rate of growth for equality is the highest of the three and given the centrality of equality in the definition of sustainable development, the objective of public policy must be the convergence of all rates with the growth rate needed for equality. Sustainable development is said to be achieved when this convergence occurs and the three gaps are closed (i.e. the three growth rates coincide, $y^S = y^E = y^A$). The three-gap model discussed in chapter II allows the three sustainable development objectives to be built into a common analytical framework. The challenge for industrial and technological policy is to foster change in the production structure that simultaneously increases genuine competitiveness (and redefines the pattern of specialization) and the decoupling of emissions and environmental destruction from growth; and the challenge for social policy is to reduce inequality, increase well-being and support capacity-building, in a pincer movement that closes all three gaps.

From the perspective of the Latin American and Caribbean periphery, the three gaps reflect the three crises of the international system: weak growth in a global economy that reproduces technological and productive asymmetries, forcing deficit-running economies to adjust through lower growth rates; unequal economic structures that cannot generate high-productivity formal jobs and allow the concentration of political and economic power; and the destruction of the environment in economies that depend on natural-resource exports to sustain growth and imitative consumption patterns.

This document argues that the right mix of social and environmental policies, together with economic, technological and industrial policies, can relaunch development in Latin America and the Caribbean, with redistribution as a crucial component. This virtuous combination of policies should lead to the objective targeted over the past decade, which is encapsulated in the proposal of growth for equality and equality for growth.

These policies and their combination and coordination are referred to as the "big push for sustainability" and are geared towards substantially increasing investment in Latin American and Caribbean economies, redirecting it towards productivity, environmental stewardship, employment and social inclusion. Only a sharp rise in investment can bring about the radical transformation of production and consumption patterns, ensuring that the technological revolution serves the new development model. The aim is to produce an interconnected shift towards building a welfare state, reducing technological gaps, moving production onto an environmentally sustainable path and attaining social equality.

This document has five chapters. Chapter I provides an assessment of the three crises facing the world and Latin America and the Caribbean. Chapter II presents an analytical framework for discussing these crises in an integrated and systematic manner, using a three-gap model. Chapter III sets forth studies of the quantitative impacts on growth, emissions, income distribution and the external sector in different policy scenarios, highlighting the potential of policies for a big push for sustainability to create a path for low-emissions growth with equality. Chapter IV examines the sectoral dimension of policies for a big push, identifies the sectors that could be instrumental in steering the economy towards environmentally sustainability, and discusses policies to foster them. Chapter V analyses core policies in the ECLAC development proposal, which articulates the macroeconomic, sectoral, social and environmental dimensions. These policies combine to foster progress towards a new development pattern with sustainability and equality, which should be supported by the relaunch of a long-delayed project: the economic integration of the region.

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CHAPTER

I

The three crises of the development model facing the global economy and Latin America and the Caribbean

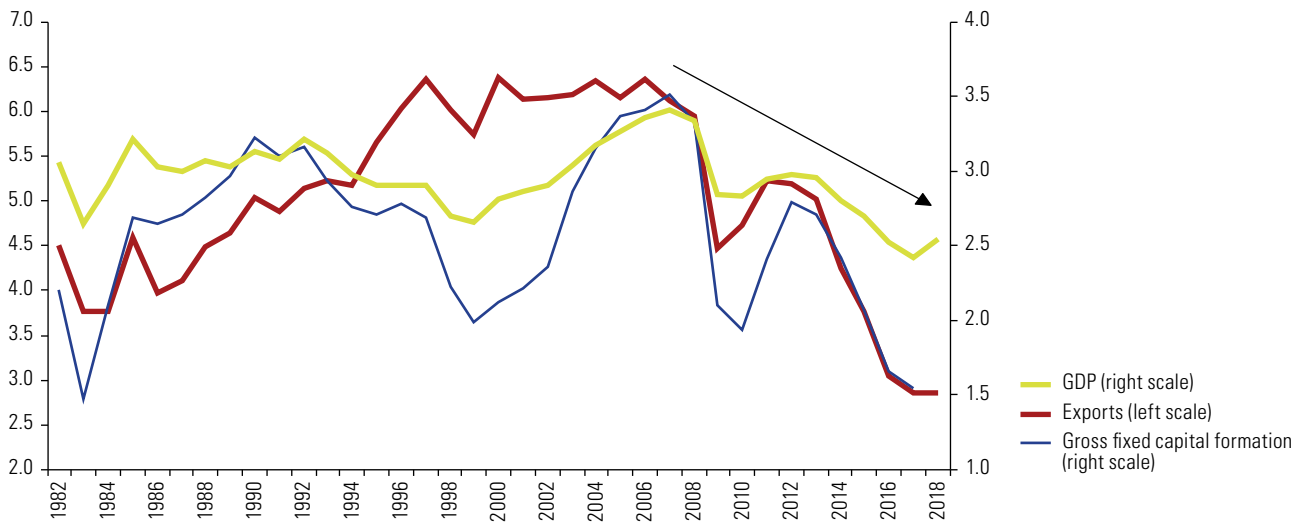
This chapter addresses the three structural crises —of the economy, of inequality and of the environment— that form the backdrop to the crisis caused by the coronavirus disease (COVID-19) pandemic. First it examines long-term trends, then it explores the effects of the pandemic that reveal and exacerbate structural problems. Section A focuses on the global scenario, and section B on Latin America and the Caribbean.

A. The three crises facing the global economy

1. The pandemic is affecting a global economy already marked by slow growth in GDP and trade

The first structural crisis is related to the weak recovery following the global financial crisis of 2008–2009, when growth in GDP, trade and investment trended downward. Average global GDP growth in the past decade is among the lowest levels seen since the 1980s. Figure I.1 shows this downward trend prior to the impact of the COVID-19 crisis, which is described later.

Figure I.1
GDP growth, exports and gross fixed capital formation in the global economy prior to the COVID-19 crisis, 1982–2018
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators, Washington, D.C., 2019 [online database] http://data.worldbank.org/data-catalog/world-development-indicators.
Note: The series for GDP growth, exports and gross fixed capital formation are based on 10-year rolling averages.

Economic dynamism was weak in both developed and developing countries prior to the pandemic. GDP growth declined in all regions of the world, without exception, in 2011–2019, compared to the previous decade. This phenomenon was worse in emerging and developing economies, including in Latin America and the Caribbean, which recorded the sharpest slowdown among developing regions. China, whose economy was already experiencing significant macroeconomic imbalances in the real and financial sectors, recorded the biggest slowdown in three decades in 2019.[1]

[1] China is the most indebted economy in the world (its total debt represents 477% of GDP) and the shadow banking sector accounts for over 40% of total lending.

The weakness of GDP growth and world trade stems from a combination of three factors: differences in the specialization patterns of economies, which mean that for many, growth is limited by current account imbalances (stemming from recurrent external debt crises and exchange-rate crises, for example); significant capital mobility, which encourages short-term speculation and hinders national policymaking for full employment and income redistribution; and the absence of international governance to correct these imbalances.

In countries where technological and productive gaps are reproduced or widened, this gives rise to specialization in sectors that typically have weak technological capabilities and slow demand growth, based on the competitiveness facilitated by natural resources or cheap low-skilled labour, which is one of the foundations of the centre-periphery theory (see chapter II). The international financial architecture is designed in such a way that strong commodity price variations lead to recurrent current account deficits in countries suffering from these structural gaps, which forces them to borrow in foreign currency and reduce their growth to ensure that debt levels do not spiral out of control. Poorly placed to compete internationally, these countries cannot sustain expansionary fiscal or monetary policies or social protection policies in the event of strong capital outflows. This has been reflected in the dismantling or non-existence of social protection and the limited weight of labour income in GDP. International governance does not offer mechanisms to encourage expansionary adjustments in economies running a surplus, but rather imposes recessionary adjustments on economies recording a deficit. Nor does it offer mechanisms to scale back the speculation that feeds financial instability.

The absence of adequate governance in the international system has given rise to a dynamic according to which the financial sector has a dominant influence on the macroeconomic sphere, resulting in what has been termed "financialization" of economies. Although the financial sector has traditionally been considered essential for stimulating investment, in fact, its expansion has not produced an increase in fixed capital formation. The rapid growth of this sector has been a source of instability which has had negative medium- and long-term effects on investment. Testimony to this is the increase in the number of financial crises worldwide since the 1970s, which marked the beginning of financial market liberalization and the lifting of restrictions on short-term capital movement.

While the real sector has lost momentum post-2008, the opposite has occurred in the financial sector: the boom that started in the 1990s —and was temporarily interrupted by the global financial crisis— has in fact intensified. This performance is partly explained by quantitative easing practices, implemented mainly to reduce long-term interest rates in order to stimulate aggregate demand. Quantitative easing, adopted by the United States in 2008[2] and subsequently by the European Central Bank and the Bank of Japan, had little impact on the real sector compared to the stimulus provided to the global financial system, with possible negative effects on financial stability.

Limited investment and weak growth in aggregate demand affected labour productivity growth. In the advanced economies, productivity growth declined from 1.4% in 2000–2009 to 1.1% in 2010–2019 (see table I.1). Excluding the years of the global financial crisis (2008–2009), the decrease in productivity growth was even stronger, from 2.0% in 2000–2007 to 1.1% and 2010–2019. Among the emerging economies, the Asian countries recorded the strongest growth in labour productivity, while the performance of Latin America and the Caribbean was at the other end of the spectrum, with the second lowest level of productivity growth in the world in 2010–2019, outperforming only the Middle East and North Africa.

The COVID-19 crisis is having a significant impact in this context of weak economic momentum and the decoupling of the financial sector from the real sector. The global economy is expected to undergo the deepest recession since the Second World War and per capita gross domestic product (GDP) is projected to shrink in 90% of countries, with unprecedented synchronization. Global GDP is forecast to contract by 5.2% in 2020. Developed economies are expected to shrink by 7% and emerging economies by 1.6% (see figure I.2). China's growth is expected to remain at just 1%, the lowest rate in over 40 years, while in the United States the Federal Reserve projects a decline of 6.5%. Meanwhile the European Central Bank (ECB) foresees an 8.7% fall in the eurozone (ECLAC, 2020).

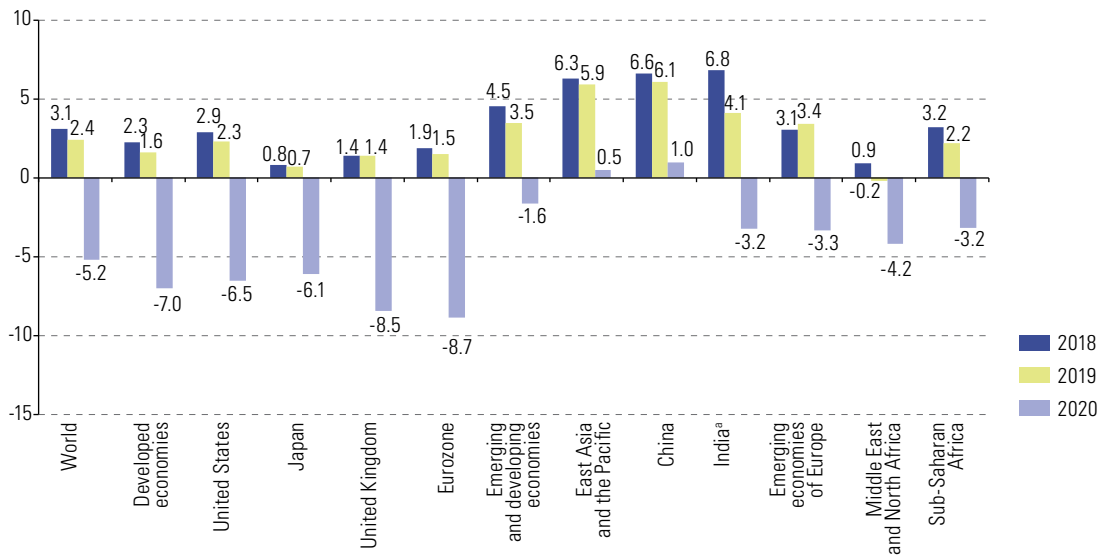
[2] Quantitative easing in the United States was implemented over roughly six years and consisted of three major rounds of large-scale asset purchases: in December 2008–March 2010, November 2010–June 2011 and September 2012–December 2013.

Table I.1
World, selected regions and countries: labour productivity growth, 1990–2019
(Percentages)

Regiones/países	1990-1999	2000-2009	2010-2019
World	**1.5**	**2.5**	**2.3**
Advanced economies	2.0	1.4	1.1
Eurozone	1.5	0.5	0.8
Organization for Economic Cooperation and Development (OECD)	1.9	1.3	1.1
United States	2.2	1.9	1.2
Emerging and developing economies	1.0	3.9	3.2
Middle East and North Africa Region	0.1	0.2	-0.1
Sub-Saharan Africa	-0.8	2.9	1.8
Latin America and the Caribbean	0.8	0.7	0.5
Central Asia and Southern Europe	-2.9	4.7	2.0
Other developing countries in Asia	2.7	3.0	3.6
China	4.9	8.7	5.8
India	4.1	5.4	5.8

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of The Conference Board, Total Economy Database, 2019 [online] https://conference-board.org/data/economydatabase/total-economy-database-productivity.
Note: Calculations in dollars at 2010 prices.

Figure I.2
Selected regions and countries: GDP growth rates for 2018 and 2019, and projections for 2020
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, Global Economic Monitor (GEM) [online database] https://datacatalog.worldbank.org/dataset/global-economic-monitor [accessed: June 2020]; Organization for Economic Cooperation and Development (OECD), *OECD Economic Outlook*, Paris, OECD Publishing, June 2020; European Central Bank (ECB), "Eurosystem staff macroeconomic projections", June 2020 [online] https://www.ecb.europa.eu/pub/projections/html/index.en.html; United Nations, *World Economic Situation and Prospects as of mid-2020*, New York, 2020; and projections from the United States Federal Reserve's Federal Open Market Committee (FOMC) as of 10 June 2020.
[a] The figures for India cover the fiscal year, which begins in April and ends in March the following year.

The negative effects are strongly felt in international trade. Between December 2019 and May 2020, global trade volume plunged by 17%, and a drop of 14%–15% is expected for the full year. The disruption of production in countries that participate in global value chains was a crucial factor in the deterioration of trade in intermediate goods, which was compounded by a widespread weakening of demand for consumer and investment goods as a result of lockdowns and the economic crisis. Tourism was one of the most affected sectors: in the first four months of the year, it fell by 44% worldwide, and could drop by 60%–80% by the end of the year, the worst figure recorded since 1950 (ECLAC, 2020).

The collapse in output and trade was accompanied by a marked deterioration in international financial conditions, which in many cases was worse than that of the 2008–2009 global financial crisis. Stock markets around the world plummeted. The sovereign bond yields of countries considered safe havens for investors in search of security reached all-time lows, and demand for the United States currency increased sharply. The fact that financial markets have been so severely affected is also a product of the financial vulnerabilities that had been building up for a long time. The global debt stock has reached historic highs, exceeding US$ 255 trillion in the fourth quarter of 2019, more than 322% of global GDP (IIF, 2020). Much of the debt accumulated since the global financial crisis has been in the non-financial corporate sector, where the disruption of supply chains and reduced global growth have led to greater difficulty in repaying the debt.

Since the second half of March, the policies implemented by the world's major central banks and governments led to an improvement in global financial conditions. In addition to reducing its policy rate by 1.5 percentage points so far this year (down to 0.0%–0.25%), on 23 March the United States Federal Reserve announced that its quantitative easing measures would be open-ended, with bond purchases "in the amounts needed", and also made dollar liquidity swap lines available to a number of major central banks worldwide. The European Central Bank announced the launch of a new quantitative easing programme, the pandemic emergency purchase programme (PEPP), with an overall envelope of 750 billion euros, which was increased in June to 1.35 trillion euros to purchase financial assets, equivalent to 11% of GDP of the eurozone. As a result, capital outflows from emerging economies have been reversed and, since April, net portfolio inflows have been observed.

The sharp deterioration in global financial conditions thus began to be reversed from late March, thanks to policy actions taken by the world's major central banks and governments, unlike the trend seen in the real sector. However, a new round of increased risk aversion and deteriorating financial conditions cannot be ruled out (ECLAC, 2020). The current account deficit, limited fiscal space and high debt levels in many developing economies make them particularly vulnerable to this deterioration.

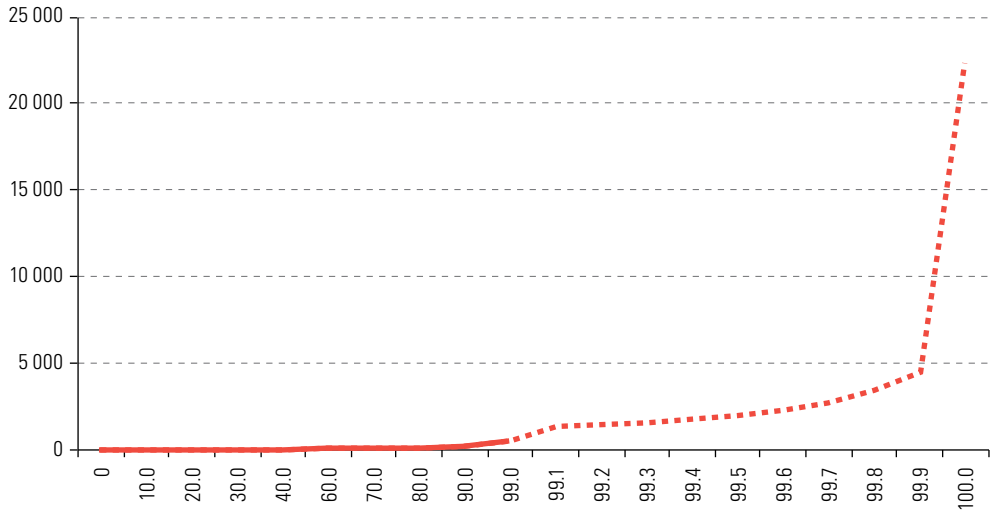
2. Inequality is an obstacle to development

Rising inequality in the world's major economies has been one of the main factors behind the increase in domestic political tensions and in trade conflicts. From a long-term perspective, between 1980 and 2016, the wealthiest 1% of the global population increased their income steadily in most countries and captured 27% of the total cumulated growth, while the poorest 50% of the population captured only 12%.[3]

Figure I.3 shows the annual growth of income in the global distribution (from the lowest to the highest income percentiles) between 1990 and 2016, in dollars at 2018 prices. The curve is almost flat, except in the final section, where the income of the wealthiest percentile is concentrated.[4] Figure I.4, in turn, shows the trend in the share of total income of the wealthiest percentile in different countries. The share of the top 1% increases sharply in many of these countries, but this is most marked in the two most populous, China and India.

3 Data from Alvaredo and others (2019), which combine data from household surveys, national accounts and administrative records (tax returns).
4 Niño-Zarazúa, Roope and Tarp (2016) also underscore an increase in absolute global inequality over time.

Figure I.3
Growth in real annual income per adult, by decile and percentile of income in the global distribution, 1990–2016
(Dollars at 2018 prices)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Inequality Database [online] https://wid.world/data/.

Figure I.4
Developed economies (6 countries) and developing economies (8 countries): income share of the wealthiest 1% of the population, 1980–2019
(Percentages)

A. Developed economies

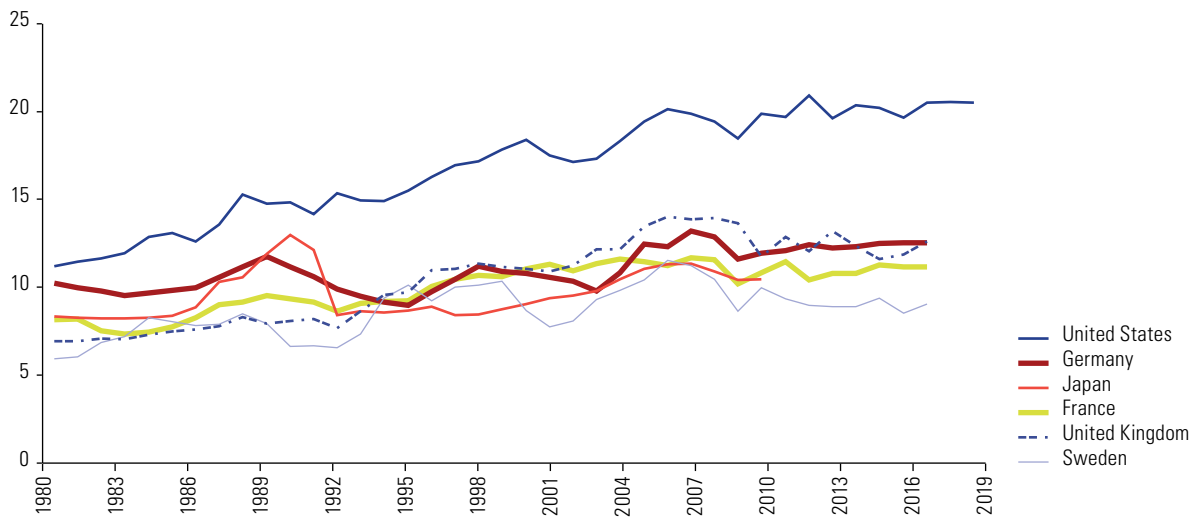
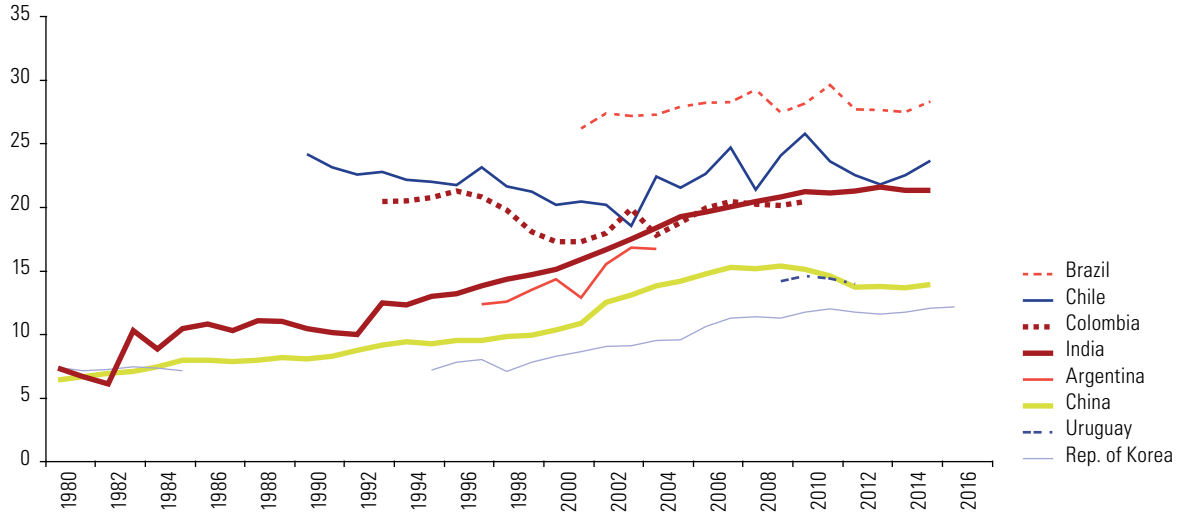


Figure I.4 (concluded)

B. Developing economies



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

The concentration of income is also reflected in the decline in the share of labour income in global GDP (ILO, 2017). This dynamic is associated with a 2% reduction in the median value of labour income between 1995 and 2014 in 133 countries: the share of labour decreased in 91 countries, increased in 32 and remained stable in 10.

Inequalities are not limited to income. According to UNDP (2019), the difference in life expectancy at birth between countries with low and very high human development is 19 years, reflecting gaps in access to health. The supply of health care is fragmented in terms of the services provided and the population's access to these services. Moreover, it is commodified (that is, health is seen as a commodity, not a right), with negative impacts on the well-being and productivity of a large segment of the population in developing countries. Similarly, only 42% of adults in countries with low human development have completed primary education, compared to 94% of adults in countries with very high human development. At the level of tertiary education, only 3.2% of adults in countries with low human development have completed the cycle, compared to 29% of adults in developed countries.

Although significant progress has been made in guaranteeing women's rights in recent decades, no country in the world, regardless of its income level, has achieved gender equality. Inequalities are manifested in higher levels of poverty among women[5] (in terms of money and disposable time), the burden of unpaid and care work,[6] precarious labour market participation, limited access to economic and technological resources, weaker representation in decision-making in the political, economic and social spheres, and the persistence of discrimination and violence against women in its most extreme form: femicide.

The improvement in women's education indicators has barely reduced occupational segregation, and the gender wage gap remains at 20% globally (United Nations, 2019). Furthermore, although women represented 39% of the workforce in 2018, they held only 27% of the managerial positions in governments, large companies and other institutions. In parliaments, only one in four seats is occupied by women (UN-Women/DESA, 2019).

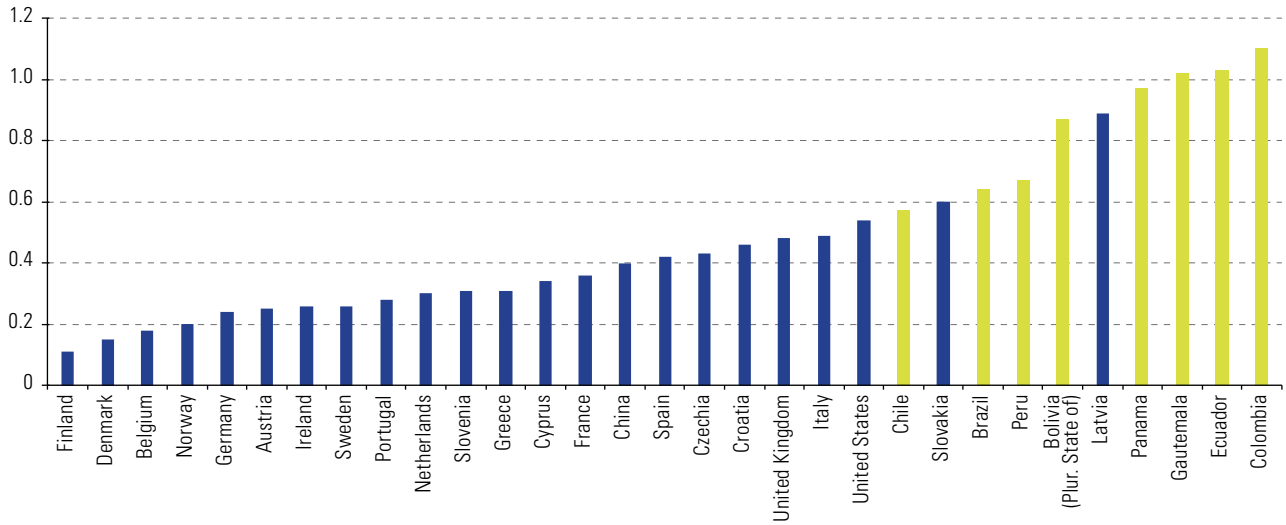
Privileges and inequalities are reproduced over time. Figure I.5 shows the extent to which parents' income is related to that of their children based on the estimation of an intergenerational income persistence coefficient. In countries where the culture of privilege is less engrained, for example Denmark and Finland, this coefficient is usually insignificant. However, it is very high in many countries, particularly in Latin America and the Caribbean.

Increased inequality is accompanied by a breakdown in the foundations of the social compact shaped by social mobility in many countries, which had created expectations of improvements in well-being. Social mobility is stagnating or declining: the world of work is becoming increasingly precarious and unstable.

5 Women aged 25–34 are 25% more likely than men to live in extreme poverty (United Nations, 2019).

6 Women spend thrice as much time as men on unpaid domestic and care work.

Figure I.5
Coefficient of intergenerational income persistence in the 1980 cohort in various countries of the world, 2018



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, Database on Intergenerational Mobility (GDIM), 2018, Washington, D.C. [online] https://www.worldbank.org/en/topic/poverty/brief/what-is-the-global-database-on-intergenerational-mobility-gdim.

Note: Intergenerational income persistence is used to measure how parents' income affects the expected income of their children. It is a measure of relative mobility in terms of income that is obtained in three steps: (i) estimation of an income equation from a previous sample that is representative of the current population of parents; (ii) use of estimated model coefficients (education and experience) to predict parental income at the reference age, using retrospective data on parents' age and education as explanatory variables; and (iii) regression of children's income on expected parents' income at the reference age. The resulting regression coefficients are considered a measure of relative income persistence. The countries of the region show the highest level of intergenerational income persistence. Estimates are based on the 1980 cohort.

The pandemic has exacerbated negative trends in personal and functional income distribution. The International Labour Organization (ILO) estimates that the income of half the world's workers is at risk. This is particularly serious in the case of informal workers (estimated at 1.6 billion people), who lack social protection or other sources of income (ILO, 2020). The income of informal workers is projected to fall by 60% worldwide, and by 81% in Latin America and Africa. Inequality is exacerbated by the fact that the recovery of financial markets also means that the richest 1% have regained some of the wealth they lost at the beginning of the crisis.

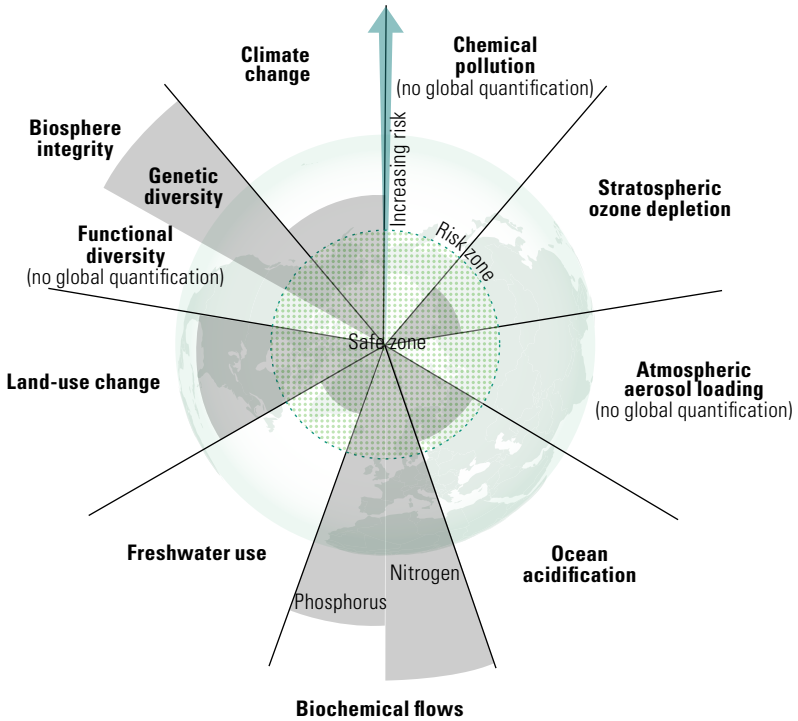
The economic and human cost of the pandemic is extremely high, and within countries it has the biggest impact on those who lack access to social protection systems, which could ensure resilience in the face of income loss. The pandemic represents significant costs in terms of increased inequality, which cannot be offset given the inadequacy of social protection systems.

3. Exceeding planetary boundaries

The current development path has reached a point that has put the survival of the ecological system that supports it at risk. Markets cannot stop these processes, as rates of return do not take into account the destruction of nature or many of its effects on health and well-being.

The world as we know it today is a relatively new geological phenomenon: for most of the planet's 4.5 billion years of evolution, conditions were not apt for human development. Only in the last 12,000 years (the Holocene), conditions allowed civilization to develop thanks to relatively stable temperatures (±1.5°C) (Rockström and others, 2009; Young and Steffen, 2009; Burke and others, 2018). This development led to a new geological period, the Anthropocene, in which human action is the main driving force behind the changes occurring in the biosphere (Crutzen, 2002). These changes tend, in some cases, to exceed the planetary boundaries that ensure a safe operating space for humans, as illustrated in diagram I.1. Most of the evidence of environmental degradation lies in processes such as the reduction of genetic biodiversity, deforestation and soil degradation, the alteration of biogeochemical nutrient cycles and climate change. All these processes are interrelated and mutually reinforcing, and exceeding these boundaries would have unforeseeable consequences for humanity.

Diagram I.1
Exceeding planetary boundaries, 2015



Source: J. Lokrantz/Azote, on the basis of W. Steffen and others, "Planetary boundaries: guiding human development on a changing planet", *Science*, vol. 347, No. 6223, 2015 [online] https://www.stockholmresilience.org/research/planetary-boundaries.html.

Note: Estimate of how different control variables for nine planetary boundaries have changed from 1950 to the present. The shaded area represents an indicator of risk and, the more it spreads, the greater the risk. The fact that the shaded area goes beyond the edge of the world means that the planetary boundary has been exceeded.

Ecosystems and biodiversity are being reduced at alarming rates: more than 1 million species are in the process of extinction (IPBES, 2019). According to the Living Planet Index, the 16,704 populations representing the 4,005 species monitored worldwide between 1970 and 2014 were reduced by 60%. This loss was particularly pronounced in tropical regions. In Latin America and the Caribbean, the decline was 89% among 1,040 populations representing 689 species, the largest drop recorded in any biogeographic realm (Grooten and Almond, 2018). Deforestation and changes in land use, the use of agrochemicals and climate change intensify the problem (Sánchez-Bayo and Wyckhuys, 2019).

Nutrient biogeochemical cycles have been radically altered. In the last half of the twentieth century, the production of artificial reactive nitrogen (which organisms are capable of assimilating) increased 5–10 times, exceeding the production of natural nitrogen (Galloway and others, 2003 and 2004; Battye, Aneja and Schlesinger, 2017). At the same time, the indiscriminate increase in the use of phosphorus, whose global footprint has increased by 38% since 1945, is expected to lead to the depletion of phosphorus reserves by the end of the century, putting agricultural production at risk (Enrich-Prast and others, 2018).

Excessive deposition of nutrients (atmospheric nitrogen, phosphorus) encourages unintentional fertilization, threatening the integrity and functioning of ecosystems. Once the critical thresholds are exceeded, acidification processes begin, as well as eutrophication of aquifers and terrestrial and marine ecosystems. The most visible effects include harmful algal blooms (such as that of sargassum in the Caribbean) which, during decomposition, consume oxygen vital to other species, and the expansion of dead zones as a result of hypoxia. In addition, nitrogen dioxide emissions have a warming potential that is 250 to 300 times greater than that of carbon monoxide, and contribute to the destruction of the ozone layer (Enrich-Prast and others, 2018; Ochoa-Hueso, 2017; IPCC, 2007 and 2013; and Díaz, Selman and Chique, 2011).

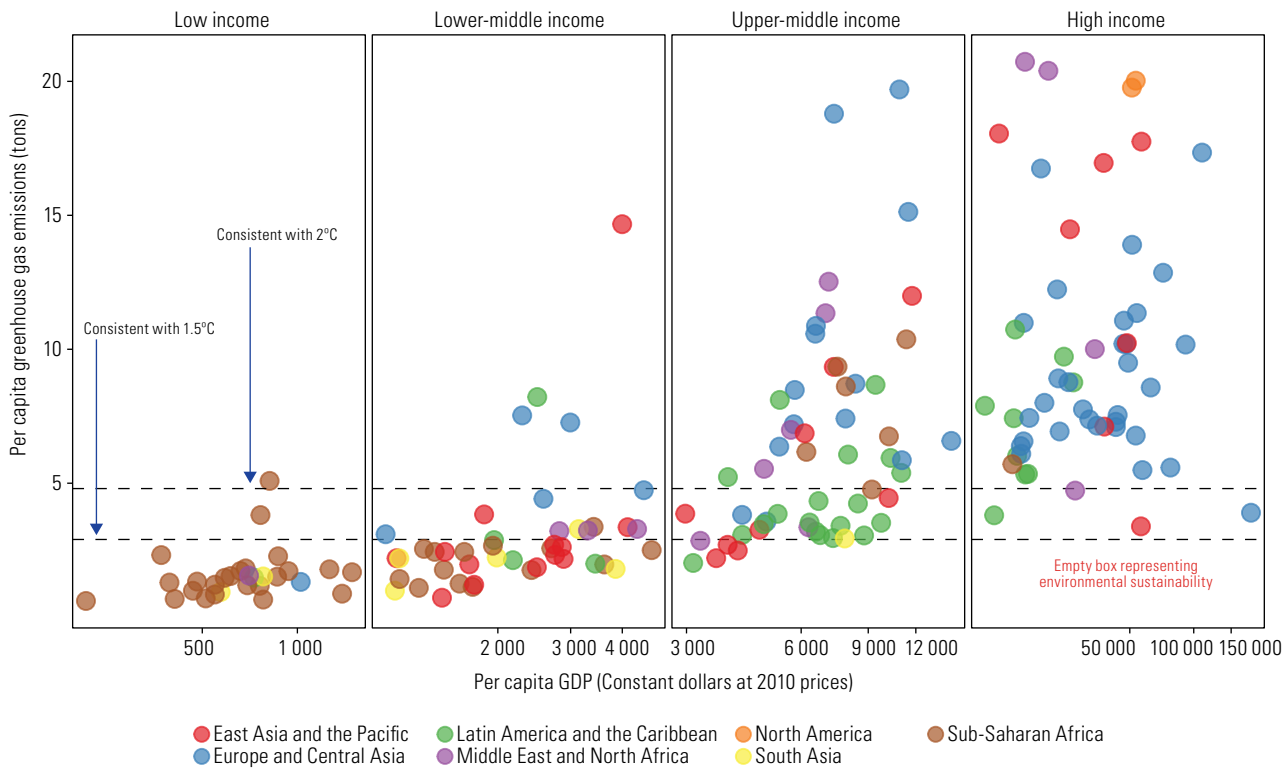
Climate change caused by human activity is the clearest and best known expression of the economic model's inability to incorporate environmental variables. The present generation may be the last to be able to act on this phenomenon and avoid its most serious consequences (which is not to say that the other thresholds are not important). The accumulation of carbon dioxide (CO_2), methane, nitrogen oxides and fluorinated gases has accelerated since the industrial revolution. In the pre-industrial period, the concentration

of atmospheric CO_2 —the quantity of CO_2 molecules in relation to the total number of gas molecules in the atmosphere— was 278 ppm; in January 2020, that concentration exceeded 413 ppm (NOAA, 2020).[7] There is no precedent for this level of concentration in the last 3 million years (Willeit and others, 2019; Hansen and others, 2008; Stern, 2015) and it is causing the surface temperatures of the earth and ocean to rise, among other things. According to IPCC (2014b), the concentration of CO_2 must not exceed 450 ppm to ensure that the temperature does not increase by more than 2°C on average compared to pre-industrial levels.

In this context, the objective of the Paris Agreement and the United Nations Framework Convention on Climate Change (UNFCCC) is to keep the increase in global average temperature below 2°C above pre-industrial levels and preferably not to exceed 1.5°C. This is crucial as, according to IPCC (2018), the difference between 1.5°C and 2°C would increase risks considerably: the loss of vertebrate and plant species would double and the loss of insects would triple; up to 99% of coral reefs would be lost; the decline in fish stocks would double; the Arctic would be ice-free in summer once every 10 years (instead of once every 100 years), and the percentage of the population exposed to heat waves every five years would increase to between 14% and 37%.

Approximately 80% of the energy we use comes from fossil fuels. Given the strong interdependence between the production of goods and services and energy consumption, economic growth translates into greenhouse gas emissions. Figure I.6 shows how, with the prevailing development model, no country has managed to achieve high income without radically increasing emissions, in other words, the box representing the space where high GDP and environmental sustainability would overlap is empty. If low- and lower-middle-income countries continue on the same path, all other things being equal, the environmental boundaries will be exceeded. Altering this trajectory requires radically changing production, distribution and consumption patterns, directing major technological efforts towards sustainability and, in addition, as discussed below, adjusting growth in the countries at the centre of the system to allow those on the periphery to grow fast enough to permit economic and social convergence within planetary environmental boundaries.

Figure I.6
Per capita GDP and per capita greenhouse gas emissions around the world, 2017
(Dollars at 2010 prices and tons of CO_2eq)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of J. Gütschow and others, "The PRIMAP-hist national historical emissions time series (1850-2017)", German Research Centre for Geosciences (GFZ), GFZ Data Services [online] http://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:4736895; and World Bank, World Development Indicators, 2019, Washington, D.C. [online database] http://data.worldbank.org/data-catalog/world-development-indicators.

[7] Mauna Loa measurement. If all greenhouse gases are considered, including cooling aerosols, the concentration of emissions amounted to 454 ppm (2019 data; see EEA, 2020).

4. The double asymmetry in environmental issues and the importance of the principle of common but differentiated responsibilities

Not all countries or social groups contribute to emissions or suffer their impact in the same proportion. There is a double asymmetry in the sense that those who produce the most emissions (the richest countries and social groups) are those who have the greatest capacity to defend themselves against the effects of climate change, while those who produce the least emissions (the poorest countries and social groups) are those who suffer the most and have the least resources to recover. This double asymmetry gives rise to the principle of common but differentiated responsibilities: environmental stewardship is a responsibility of the international community, but the cost of mitigation and adaptation should not fall on everyone equally, because the contribution of different social groups and different countries to environmental degradation varies significantly. Rich countries are the biggest contributors to and beneficiaries of environmental deterioration and should make the biggest efforts to reduce this deterioration and its impacts.

The first asymmetry stems from the fact that the level of emissions reflects consumption capacity and therefore reproduces patterns of income inequality. In high-income countries, the average inhabitant produces about 13 tons of greenhouse gas emissions per year, or about 10 tons more than the average inhabitant of low-income and lower-middle-income countries, and 4 tons more than the average inhabitant of upper-middle-income countries (see figure I.7).

The second asymmetry derives from the unequal distribution of the cost of environmental degradation. The rise in temperature has affected poor countries in particular. High temperatures have effects ranging from reduced agricultural yields to lower industrial productivity and even political instability. The greatest negative impact may occur in developing regions, such as South Asia, Africa, the Middle East and Latin America and the Caribbean. Globally, the poor bear economic costs relating to disasters that are two to three times higher than for the non-poor (see IPCC, 2019a).

Figure I.7
Annual per capita greenhouse gas emissions, 2017
(Tons of CO_2eq per inhabitant)

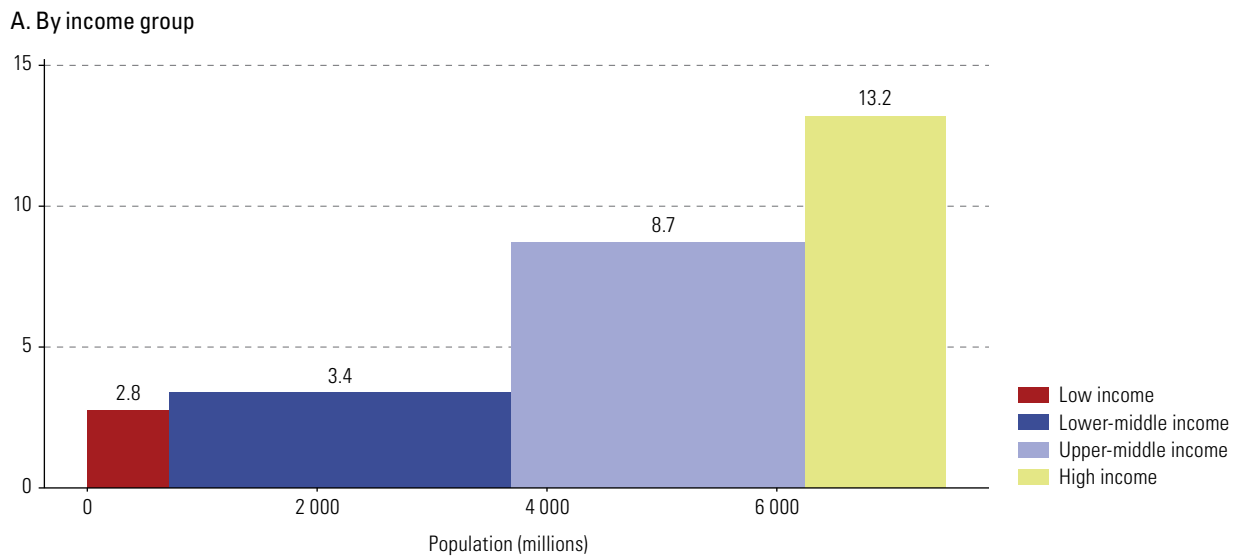
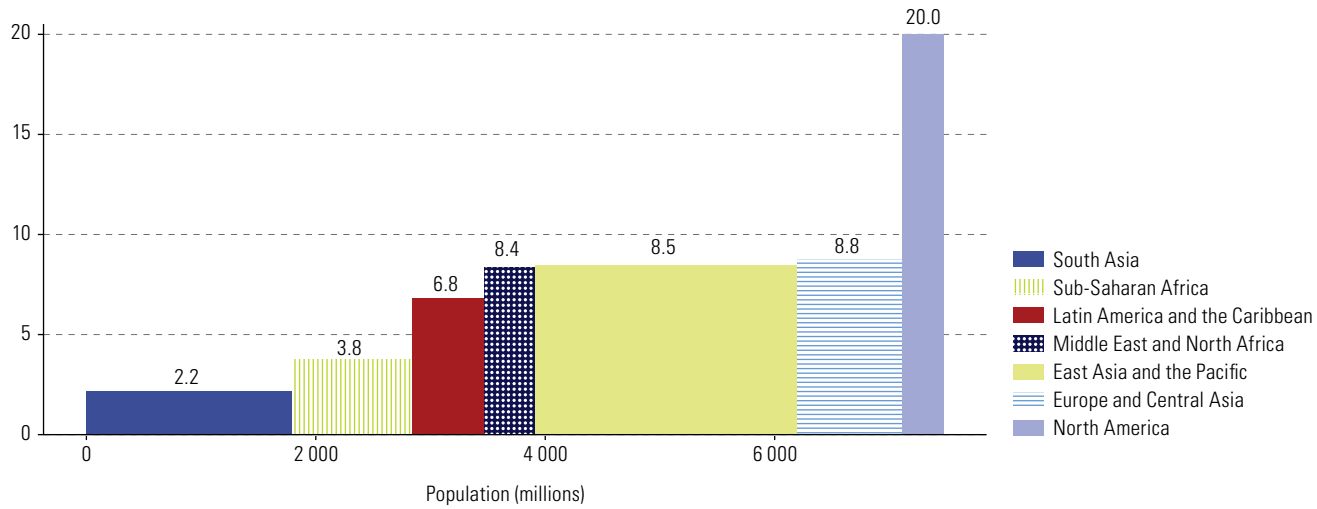


Figure I.7 (concluded)

B. By geographic region



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of J. Gütschow and others, "The PRIMAP-hist national historical emissions time series (1850-2017)", German Research Centre for Geosciences (GFZ), GFZ Data Services [online] http://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:4736895; World Bank, World Development Indicators, 2019, Washington, D.C. [online database] http://data.worldbank.org/data-catalog/world-development-indicators; and Food and Agriculture Organization of the United Nations (FAO), Corporate Database for Substantive Statistical Data (FAOSTAT) [online] http://www.fao.org/faostat/en/#home.

The impact of disasters and climate change is felt in multiple dimensions. In all of them, the poorest are affected more frequently and more intensely, since they live in more vulnerable areas, have lower levels of education, have fewer personal networks and productive and financial assets to deal with occurrence, work in occupations that are highly vulnerable to climate change (such as agriculture), lose more in proportion to their income, and have less access to institutional responses, for example, to social protection (Cecchini, Sunkel and Barrantes, 2017). Moreover, the effects of disasters include a gender dimension. The Sendai Framework for Disaster Risk Reduction 2015–2030 recognizes that, because of gender inequalities, climate change and recurring natural disasters have a greater socioeconomic impact on women. By affecting their livelihoods, these phenomena also reduce their economic autonomy and increase their unpaid care workload (IPCC, 2014b).

Some positive outcomes have been achieved through the current international environmental governance, such as the recovery of the ozone layer and the protection of marine ecosystems and some endangered species. There is also greater awareness of environmental limits and risks, as shown by the Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean (Escazú Agreement), the first treaty in which governments and civil society participate on an equal footing to guarantee access to information, justice and informed participation in environmental matters. The environmental agreements reached so far are very fragmented, voluntary and non-binding. The international community faces the challenge of moving towards a new multilateral governance, which is also addressed in chapter V.

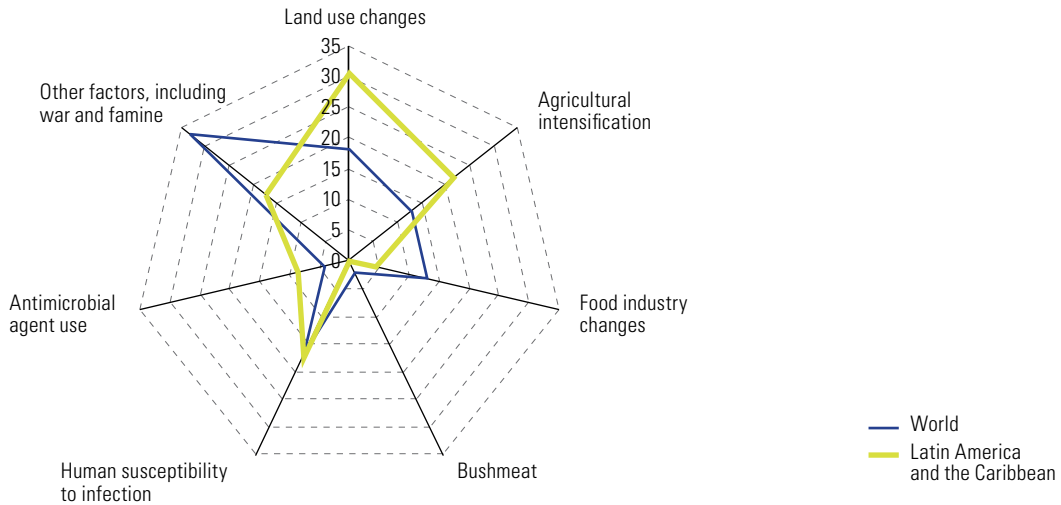
There is great concern that the pandemic, coupled with the reduction of emissions in the short term and the urgency of achieving economic recovery at any cost, will lead to reduced environmental spending and less investment in sustainable solutions. The dramatic decline in GDP led to a significant reduction in global emissions. On 7 April 2020, emissions were 17% lower than on any other day in the earlier months of the year (Storrow, 2020). Such a significant reduction was achieved only because of very exceptional conditions that cannot be sustained for long, namely lockdowns and the drastic contraction of international and domestic travel. If lockdowns persist in the second half of 2020, emissions could drop by 7% this year. That reduction is less than 7.6%, which is the annual rate of reduction in emissions that the United Nations estimates is necessary over the next decade to limit the increase in the earth's temperature to below 1.5°C. If energy patterns remain unchanged, the impact of the return to economic growth on emissions will quickly offset the decline caused by the recession.

Thus, the effect of the pandemic on the reduction in emissions was temporary and insufficient. The recovery cannot be allowed to occur within the parameters of the previous path, but making large-scale changes in energy sources and production and consumption patterns in order to decouple growth from emissions, as discussed in detail in chapter V.

5. The pandemic is a manifestation of environmental limits

The pandemic may be seen as a sign of the increasing presence and encroachment of humans in the planet's ecosystems. Emerging zoonotic diseases, such as COVID-19, show the potential negative consequences of increasing human pressure on nature (UNEP/ILRI, 2020). The frequency with which pathogenic microorganisms jump from animals to humans has increased with forest and agricultural exploitation (Vale and others, 2019) and urbanization (Shapiro and others, 2013). Natural lands are transformed, deforestation occurs, ecosystems are degraded and biodiversity is reduced;[8] the pre-existing balance changes and the natural barriers between humans and pathogens become weaker (see figure I.8).

Figure I.8
Latin America and the Caribbean and the world: causal factors in outbreaks of emerging infectious diseases, 1940–2004
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of K. Jones and others, "Global trends in emerging infectious diseases", *Nature*, vol. 451, February 2008, and F. Keesing and others, "Impacts of biodiversity on the emergence and transmission of infectious diseases", *Nature*, vol. 468, No. 7324, December 2010.
Note: About 60% of outbreaks are zoonotic and, among them, 72% originate in wildlife.

The intensive model of agricultural production and monoculture also encourages the evolution and spread of pathogens. Large numbers of animals, high turnover and small spaces exacerbate the risks of disease emergence (Meadows and others, 2018). This is compounded by the absence of genetic diversity associated with monoculture (agricultural and livestock), which reduces resilience and facilitates the spread and evolution of pathogens (Mennerrat and others, 2010). In turn, antibiotics used intensively in livestock and agricultural

[8] The links between biodiversity loss and zoonotic diseases are complex (Keesing, Holt and Ostfeld, 2006; Levine and others, 2017; Zargar and others, 2014). The fragmentation (Zohdy, Schwartz and Oaks, 2019) or impoverishment of biodiversity can facilitate the transmission of pathogens (Keesing and others, 2010; Ostfeld and Keesing, 2017). However, in the case of some ecosystems or diseases, higher species density has been associated with greater transmissibility. The two effects can work simultaneously even on a different scale (Halliday and Rohr, 2019). Zohdy, Schwartz and Oaks (2019) discuss the coevolution effect, according to which habitat fragmentation creates "islands" that accelerate the evolution of hosts, parasites and pathogens along routes independent of other islands, which can pose risks of spillover to humans.

crop production enter the environment (Fletcher, 2015), contributing to the growing antimicrobial resistance of pathogens (UNEP, 2017), weakening biogenetic richness and increasing the risk of fatal infections for animals and humans (Chang and others, 2015). Illegal trade, hunting or use of wildlife as pets also contributes to the emergence of zoonotic diseases (Johnson and others, 2020; UNEP/ILRI, 2020).

The local effects of economic activities are compounded by the possible consequences of climate change. Higher temperatures favour the development of certain infections (Zhou and others, 2008) and extend the range and seasons of high transmission of several zoonoses, especially those transmitted by vectors (Huber and others, 2020; Wells and Clark, 2019). Changing weather patterns allow some infectious diseases to appear or re-emerge (Huber and others, 2020). There is concern about ancient bacteria and viruses that have remained frozen (Myglan and Vaganov, 2005) and which have few or distant counterparts in the present day (Christo-Foroux and others, 2020), as humans would have little immune resistance to these viruses and bacteria.

Finally, the debilitating effect of environmental pollution on the human immune system, especially in the long term, cannot be disregarded. Cui and others (2003) noted that during the outbreak of severe acute respiratory syndrome (SARS) in China, patients living in areas with high air pollution levels were twice as likely to die as those living in areas with low pollution levels. According to research by Cole, Ozgen and Strobl (2020) in 355 Dutch municipalities, a 1 μ/m^3 increase in fine particulate matter (PM2.5) concentration is associated with 9.4 more cases of COVID-19, 2.9 more hospital admissions and 2.2 more deaths from COVID-19. The effects of nitrogen dioxide and sulfur dioxide concentrations are less significant.

In Latin America and the Caribbean, humans are also exposed to disease as a result of land use change (Ellwanger and others, 2020). Deforestation of the Amazon has contributed to the emergence and spread of vector-borne diseases such as malaria (see MacDonald and Mordecai, 2019, for Brazil, and Grillet and others, 2020, for the Bolivarian Republic of Venezuela), leishmaniasis (see Hernández and others, 2019, for Colombia), spotted fever (Scinachi and others, 2017), Chagas disease (Teixeira and others, 2001), microsporidiosis (Pereira and others, 2009) and toxoplasmosis (Confalonieri, Margonari and Quintão, 2014; Saccaro Junior, Mation and Sakowski, 2015). On the basis of their observations in Peru, Vittor and others (2006) reported that the biting rate of an insect species that could transmit malaria were 278 times higher in deforested areas than in forested areas.

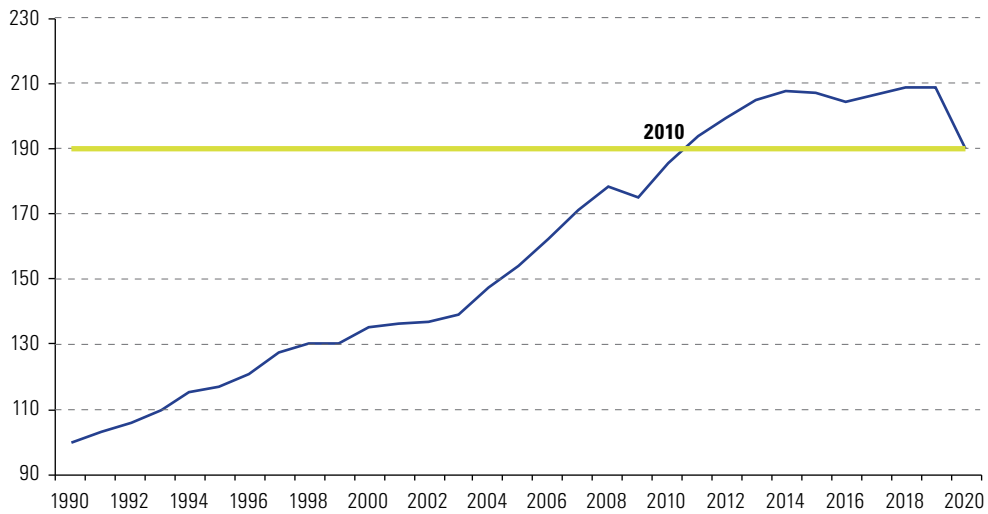
B. The three crises facing Latin America and the Caribbean

Imbalances and tensions in the global economy are manifesting themselves in Latin America and the Caribbean with varying degrees of intensity depending on national realities. As in the global economy, trends were already inauspicious before the pandemic. In the preceding six years (2014–2019), economic growth had been the lowest recorded since 1951 (0.4%). In this weak growth scenario, the pandemic is expected to cause regional per capita GDP to contract by almost 10% in 2020, to a level similar to that in 2010 (see figure I.9).

There is limited fiscal space in Latin America and the Caribbean to respond to the pandemic. Public debt increased from about 30% of GDP in 2009–2011 to over 45% in 2019. In the Caribbean, average debt was 68.5% of GDP in 2019. As a result of a series of external shocks, compounded by structural weaknesses and vulnerabilities and high exposure to natural disasters and the impacts of climate change, some small island developing States in the subregion are among the most indebted economies in the world.

The region's fiscal space is limited because of the low tax burden and regressive tax structure. In 2018, tax revenues in Latin America and the Caribbean stood at 23.1% of GDP, well below the average of 34.3% of GDP recorded in the countries of the Organization for Economic Cooperation and Development (OECD) (tax revenues include social security contributions paid to the central government). Tax evasion and avoidance and illicit flows further limit fiscal space. Tax non-compliance in Latin America stood at US$ 325 billion in 2018, equivalent to 6.1% of GDP (United Nations, 2020).

Figure I.9
Latin America and the Caribbean: per capita GDP, 1990-2020[a]
(Index: 1990=100)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official figures.
[a] Projected value for 2020.

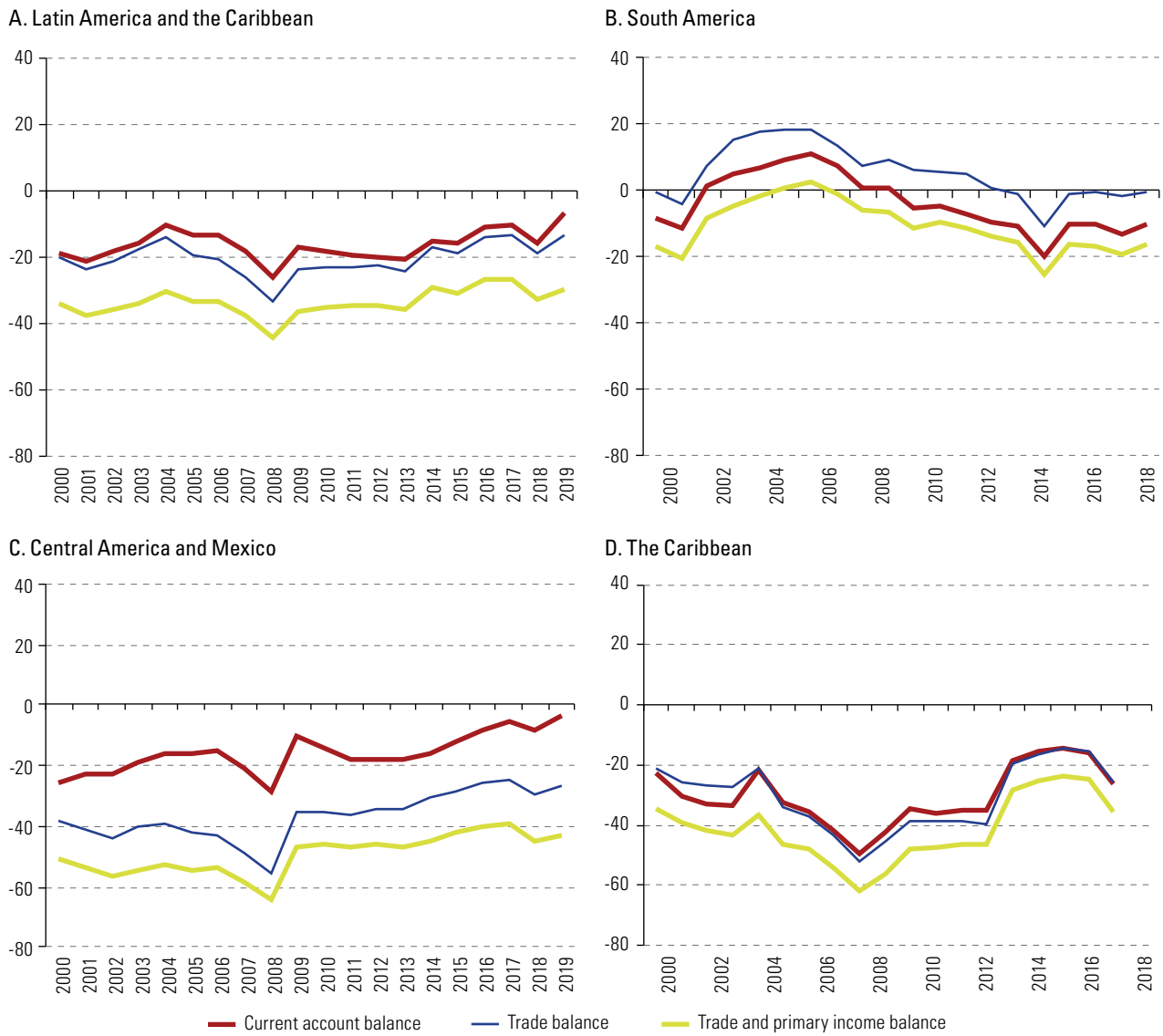
The external constraint has been a recurrent limit to the region's growth capacity. On the one hand, this derives from the position of Latin America and the Caribbean in the real global economy, which is determined by its productive specialization. The balance of trade in goods and services tends to run a deficit, especially in the countries of Central America and the Caribbean. The exception was South America during the commodity price boom, when trade in goods and services was in surplus (see figure I.10). The external financial constraint, meanwhile, is reflected in the weight of interest in external debt and earnings and returns on foreign investment, which are included in the primary income account of the balance of payments. These outlays are deepening the region's chronic external deficit and resulting in growing external financing needs. This can be seen in figure I.10, where the external balance reflects a larger deficit when the primary income balance is added to the trade balance. The deficit on the trade and primary income accounts is partly offset by remittances, which are included in the secondary income account of the balance of payments. This component is significant in the countries of Central America.

The pandemic is expected to have a strong impact on Latin American and Caribbean exports, which are projected to fall by about 23%, with declines of 11% and 12% in prices and volumes, respectively. The external constraint would be exacerbated in this context.

In 2020, the volatility of the region's currencies increased, and the turbulence created by the pandemic led to greater exchange-rate volatility and sharp depreciations. During the first quarter of 2020, the average depreciation was 9.2% across 14 currencies. Nonetheless, four currencies appreciated slightly (0.4%). Capital outflows, a fall in stock markets, a downturn in international trade, and declines in commodity prices and tourism led to these corrections. In the second quarter, with a recovery of commodity prices and increased capital inflows to emerging economies, seven currencies appreciated (3.4% on average) and 11 depreciated (3.7% on average) (ECLAC, 2020).

While it is not known what the new normality of the region will be once the pandemic is over, it is expected that structural problems will persist, as discussed below.

Figure I.10
Latin America and the Caribbean and subregions: current account balance, trade balance and primary income balance, 2000–2018
(Percentages of exports)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of data from the International Monetary Fund (IMF).
Note: Data for each subregion are simple averages, and data for the entire region are simple averages of the subregions. Total exports and the trade balance include both goods and services.

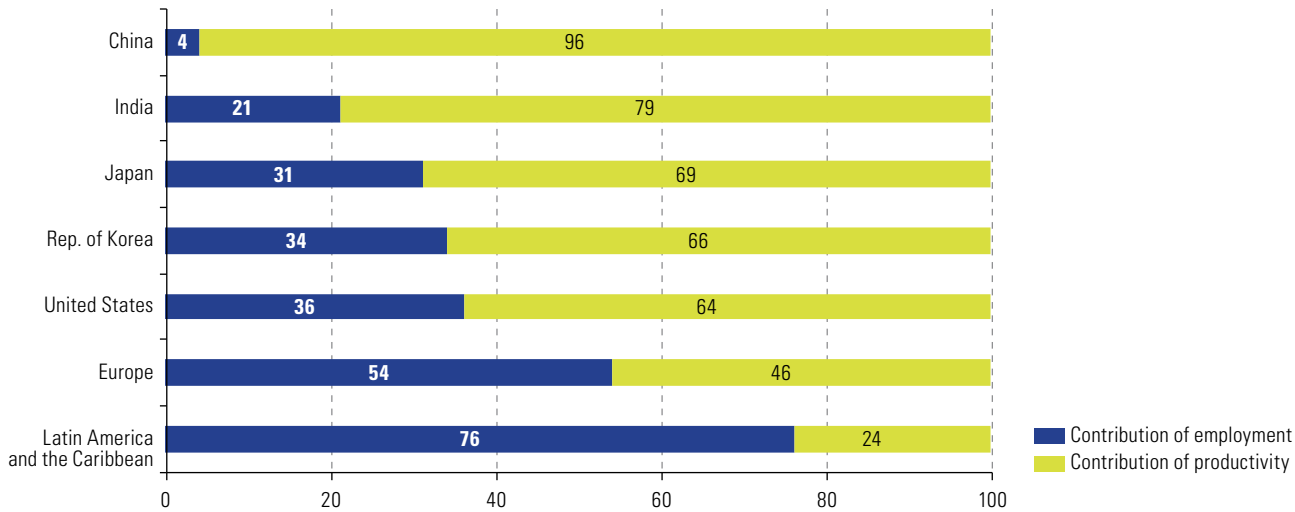
1. The determinants and evolution of the growth rate compatible with external equilibrium

This section examines the problems linked to the production structure that define the rate of growth compatible with external equilibrium of a peripheral country. As discussed in chapter II, the specialization pattern based on static comparative advantages has a negative impact on the growth of an economy that does not issue an international reserve currency, in the absence of adequate governance in the global economy. This specialization reflects endogenously reproduced technological gaps that are one of the great challenges of development policy.

The growth rate that is compatible with external equilibrium depends on the growth of the rest of the world, which affects the demand for a country's exports positively, and on the competitiveness of the economy, which defines a country's share in global aggregate demand and in its own aggregate demand, captured through the income-elasticity of exports divided by the income-elasticity of imports. In the region, competitiveness has been based largely on natural resources or the abundance of cheap labour. This type of advantage can sustain short periods of rapid growth (for example during the commodity boom), but does not ensure convergence with advanced countries in the long term. To achieve this, competitiveness must be based on technology uptake and on productive diversification towards technologically dynamic sectors (Schumpeterian efficiency) in which demand expands rapidly (growth or Keynesian efficiency) (for the definition of the different types of efficiency, see Dosi and others, 1990; for growth and external constraints, see Blecker, 2016; Blecker and Setterfield, 2019; ECLAC, 2012). The latter type of competitiveness defines what Fajnzylber (1996) called "genuine competitiveness", which is based on narrowing the technological gap between peripheral economies and the international technological frontier, by disseminating technology in existing activities or creating new activities.

Technology absorption allows for increased productivity, structural change and redefined elasticities. Figure I.11, which shows the pattern of growth in Latin America and the Caribbean compared with that of other economies, shows that the former has been based on the expansion of employment, with little or no contribution from technical progress and innovation. Growth has been limited by this lack of technological growth.

Figure I.11
Selected countries and regions: contribution of productivity and employment to GDP growth, 2000–2019
(Percentages)



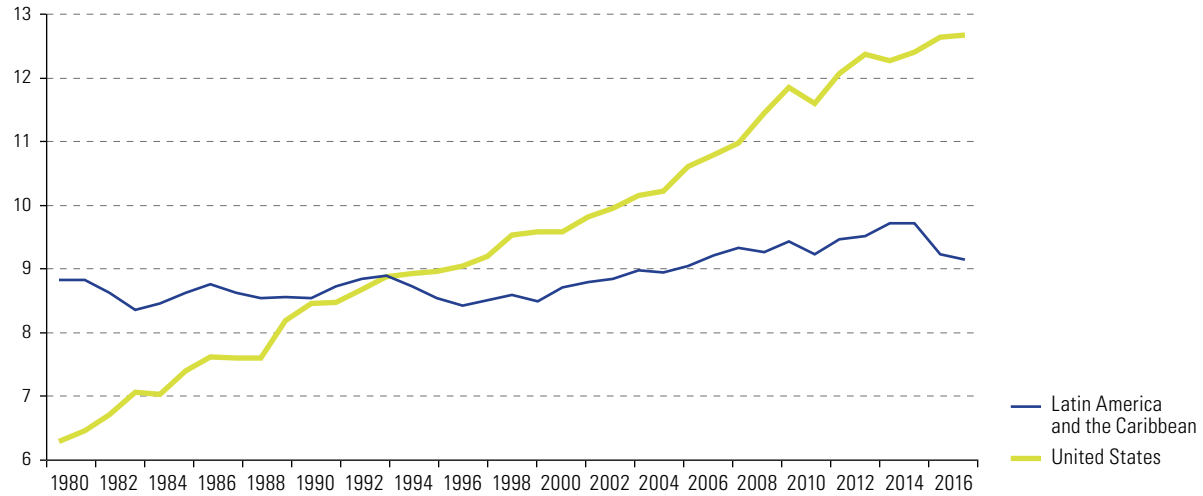
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of The Conference Board, Total Economy Database, 2019 [online] https://conference-board.org/data/economydatabase/total-economy-database-productivity.

In some cases, competitiveness-seeking through technical change can raise not only the growth rate that is compatible with the external constraint, but also the growth rate with environmental equilibrium, that is, the rate compatible with the preservation of ecosystems (see chapter II). When increased productivity translates into greater energy efficiency or lessens the demand for natural resources, both these growth rates rise.

Figure I.12 shows how energy-related productivity has evolved in the region compared to the United States. Productivity is defined as the value added (in constant dollars at 2010 prices) that can be generated through the use of one unit of energy.[9] In the region, the 2016 value is only 3.5% higher than that of 1980, indicating that energy efficiency has remained virtually unchanged for 36 years.

[9] Energy is measured in thousands of tons of oil equivalent and includes the total sum of energy production. Another concept used to represent the same phenomenon is energy efficiency.

Figure I.12
Latin America and the Caribbean and the United States: energy productivity, 1980–2016
(Value added per unit of energy)

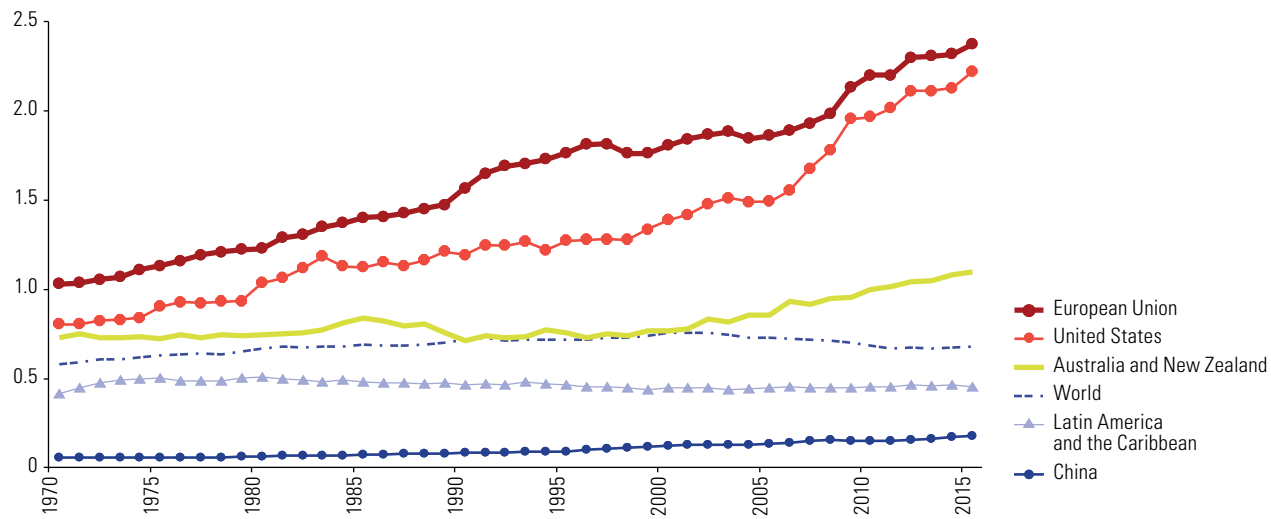


Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Conversely, the value added per unit of energy for the United States was less than that of the region in 1980, but increased over the period. The final result was an increase of 101 %, which was double the energy productivity of Latin America and the Caribbean in 2016. Given that energy is a basic input of the production process and one of the main sources of greenhouse gas emissions, the weak performance of Latin America and the Caribbean has negative effects on its competitiveness and on environmental sustainability.

Efficiency in the use of materials also has a combined effect on growth rates compatible with the external constraint and the environmental equilibrium. The material footprint of production reflects divergent trends in different regions. Measured by the ratio of GDP to kilograms of materials as an indicator of efficiency, efficiency in materials use evolved positively in the United States, Europe and China, but stagnated in Latin America and the Caribbean (see figure I.13). The region's efficiency in the use of materials has lagged behind that of the rest of the world.

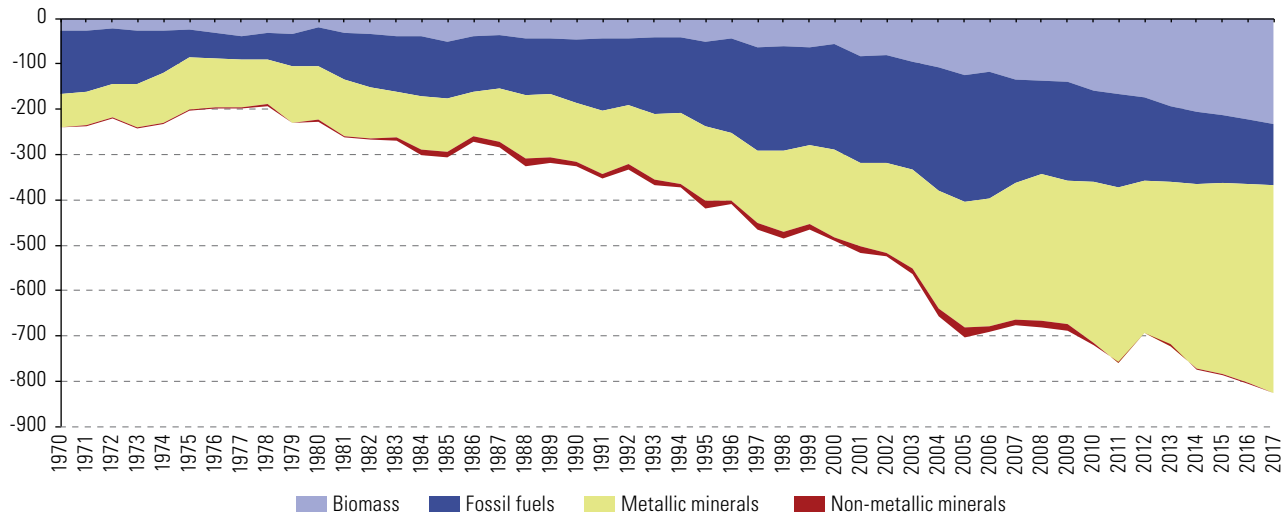
Figure I.13
World and selected regions: material productivity defined as the ratio of GDP to quantity of materials consumed, 1970–2015
(Constant dollars at 2010 prices per kilogram)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of United Nations Environment Programme (UNEP), International Resource Panel, Global Material Flows Database [online] http://www.resourcepanel.org/global-material-flows-database [accessed: February 2019].

Differences between regions in terms of material productivity can be attributed to two variables. The first is the speed of technology uptake in each production sector, and the second is the speed of the shift from an extractive, natural-resource-intensive production structure to a service-based economy with low material consumption (UNEP, 2016). Latin America and the Caribbean is a net exporter in all four major categories of materials (biomass, fossil fuels, metallic minerals and non-metallic minerals), although between 1970 and 2017, exports of biomass and metallic minerals increased, while fossil fuel exports declined (see figure I.14).[10]

Figure I.14
Latin America and the Caribbean: physical trade balance, 1970–2017
(Millions of tons)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of United Nations Environment Programme (UNEP), International Resource Panel, Global Material Flows Database [online] http://www.resourcepanel.org/global-material-flows-database [accessed: February 2019].

The intense exploitation of resources has harmful environmental effects, including the loss of natural heritage and ecosystem services, which has not been offset by public investments, which remain very low.

The technological frontier is moving increasingly towards environmental innovations (see table I.2). In the countries of the region as well as other regions of the world, these innovations have expanded more than the average. Although the region tripled its number of environmental patents per million inhabitants between 2000–2007 and 2008–2016, the figure remains small compared to those of the other economies in the table. Most of the patents relating to themes involving environmental impacts (such as renewable energies, electric and hybrid vehicles, energy efficiency in buildings, and water and waste treatment) are concentrated in the United States, Japan and European countries. The gap compared to a country that has recently converged with developed economies, such as the Republic of Korea, has increased sharply. This gap is also reflected in the relationship between spending on research and development (R&D) with environmental objectives and GDP.

[10] The Central American subregion is a net importer of materials, given its dependence on hydrocarbons. Mexico, however, tends towards equilibrium, owing to the loss of momentum in that category.

Table I.2
World and selected countries and regions: total number of patents and number of environmental patents per million inhabitants, 2000–2007 and 2008–2016

Region/country	2000–2007 average			2008–2016 average		
	Total *(number)*	Environmental *(number)*	Environmental patents as a proportion of total patents *(percentages)*	Total *(number)*	Environmental *(number)*	Environmental patents as a proportion of total patents *(percentages)*
Republic of Korea	1 678.1	105.5	6.3	2 250.9	244.7	10.9
Japan	624.5	49.0	7.8	677.2	73.8	10.9
Germany	633.6	59.0	9.3	676.3	86.9	12.8
United States	531.7	30.8	5.8	525.8	45.8	8.7
Organization for Economic Cooperation and Development (OECD)	384.5	26.6	6.9	418.2	43.5	10.4
World	88.6	6.0	6.8	90.1	8.9	9.8
China	47.1	3.2	6.8	32.3	2.4	7.4
Latin America and the Caribbean	3.9	0.3	8.7	8.6	0.9	10.6

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of European Patent Office (EPO), Worldwide Patent Statistical Database (PATSTAT) [online] https://www.epo.org/searching-for-patents/business/patstat.html#tab-1.

Environmental innovations lead to increased competitiveness, which is measured by indicators such as cost reduction, increased quality, increased market share or access to new markets.[11] For example, the introduction of technologies to reduce the effects of increasingly frequent droughts would benefit agriculture. These innovations also contribute to the decoupling of growth from environmental degradation.

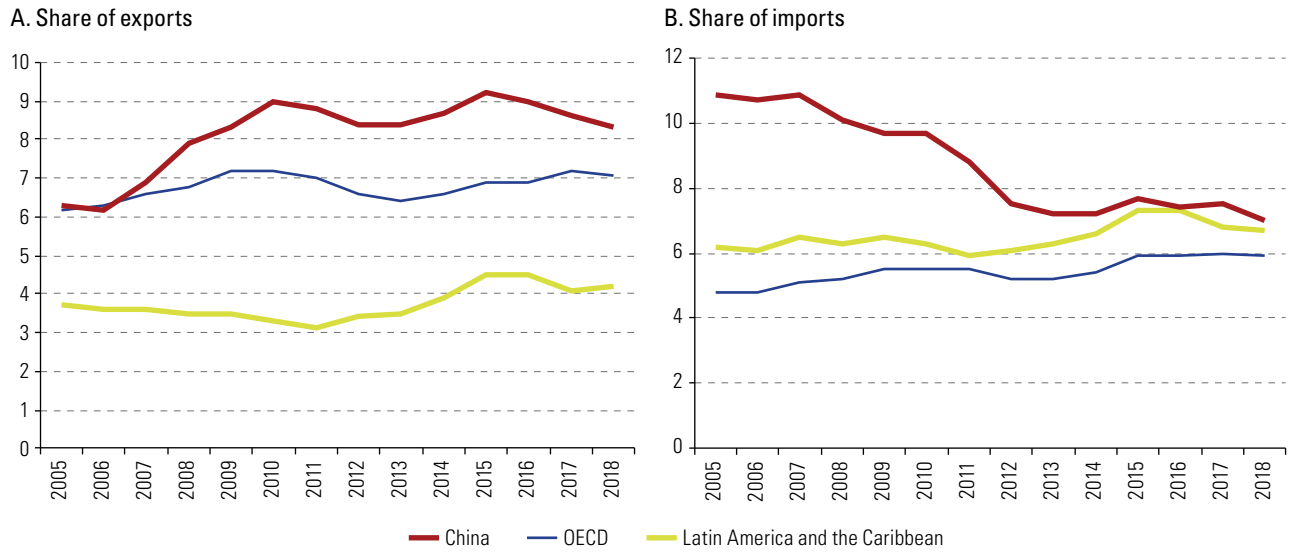
The development of environmentally friendly production sectors in the region requires greater capacity and competitiveness in these sectors. However, the weight of environmental goods[12] in the exports and imports of Latin American and Caribbean countries remained low from 2005–2018 (see figure I.15), and exports represented less than 60% of imports. In contrast with the region, which remains highly dependent on imports of environmental goods (traditionally originating from developed countries), China has gradually replaced these imports and developed its own productive capabilities, which have enabled it to become the world's leading exporter of some of these products, such as solar panels and wind turbines (see Prosser, 2019).

In short, if the region's true competitiveness is analysed in terms of changes in labour productivity, which would raise competitiveness, and changes in material and energy productivity, which would increase competitiveness and environmental sustainability, the trend is not auspicious. Investments in R&D by Latin America and the Caribbean and the number of patents registered by the region are both negligible, providing almost no stimulus for the productive sectors that could increase the proportion of environmental goods and services in the region's exports.

11 See, for example, Chiapetta Jabbour and others (2012).

12 Environmental goods are those that contribute to measuring, preventing, limiting, minimizing or correcting environmental damage to water, air and soil, and problems related to waste, noise and ecosystems (OECD/Eurostat cited in Steenblik, 2005; OECD, 2018).

Figure I.15
Latin America and the Caribbean (19 countries),[a] China and the Organization for Economic Cooperation and Development (OECD): share of environmental goods in total exports and imports of goods, 2005–2018
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of UN Comtrade Database [online] https://comtrade.un.org/.
[a] Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Plurinational State of Bolivia, Trinidad and Tobago, and Uruguay.

2. Equality: the pending challenge for Latin American and Caribbean development

The inequality of the region's societies is a hallmark on the world stage. Inequality in Latin America and the Caribbean, as measured by the Gini index, began to decline in 2004, but this fall slowed from 2014 onward. The simple average of the Gini indices for 15 countries in the region decreased from 0.537 in 2002 to 0.477 in 2014 and to 0.464 in 2018, an average annual decline of 0.9%. Between 2014 and 2018, however, the improvement in distribution slowed and the Gini index fell by just 0.6% per year on average. Social policies and more sustained growth in GDP and employment in the period contributed to reducing inequality. A minimum rate of growth exists that is needed to reduce inequality in a sustained manner, especially by expanding formal employment with rights.

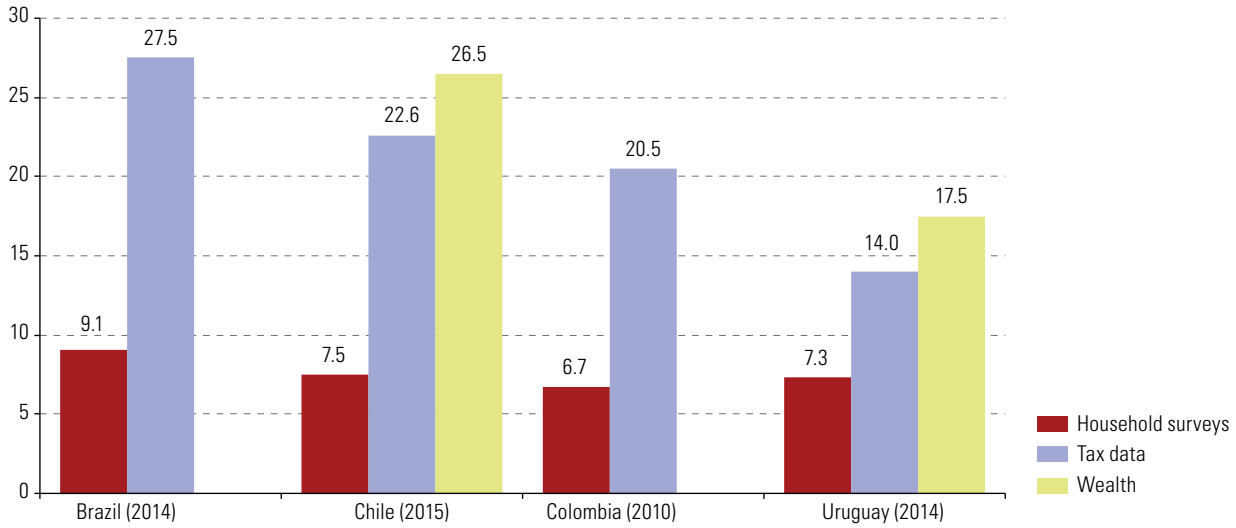
It is difficult to capture the income or wealth of the richest 1% in inequality estimates based on household surveys; therefore, inequality is underestimated. If information from tax records and financial surveys is included, the share of the richest 1% in income and wealth are shown to be much larger than estimated based on household surveys alone (ECLAC, 2019a) (see figure I.16).

To overcome this problem, measurements of inequality have incorporated tax data on the contribution to tax revenue of the 1% with the highest income.[13] Using that information, a corrected Gini index is calculated that includes the estimated share of the highest income percentile, following the proposal in Atkinson (2007) and Atkinson, Piketty and Saez (2011).[14] This adjustment results in a significant increase in the index, to around 0.60 for Brazil, Colombia and Mexico, 0.50 for Chile, and 0.42 for Argentina and Uruguay (see figure I.17).

[13] See Jiménez and Rossignolo (2019) for Argentina, Morgan (2017) for Brazil, Atria and others (2018) for Chile, Alvaredo and Londoño Vélez (2013) for Colombia, Del Castillo Negrete (2015) and Santaella, Leyva and Bustos (2017) for Mexico, and Burdín, Esponda and Vigorito (2014) for Uruguay.
[14] To implement this correction, the Gini index has been calculated for adults aged 20 years and over in percentiles 1 to 99 of the distribution, and has been corrected using the estimated share of the highest income percentile.

The results of application of the new methodology suggest that a 1% annual reduction in the Gini index would be consistent with the region's past achievement in this regard as measured by the conventional Gini index, but would be very ambitious when the historical trend is viewed in the corrected Gini index.

Figure I.16
Latin America (4 countries): share of the richest 1% in total income and wealth, latest available year[a]
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Social Panorama of Latin America*, 2019 (LC/PUB.2019/22-P/Rev.1), Santiago, 2019, on the basis of World Inequality Lab.

[a] Corresponds to the share of net domestic income, before taxes, including retirement income but excluding cash transfers of any other kind. The data on net wealth (assets minus liabilities) refer to 2017 in the case of Chile, and 2013/14 in the case of Uruguay.

Figure I.17
Latin America (6 countries): Gini indices for the total population, adults aged 20 years and over (percentiles 1 to 99) and adults aged 20 and over, corrected, 2000–2017

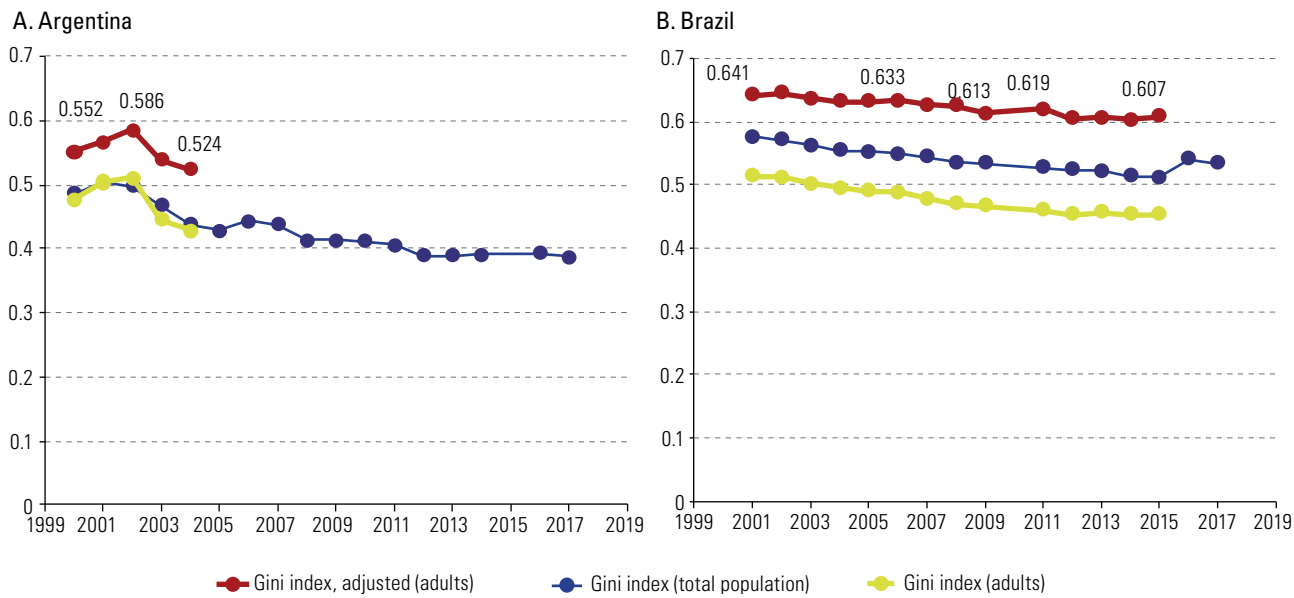
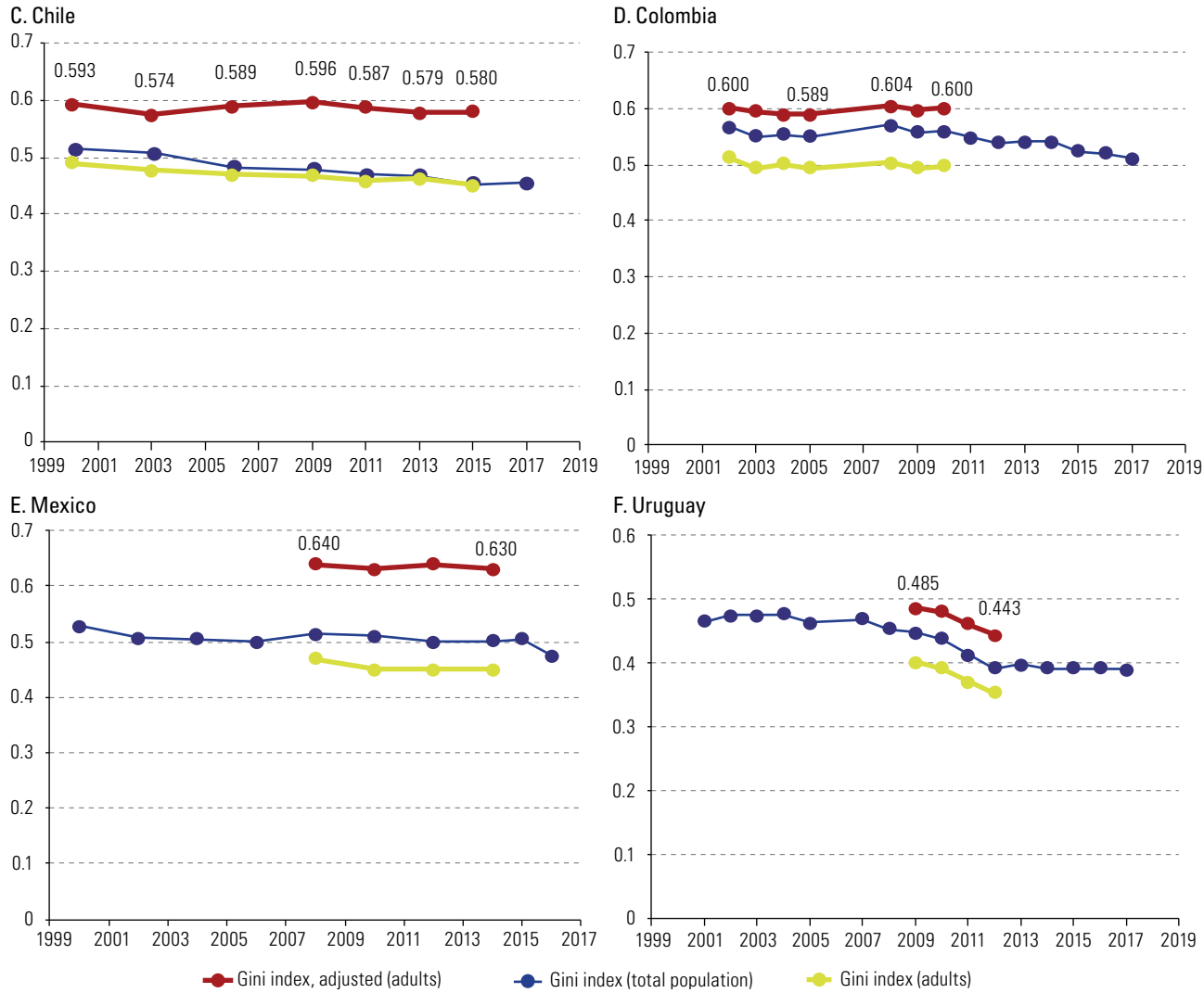


Figure I.17 (concluded)

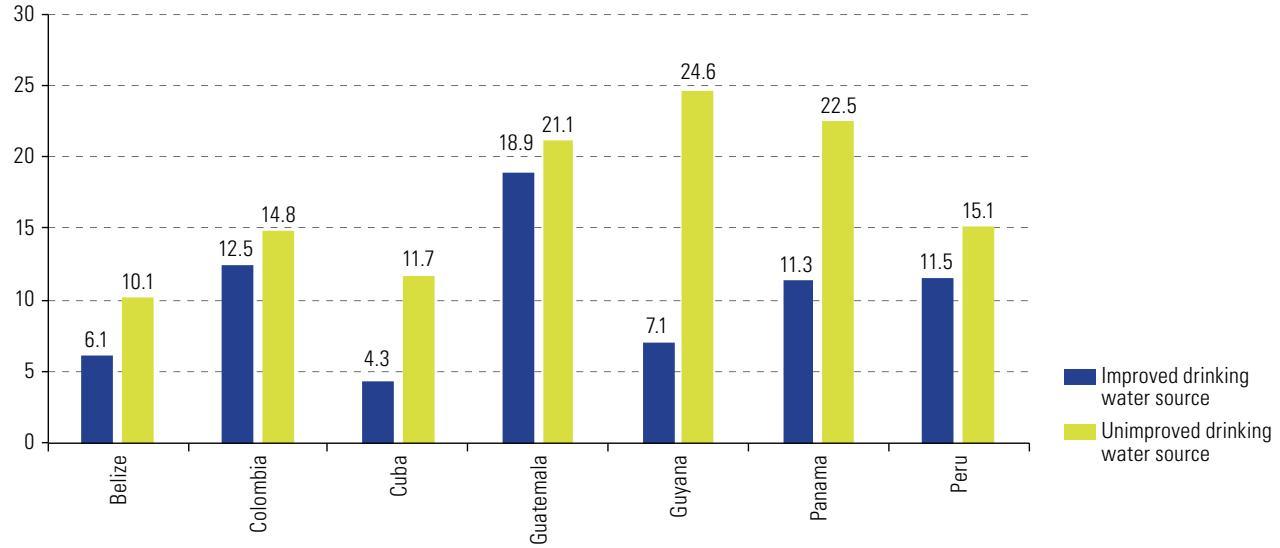


Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Household Survey Data Bank (BADEHOG); World Inequality Lab, and J. Santaella, Leyva and A. Bustos, "¿Quién se lleva los frutos del éxito en México?:una discusión sobre la verdadera distribución del ingreso", *Nexos*, 28 August 2017 [online] https://www.nexos.com.mx/?p=33425

In Latin American cities, inequality takes the form of a lack of access to certain basic services such as drinking water, sanitation, housing or mobility. Slums or precarious human settlements, in which one out of every five urban dwellers lives, are both a physical and spatial manifestation of inequality and a factor that reproduces it, because they limit labour potential and social inclusion (UN-Habitat/CAF, 2014). Moreover, 7% of the population lives in areas without urban waste collection services, and much of this waste is not deposited in appropriate locations, creating health risks and environmental effects (ECLAC, 2019d).

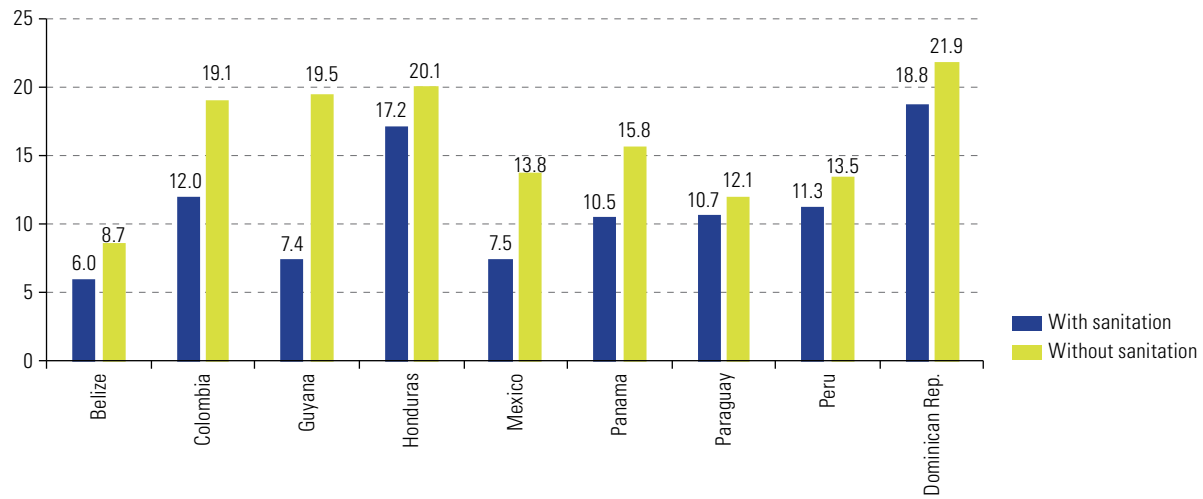
Access to safe drinking water and sanitation is essential for the building of human capabilities, as it promotes health and good nutrition, improves children's school attendance, and fosters productivity among adults. This factor is particularly important given the impact of the pandemic and the importance of access to water to prevent infection. Gaps in access also have a qualitative dimension: in low-income households, access to drinking water is often provided through means such as wells, delivery trucks, a public pool or a water standpipe located some distance from the household, which do not guarantee levels of quality and safety comparable to those enjoyed by higher-income households. Access may also be intermittent and vulnerable to disruption (for example, owing to drought), quality controls on supplied water are limited, and it is not always properly disinfected (ECLAC, 2018). The lack of quality sanitation and water sources is associated with a higher prevalence of diseases, such as diarrhoea in children under age five, which are risk factors in terms of chronic undernutrition and child mortality (see figures I.18 and I.19).

Figure I.18
Latin America and the Caribbean (7 countries): diarrhoea in children under five by water source, 2011–2015
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of special processing of Demographic and Health Surveys (DHS) for Colombia (2015), Guatemala (2014–2015) and Peru (2013), and Multiple Indicator Cluster Surveys (MICS) for Belize (2011), Cuba (2014), Guyana (2014) and Panama (2013).

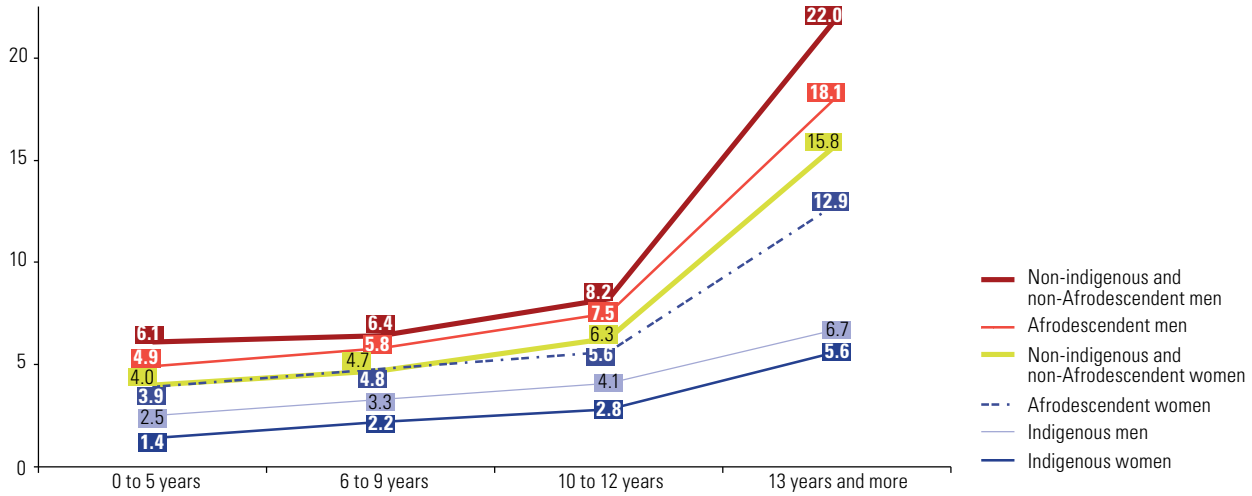
Figure I.19
Latin America and the Caribbean (9 countries): diarrhoea in children under five by type of household sanitation, 2011–2015
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of special processing of Demographic and Health Surveys (DHS) for Colombia (2015), Honduras (2011–2012) and Peru (2013), and Multiple Indicator Cluster Surveys (MICS) for the Dominican Republic (2014), Guyana (2014) and Panama (2013).

Income inequalities interconnect with gender, ethnic, racial and territorial inequalities and with those connected to the different stages of the life cycle. Women, indigenous people and Afrodescendants —above all indigenous women and Afrodescendent women— receive significantly lower wages than non-indigenous or non-Afrodescendent men with the same level of education (see figure I.20).

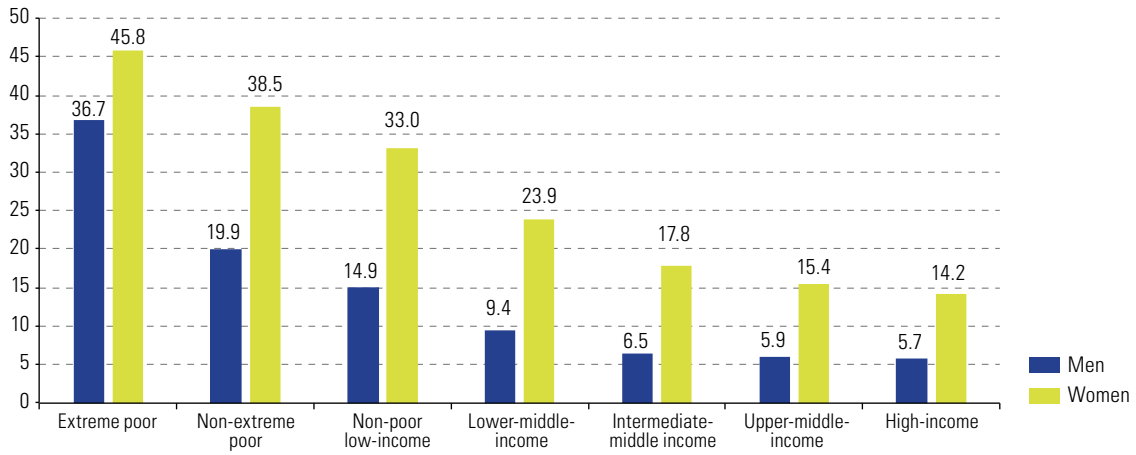
Figure I.20
Latin America (weighted average for 4 countries):[a] hourly income of the employed population aged 15 years or older, by years of schooling, sex and ethnicity or race, around 2017
(International dollars)[b]



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Women's autonomy in changing economic scenarios* (LC/CRM.14/3), Santiago, 2019.
[a] The countries examined are Brazil, Ecuador, Peru and Uruguay.
[b] Calculations are based on the implied purchasing power parity (PPP) conversion rate, which indicates the relation between local currencies and the international dollar, as published in 2019 by the International Monetary Fund (IMF).

Around 2017, a weighted average of 28.1% of women in the region had no income of their own, and thus depended entirely on others for subsistence; this compares to 13.2% for men. These averages mask the differences between the various income strata, since the percentages are very high among those living in poverty and extreme poverty (see figure I.21).

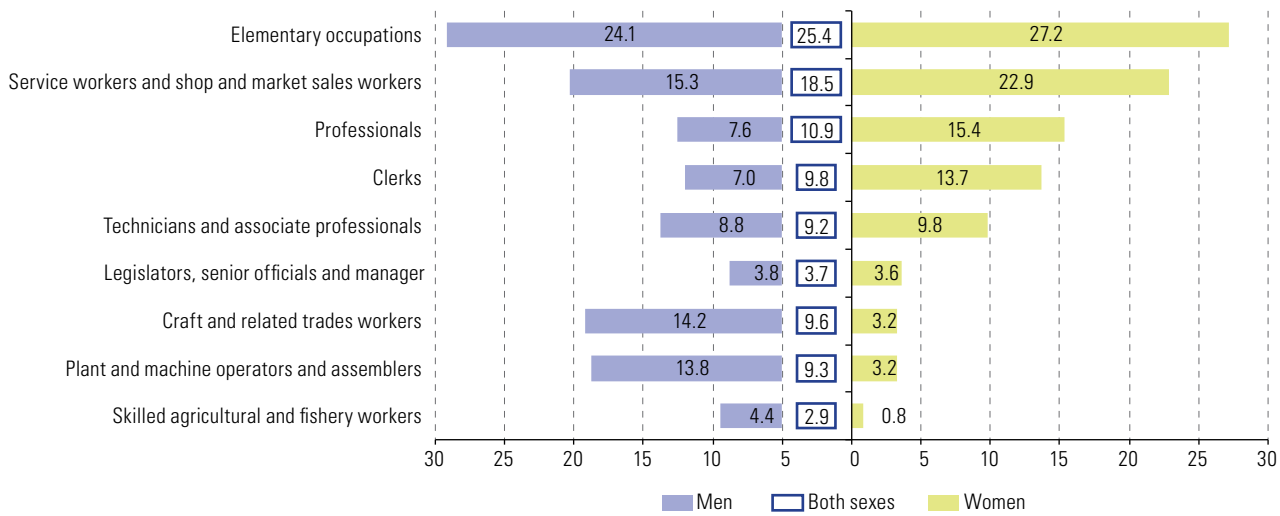
Figure I.21
Latin America (18 countries)[a]: population without own income by sex and per capita income stratum, around 2017
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Household Survey Data Bank (BADEHOG).
[a] Includes all Latin American countries, except Cuba and Haiti.

The sexual division of labour is also expressed in the labour market through occupational gender segregation, in two ways: a high concentration of women in professions and occupations that require fewer qualifications, and lower pay in occupations where women are relatively more numerous. Over half of all women are employed in jobs that require limited formal training, in elementary occupations, as sales workers or in other services (see figure I.22). For men, the diversification between occupational categories is greater. Women are overrepresented among domestic workers (10.6%) and unpaid family workers (6%), which are the lowest paid and most vulnerable employment categories (ECLAC, 2019c). The gender wage gap in the region reinforces socioeconomic and gender inequality; on average, women earn 16.1% less than men in the same occupations (ECLAC, 2019c).

Figure I.22
Latin America (16 countries): distribution of the working population by type of occupation and sex, weighted averages around 2017[a b]
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Household Survey Data Bank (BADEHOG).
[a] The data refer to 2017, unless a different year is indicated. The countries included are: Argentina, Brazil, Chile, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala (2014), Honduras (2016), Mexico (2016), Nicaragua (2014), Panama, Peru, Paraguay, the Plurinational State of Bolivia and Uruguay.
[b] The occupations were aligned the 1988 International Standard Classification of Occupations (ISCO-88).

Over the past decade, the middle-income strata of the Latin American social structure have expanded. However, most of this growth occurred in the low- and lower-middle income strata, where households are highly vulnerable to negative shocks and can easily fall back into poverty. In 2019, 77% of the population of Latin America and the Caribbean belonged to low- or lower-middle income groups (per capita income of less than three times the poverty line), with no savings to withstand a crisis. In addition to this vulnerability, 53.1% of workers in Latin America and the Caribbean were informal in 2016 (ILO, 2018).[15] This informality affected women (54.3%) more than men (52.3%), especially in Central America.

The foregoing discussion lays out the reasons why the impact of the pandemic is asymmetric in terms of the various dimensions of inequality in Latin America and the Caribbean. The Gini index could rise by between 1.1% and 7.8%. As noted earlier, although the region is mainly composed of middle-income countries, pronounced inequality means that distribution is highly skewed within each country. They are middle-income countries in which the middle-income strata constitute a very vulnerable portion of the total population. Many people who are now included in middle-income strata will be pushed back into poverty by loss of income owing to the pandemic.

[15] By subregion, the highest percentages of informal employment are found in Central America, with 58.0%, and in the Caribbean, with 57.6%. At the country level, informal employment ranges from 24.5% in Uruguay to 83.1% in the Plurinational State of Bolivia (ILO, 2018).

Vulnerable segments of the population and those working in the informal sector are being hit hardest by the COVID-19 crisis. The sharp drop in economic activity is expected to drive the unemployment rate up from 8.1% in 2019 to 13.5% in 2020. In addition, the poverty rate is expected to rise by 7 percentage points in 2020, to 37.3%, while extreme poverty is expected to rise by 4.5 percentage points, from 11.0% to 15.5%, an increase of 28.5 million people in extreme poverty. What is more, the number of people experiencing acute food insecurity could increase by 11.7 million to 16 million. In this regard, the most critical situations are expected to occur in Haiti and the Central American Dry Corridor.

Indigenous persons and Afrodescendants, who constitute 9.3% and 21% of the population of Latin America and the Caribbean, respectively, will suffer a proportionally greater impact, as they have less social security coverage and are subject to discrimination in the labour market. Moreover, indigenous populations often live in remote areas without access to health services or basic sanitation.

While the pandemic has affected children and young people less in terms of health, 171 million students have had to stay home because of the suspension of classes. It is not yet known how the school year will proceed, but as not all students have the same ease of access to connectivity and equipment at home, the pandemic may deepen inequalities in access to education. There is an extremely high risk that learning and skills will be lost, and that this will affect the future integration of young people into the labour market.

Socioeconomically, the pandemic will affect women more, as they are overrepresented in informal work, own-account work and the service sector. The service sector in particular provides work to 78% of employed women and is made up of transport, commerce, business services and social services. Women are at the front line of the health sector (accounting for 72.8% of those employed), but their income is 25% lower than men employed in the same sector. Lockdowns, school closures and sick family members have placed additional pressure on women as primary caregivers. Domestic violence, femicide and other forms of sexual and gender-based violence have increased. Calls received by emergency helplines for women in Chile and Mexico, for instance, have increased by more than 50%.

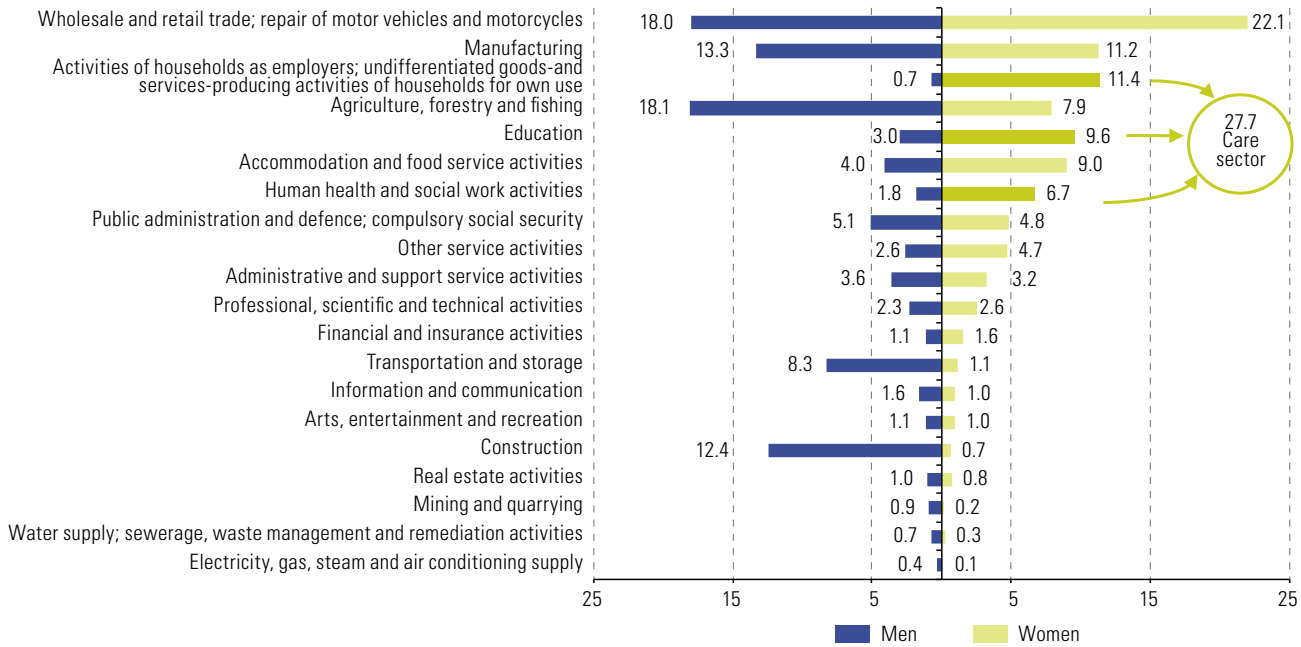
Despite the importance of care in sustaining life, in traditional economic theory it is not considered part of the economic system and its contribution to the economy and society is invisible (Carrasco, 2003). One contribution of feminist economics is to link the economic system with social organization of care, as a space of goods, services, activities, relations and values associated with the most basic and important needs for societal existence and reproduction (Montaño and Calderón, 2010, cited in ECLAC, 2019b).

The care economy comprises all unpaid work within households and paid care work in the labour market. The distribution of tasks associated with the care economy reflects an unfair social organization: women are overrepresented in care-related jobs and in unpaid care work, which is a product of the rigid sexual division of labour (see figure I.23). The naturalization of the idea that care activities are women's obligation makes it difficult for these tasks to be recognized as work and affects those who carry them out. Because it is undervalued, domestic and care work is not taken into account. Therefore, economies have been organized on the assumption that there is, and always will be, "an invisible hand" that supports social reproduction.

In the region, those aged 60 years or over are expected to outnumber children and adolescents under the age of 15 for the first time by around 2037, and their number will continue to rise until 2090 (United Nations, 2019). Population ageing and declining fertility rates will continue to change the age distribution of those needing care, which will shift from the child population to the older population (ECLAC, 2019b). This will have a major impact on the magnitude and composition of demand for care, and on the resulting demand for labour (Simonazzi, 2008). Moreover, the shrinking of the working-age population will reduce the number of potential caregivers relative to those needing care. In the balance between care supply and demand, women will continue to be affected the most, because they are the main caregivers. With these demographic changes and without adequate public policies, gender inequalities could increase and the care crisis could worsen.

In short, equality, poverty reduction, the fight against discrimination, and improvements in education and labour indicators for both women and men —in order to reduce income gaps— form the economic and social foundations of a democratic society. The pandemic has afforded a much clearer view of the rifts in Latin American and Caribbean societies and the vulnerability of most of the population to all kinds of shocks. In the response to the crisis and in the process of rebuilding economies, these rifts must be repaired, and more egalitarian and resilient societies must be pursued.

Figure I.23
Latin America (weighted averages of 16 countries):[a] distribution of the employed population by sector of economic activity, around 2017[b]
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Women's autonomy in changing economic scenarios* (LC/CRM.14/3), Santiago, 2019.
[a] Weighted average for the following countries: Argentina, Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, Plurinational State of Bolivia and Uruguay.
[b] Data refer to 2017, except in the case of Honduras and Mexico, for which they refer to 2016, and in the case of the Bolivarian Republic of Venezuela, Guatemala and Nicaragua, for which they refer to 2014.

3. The environmental balance: climate change and the degradation of natural heritage

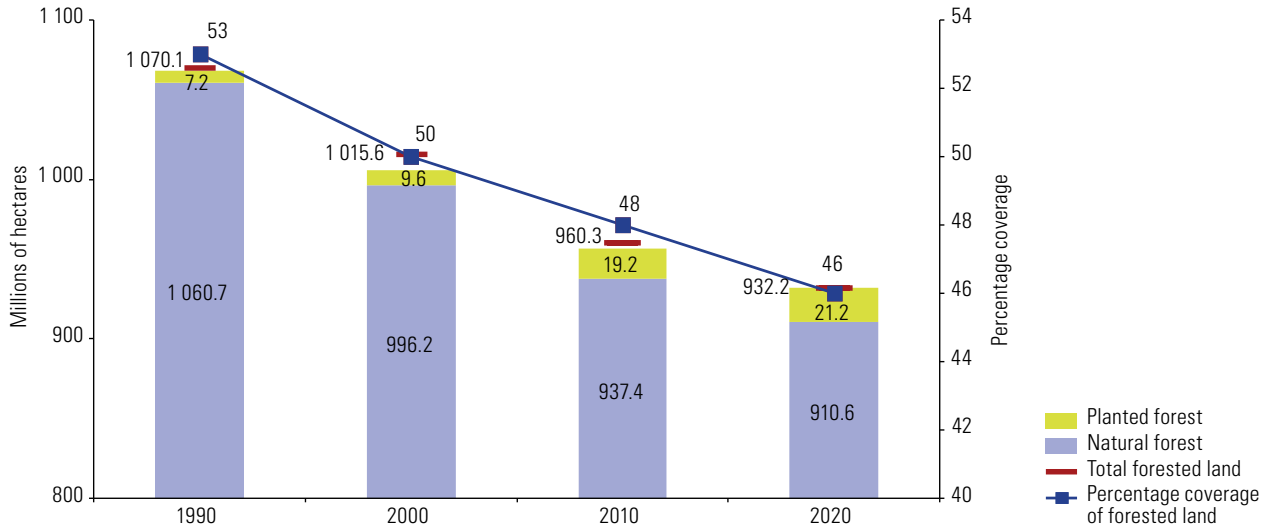
The global environmental crisis is also having repercussions in Latin America and the Caribbean. Firstly, there is a severe deterioration in natural resources. Secondly, even though the region is responsible for a relatively small share of global emissions, it is greatly affected by climate change. These two dimensions of the environmental crisis in the region are examined below.

(a) Forest and land degradation

Forests must be managed sustainably to fulfil their economic and environmental functions. Three quarters of the globe's accessible freshwater comes from forested watersheds, but 40% of the world's 230 major watersheds have lost more than half of their original tree cover (FAO, 2018). By 2015, one quarter of forested land was managed with the aim of conserving soil or water. For example, the cloud forests of La Tigra National Park in Honduras provide more than 40% of the water that reaches Tegucigalpa, and 80% of the population of Quito receives drinking water from two protected areas (United Nations, 2017).

The progressive loss of forest cover is also a threat to the economy. From 2001 to 2018, 361 million hectares of forest cover were lost worldwide; this was a 9% decline in coverage from the 2000 level (WRI, 2019). Between 1990 and 2015, 104 million hectares of natural forest were lost in Latin America and the Caribbean and the area of planted forest doubled. Overall, forest cover fell by 5%, which is more than the area of the Bolivarian Republic of Venezuela (see figure I.24).

Figure I. 24
Latin America and the Caribbean: area of natural and planted forest, and proportion of total forest area, 1990–2020
(Millions of hectares and percentage coverage)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Food and Agriculture Organization of the United Nations (FAO), *Global Forest Resources Assessment 2020*, Rome, 2020.

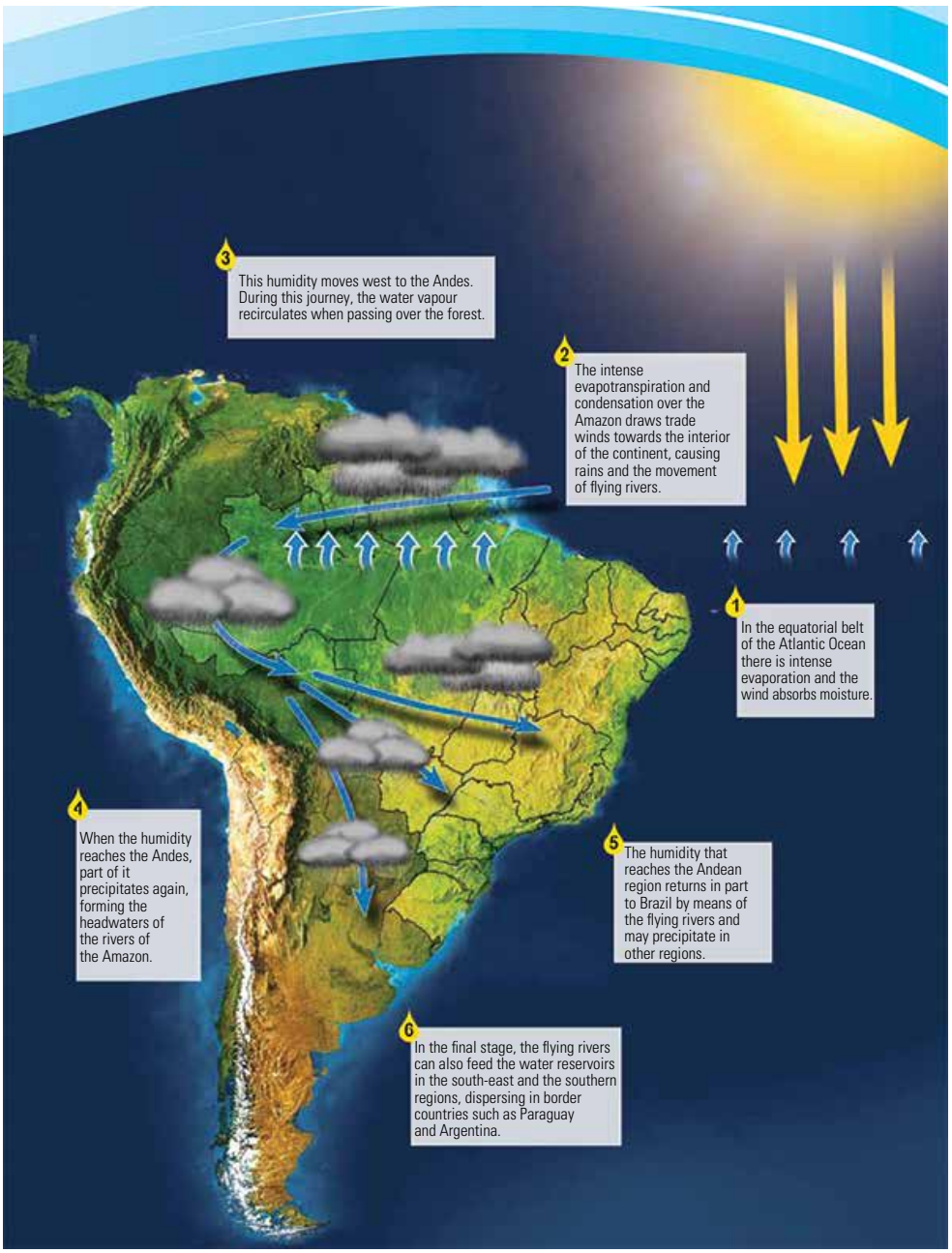
The loss of tropical and subtropical forests has a major impact on hydrology, as forests play a key role in transporting atmospheric moisture and provide a global circulation system that influences cloud cover and rainfall on a regional scale. In the Amazon Basin this effect is called "flying rivers". Over 70% of the rainfall in the River Plate Basin originates in the Amazon rainforest (Van der Ent and others, 2010). Therefore, the decline in the flying rivers could have a devastating effect on the South American economy (see map I.1).[16]

Deforestation, climate change and the widespread use of fire to clear new farming areas could push the Amazon forest system over a tipping point and into a state of collapse (savannization). This point could be reached once deforestation has affected between 20% and 25% of the biome; today, it has already affected 20% (Lovejoy and Nobre, 2018). This is a threat to the functioning of flying rivers and the socioeconomic systems they support.

In the Brazilian Amazon, the area deforested per year decreased significantly between 2004 and 2012 (INPE, 2019a and 2019b); however, since 2012 deforestation has accelerated, reaching 9,762 km^2 in 2019. Another area of concern in terms of deforestation is the Gran Chaco, the second largest ecosystem by surface area after the Amazon and the largest dry forest in South America. It is very biodiverse and covers more than 1 million km^2, extending into Argentina, Brazil, Paraguay and the Plurinational State of Bolivia. From 2000 to 2012, the Argentine, Paraguayan and Bolivian areas of the Gran Chaco recorded the fastest rate of tropical forest loss in the world, which reached 19.73 km2 per day in August 2013 (Hansen and others, 2013). This problem occurred especially in Paraguay (Cardozo and others, 2014). From 2012 to July 2018, the use of some 29,250 km^2 of land in the Gran Chaco changed owing to deforestation (Arévalos and others, 2018).

[16] The volume of water carried by the flying rivers from the Amazon corresponds to more than 200,000 tons of steam per second, equivalent to the volume of water that the Amazon River discharges into the Atlantic Ocean (Fearnside, 2019).

Map I.1
South America: evapotranspiration from the Amazon that feeds the subregion's economy, the path of the flying rivers

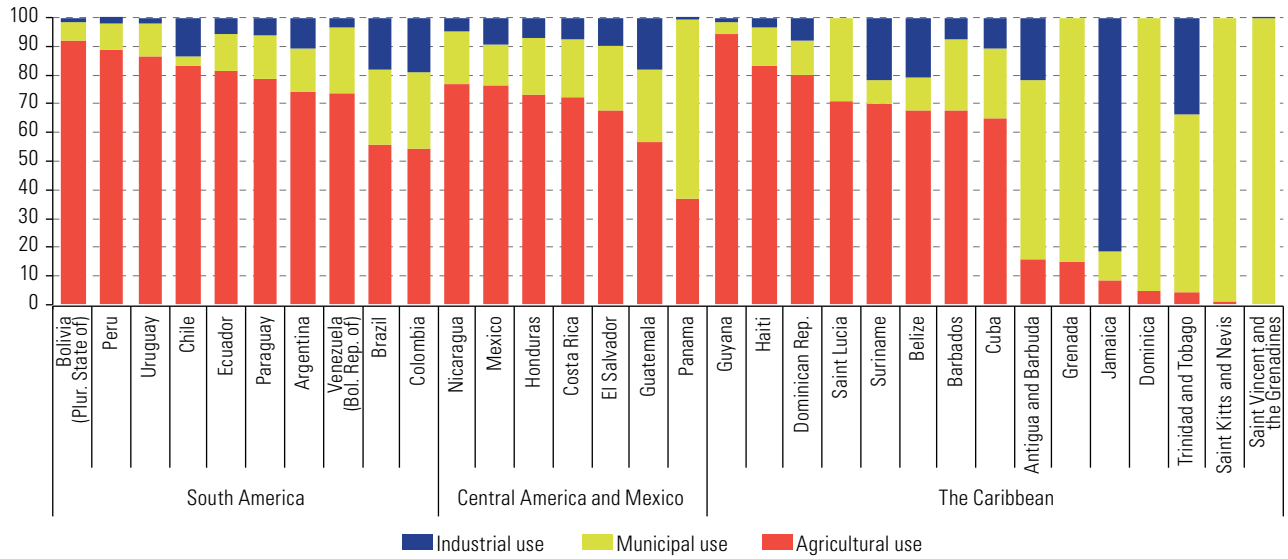


Source: Petrobras/Government of Brazil, "The flying rivers phenomenon" [online] https:// http://riosvoadores.com.br/english/the-flying-rivers-phenomenon/.

(b) The vulnerability of water resources

In Latin America and the Caribbean, water is available in abundant quantities, but it is distributed heterogeneously among and within countries. More than 60% to 70% of water is used for agriculture; municipal purposes are the second most common use. In the small island States of the Caribbean, priority is given to municipal uses because of the low total supply of water (see figure I.25).

Figure I.25
Latin America and the Caribbean (32 countries): water uses as a proportion of total extraction, 2000–2017
(Percentages)



Source: Food and Agriculture Organization of the United Nations (FAO), Information System on Water and Agriculture (AQUASTAT) [online] http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en and "Water withdrawal by sector" [online] http://www.fao.org/nr/water/aquastat/countries_regions/americas/table08.pdf.

Water resources are also at risk: in 2010, around a quarter of river sections were affected by severe pathogen contamination, and monthly concentrations of faecal coliform bacteria in the stream flow exceeded 1,000 colony-forming units (CFU) per 100 millilitres (an increase of almost two thirds since 1990). The main source of this contamination was domestic wastewater from sewers, a result of insufficient capacity to treat wastewater. About one tenth of river sections had severe or moderate saline contamination, caused by unsuitable irrigation practices. The largest lakes are polluted by anthropogenic phosphorus, mainly originating from livestock waste and inorganic fertilizers.

In the Andean region, the surface area of glaciers is decreasing, and several have already disappeared (WGMS, 2018), affecting large urban and rural areas. Climate change and ineffective management are leading to the loss of strategic freshwater reserves (see figure I.26).

The region's economic vulnerability is also related to high dependence of production processes on water from rainfall (green water). Many countries depend on water that is not stored in reservoirs, so its availability is uncertain.

Figure I.26
Latin America (7 countries): shrinking area of glaciers, various years
(Water equivalent millimetres)

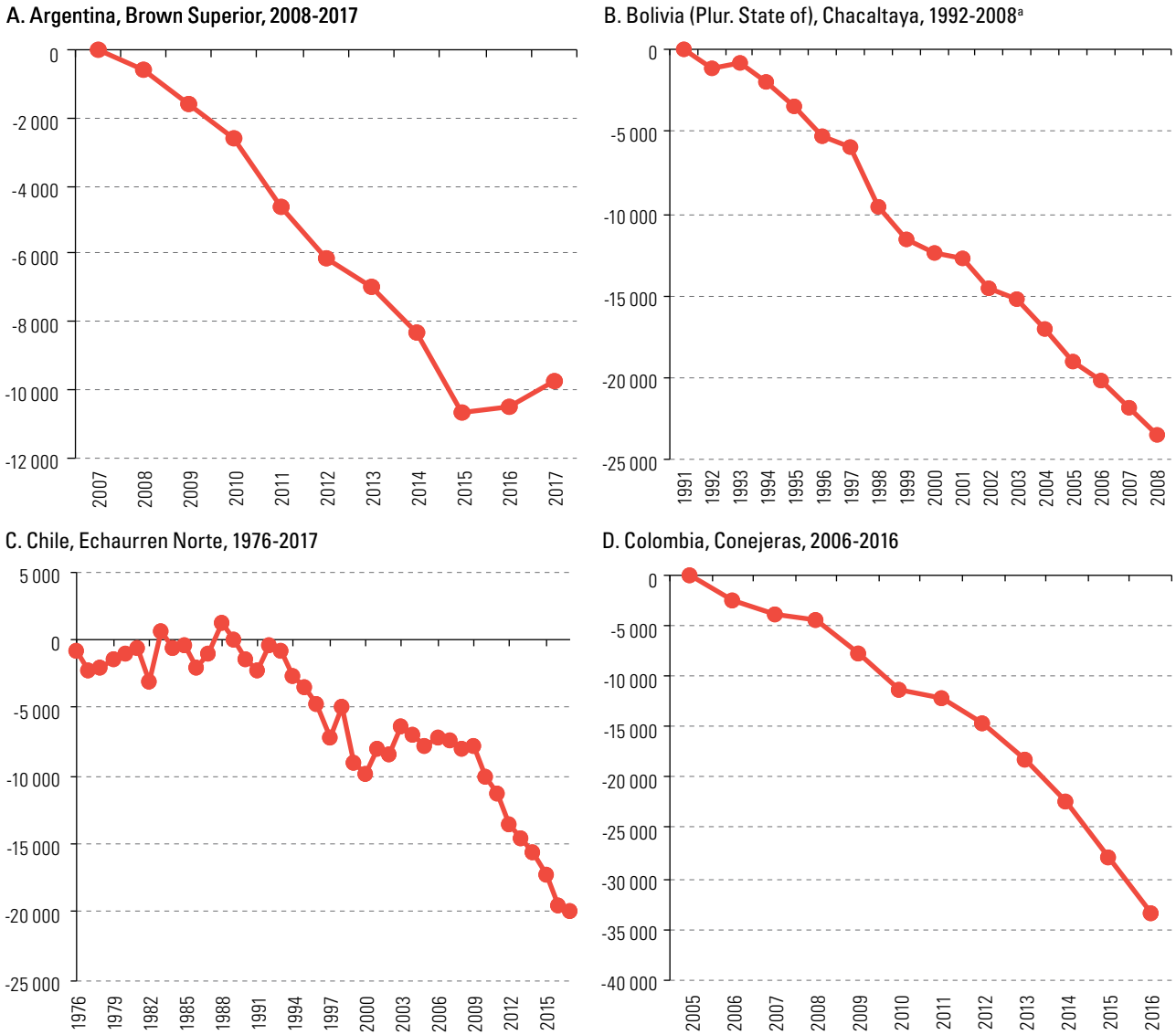
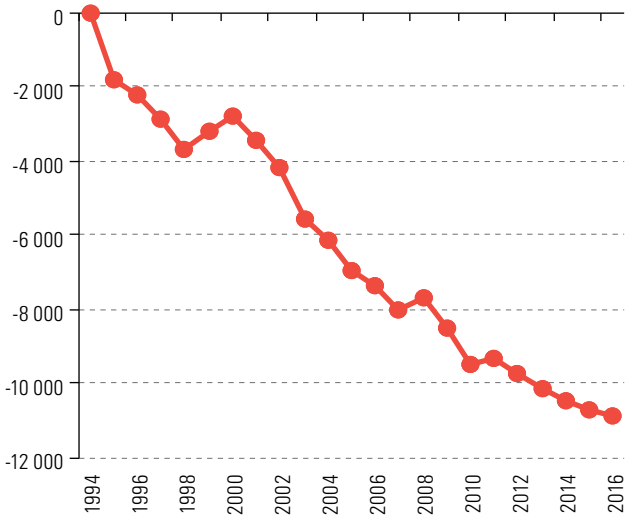
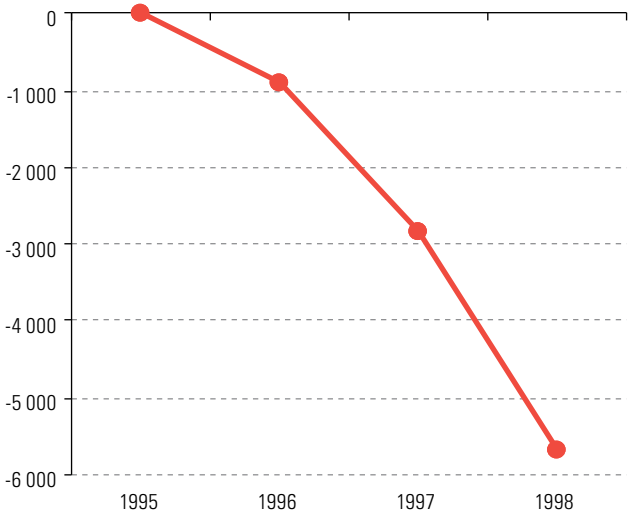


Figure I.26 (concluded)

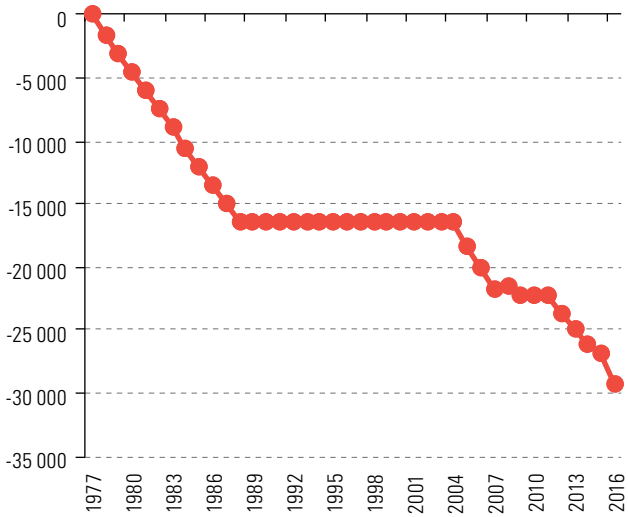
E. Ecuador, Antisana 15 Alpha, 1995–2015[b]



F. Mexico, Ventorrillo, 1996-1998[c]



G. Peru, Yanamarey, 1978-2016[d]

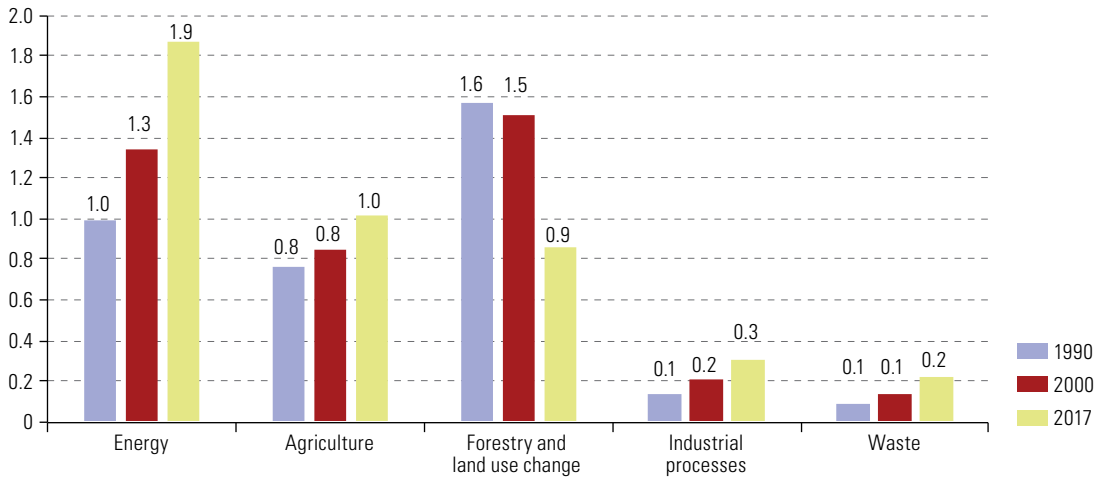


Source: World Glacier Monitoring Service (WGMS), Fluctuations of Glaciers (FoG) Database, Zurich, 2018 [online] http://dx.doi.org/10.5904/wgms-fog-2018-11.
Note: Declarations of extinction were compiled from press articles, as there are no government records of these extinctions.
[a] Declared extinct in 2009.
[b] Shrinking by approximately 25 metres per year.
[c] Declared extinct in 2005.
[d] Since 1942, 78.5% of this glacier's area has melted.

(c) The region's share of global emissions

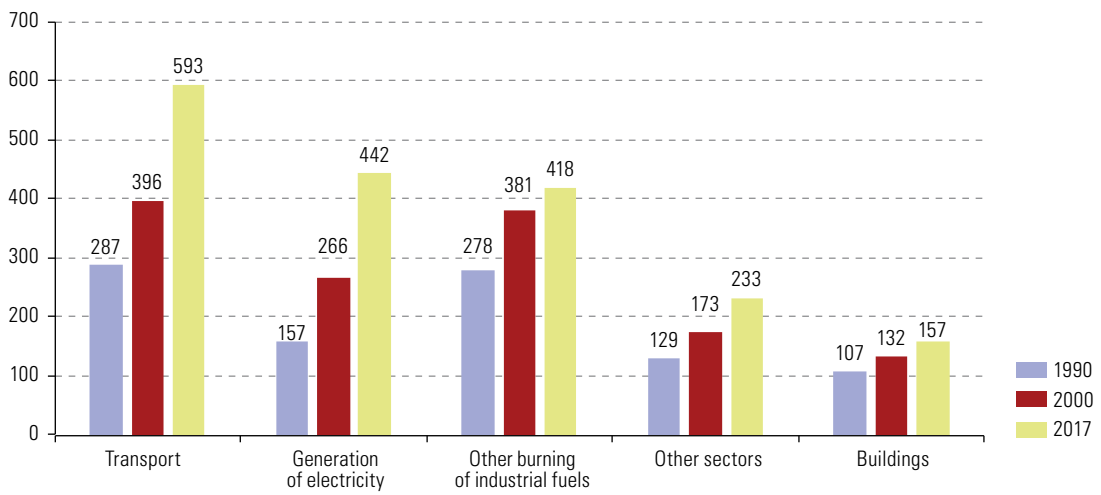
In 2017, just over 8% of global greenhouse gas (GHG) emissions were generated in Latin America and the Caribbean: 4.3 out of 51 gigatons of CO_2 equivalent. In the region, emissions have increased in all sectors except land use change (see figure I.27). Energy was the sector with the largest volume of emissions and the largest increase: within energy, transport produced the most emissions (see figure I.28).

Figure I.27
Latin America and the Caribbean: greenhouse gas (GHG) emissions, by sector, 1990, 2000 and 2017
(Gigatons of CO_2 equivalent)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of J. Gütschow and others, "The PRIMAP-hist national historical emissions time series (1850–2017)", German Research Centre for Geosciences (GFZ), GFZ Data Services, 2019 [online] http://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:4736895; and M. Crippa and others, *Fossil CO_2 and GHG emissions of all world countries - 2019 Report* (EUR 29849 EN), Luxembourg, Publications Office of the European Union, 2019.

Figure I.28
Latin America and the Caribbean: CO_2 emissions of the energy sector, 1990, 2000 and 2017
(Megatons of CO_2)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of J. Gütschow and others, "The PRIMAP-hist national historical emissions time series (1850–2017)", German Research Centre for Geosciences (GFZ), GFZ Data Services, 2019 [online] http://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:4736895; and M. Crippa and others, *Fossil CO_2 and GHG emissions of all world countries - 2019 Report* (EUR 29849 EN), Luxembourg, Publications Office of the European Union, 2019.

The proportion of renewable energy sources in the region's electricity generation matrix is much higher than for the world as a whole (56% and 23%, respectively). Of the total generated using renewable energies, 83% is from hydropower. Despite this positive point, a significant proportion of fossil fuels in the primary matrix are used to generate electricity. Moreover, this situation has been exacerbated in recent decades by a decline in the share of hydropower, partly owing to climatic events, resulting in increased use of natural gas and coal.

The transport sector is one of the largest energy consumers (around 38% of the total), and 99% of the energy used for this purpose comes from fossil fuels. This poses a major regional energy transition challenge: it is essential to shift towards sustainable transport based on renewable technologies, such as electricity and hydrogen from renewable sources.

(d) Population dynamics and carbon dioxide emissions

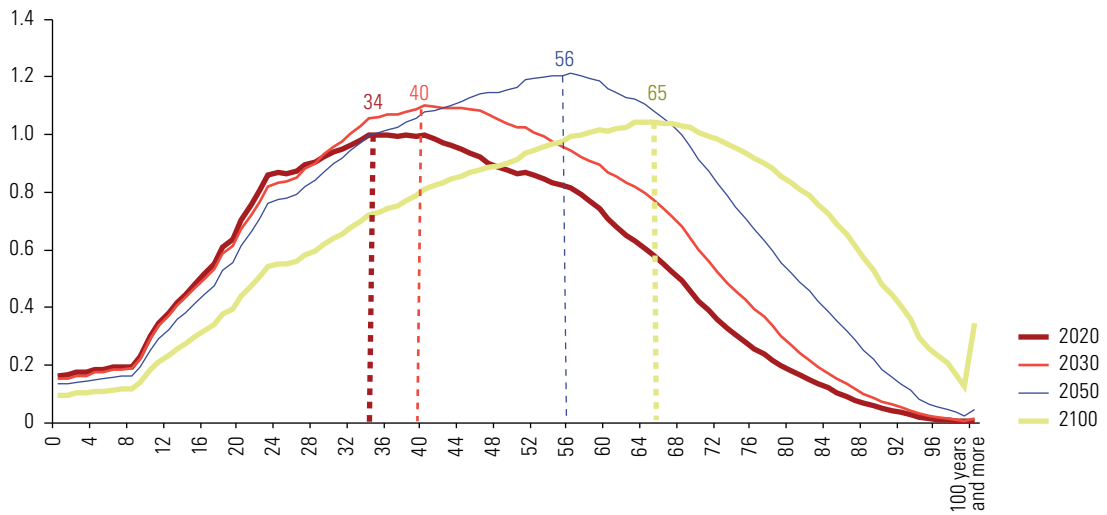
Unprecedented demographic changes are occurring in Latin American and Caribbean countries. Although the demographic transition is more advanced in some countries than in others, the region's population is growing increasingly slowly but ageing at an unprecedented rate. While the total population of the region is set to decline in absolute terms from 2059 onward, the older persons age group will continue to expand at least until the end of the century (United Nations, 2019).

The demographic transition is expected to lead to an initial increase in emissions owing to population growth and concentration in the age groups that emit the most (middle adulthood). Subsequently, emissions are projected to decline as the population stops growing and even shrinks slightly, with concentration in age groups that emit less (older persons).[17] On that basis, it is estimated that the peak in CO_2 emissions will be reached in the 2060s, when emissions could be as much as 32%–35% higher than in 2020. A decline is then projected, with a result of 18% to 23% more emissions in 2100 than in the base year (Zagheni, 2011; United Nations, 2019).

The effect of ageing alone, calculated as the difference between total emissions and emissions caused by population growth, is projected to prolong the upward trend in emissions and slightly slow the downward trend from the 2060s onward. It is only towards the end of the century that both factors (population decline and ageing) will likely contribute to a reduction in total emissions.

Figure I.29 presents a forecast of total CO_2 emissions by age cohort. The age of the group generating the most emissions is predicted to rise from 34 years in 2020 to 56 years in just three decades, and to continue to rise to 65 years in 2100. In line with population growth, the volume of emissions from these age groups is estimated to rise by 21% from 2020 to 2050. A decline is then expected, resulting in a level that is 4.5% higher in 2100 than in 2020.

Figure I.29
Latin America and the Caribbean: total CO_2 emissions by age cohort, 2020–2100
(Relative values, maximum 2020=1)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E. Zagheni, "The leverage of demographic dynamics on carbon dioxide emissions: does age structure matter?", *Demography*, vol. 48, No. 1, 2011, and United Nations, *Review and appraisal of the Beijing Declaration and Platform for Action and the outcomes of the twenty-third special session of the General Assembly. Report of the Secretary-General* (E/CN.6/2020/3), New York, 2019.

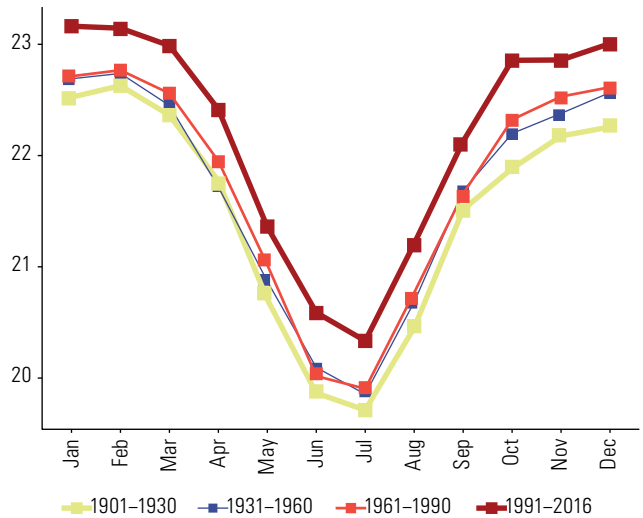
[17] The methodology used has limitations. Firstly, the age profiles of per capita emissions in the United States have been used. Secondly, as it is assumed that the profiles are constant over time, expected effects over the course of the century are not captured, such as technological change or changing consumption patterns. However, even if absolute values vary and profiles change over time, the overall pattern of CO_2 emissions in an individual's life cycle is expected to be similar: a trend of rises, stabilization in middle adulthood and then gradual declines.

(e) The double asymmetry in Latin America and the Caribbean: the impact of climate change

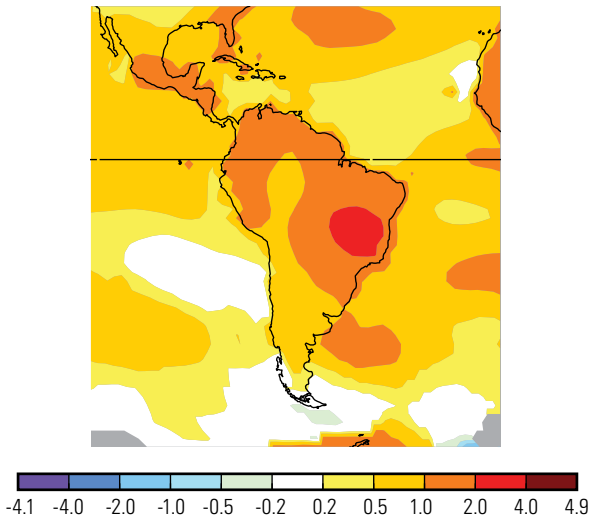
In Latin America and the Caribbean, climate change has physical, environmental, social and economic consequences. In the region, the average temperature is following an upward trend (see figure I.30), as it is globally. Over the past decade, the temperature increased with an average anomaly of 0.7°C (IPCC, 2013; Magrin and others, 2007). In 2019, average temperatures in much of the region were at least one degree higher than the averages seen between 1951 and 1980, and were more than two degrees higher in some regions of Brazil.

Figure I.30
Latin America and the Caribbean: average temperature of different periods and temperature anomalies, 1901–2019
(Degrees centigrade)

A. Average temperature, 1901–2016



B. Anomalies in the combined land and ocean surface temperature relative to the period 1951–1980, 2019

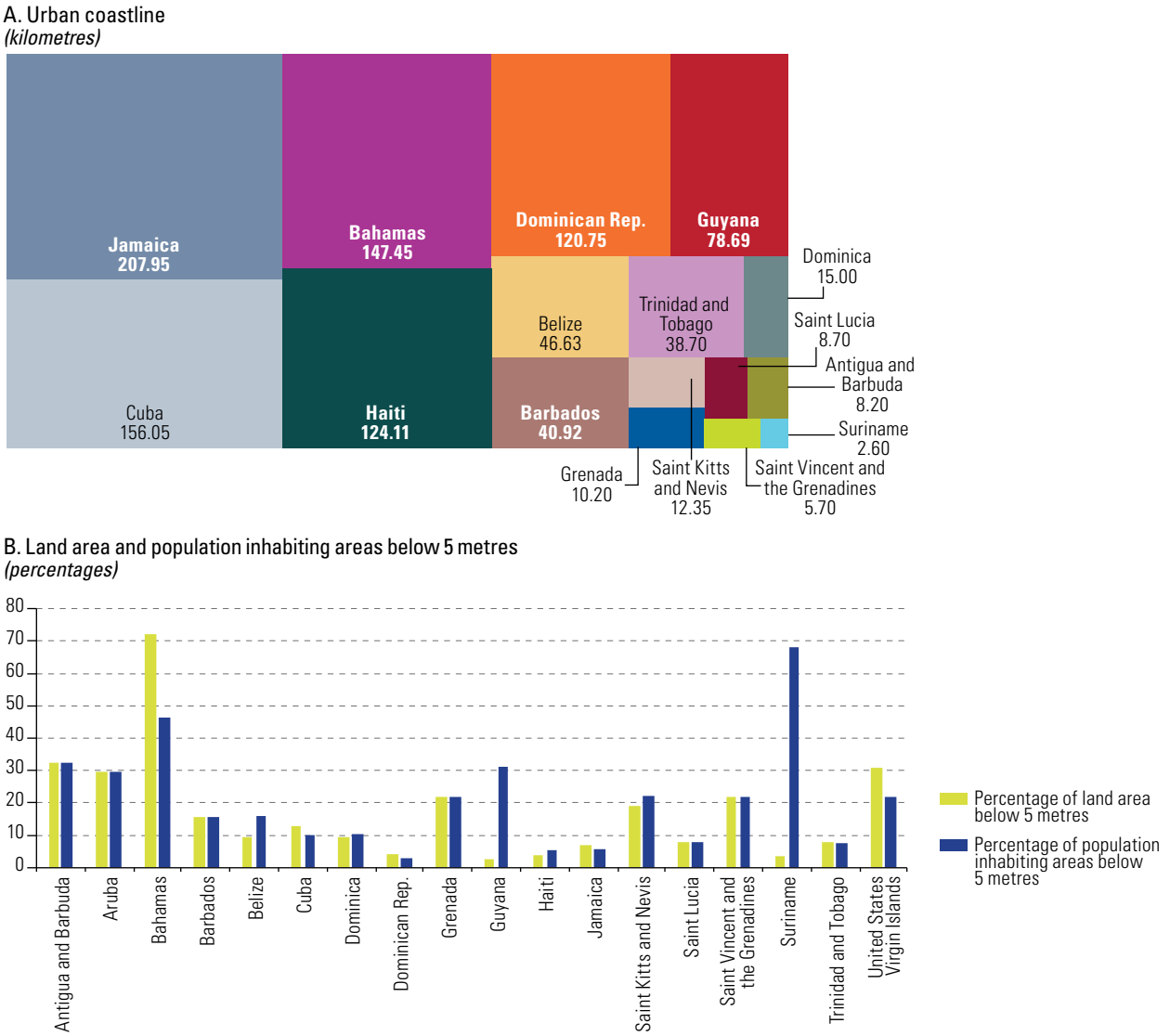


Source: GISTEMP Team, "GISS Surface Temperature Analysis (GISTEMP v4)", Goddard Institute for Space Studies (GISS), 2020 [online] https://data.giss.nasa.gov/gistemp/; and N. Lenssen and others, "Improvements in the GISTEMP uncertainty model", *Journal of Geophysical Research: Atmospheres*, vol. 124, No. 12, 2019.

Sea levels rose by around 15 cm worldwide during the twentieth century. If coastal dynamics persist, the next two decades will see further rises, most visibly along the Atlantic coastal margins, especially on the northern coast of South America and the Caribbean islands. The loss of mass from glaciers and ice sheets in the polar and mountainous regions is contributing to accelerated sea level rises and the expansion of warm waters in oceans. By 2100, sea levels could rise by around 30 cm to 60 cm, even if global warming remains well below 2°C. If emissions are not reduced as needed, water levels could rise by more than 1 metre (IPCC, 2019b), which would have a major impact on the coastal population.

The Caribbean is particularly vulnerable to disasters and to these climate change scenarios because a large percentage of the population lives on the coast and because the cities in this subregion are more exposed owing to their proximity to the sea. For example, the Bahamas, Cuba, the Dominican Republic, Haiti and Jamaica have more than 100 kilometres of urban coastline and, in most Caribbean countries, the vast majority of the population lives less than 25 kilometres from the coast (see figure I.31).

Figure I.31
The Caribbean: urban coastline, and land area and population inhabiting areas below 5 metres



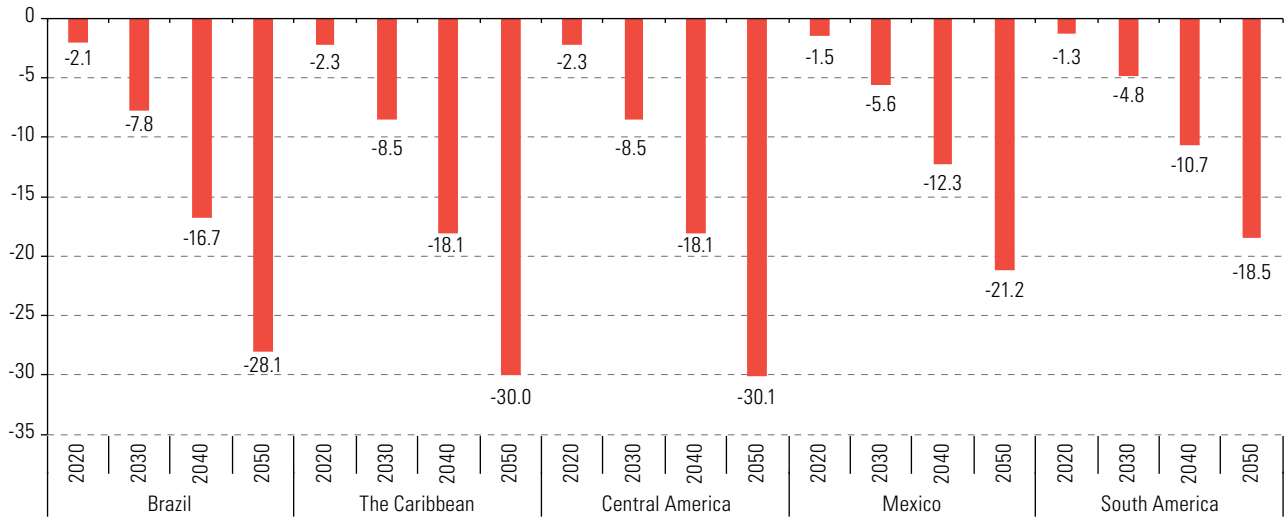
Source: M. Mycoo and M. Donovan, *A Blue Urban Agenda: Adapting to Climate Change in the Coastal Cities of Caribbean and Pacific Small Island Developing States*, Washington, D.C., Inter-American Development Bank (IDB), 2017; United Nations Human Settlements Programme (UN-Habitat), *Urbanization and Climate Change in Small Island Developing States*, Nairobi, 2015.

Climate change has a growing cost in terms of GDP. A failure to invest in environmental innovations leads not only to a loss of competitiveness in the future, but also, in the present, to a loss of productivity, higher production costs, and a need for larger investments in adaptation. According to estimates —which are partial, since some effects, such as disappearance of species, are not measurable— these costs would represent around 2 percentage points of regional GDP during the second half of the twenty-first century (ECLAC, 2015). In small island States, annual losses caused by disasters are expected to be equivalent to 20% of total social expenditure (UNDRR, 2015). In another analysis based on studies conducted between 1990 and 2012, it is estimated that the economic cost of a 2.5°C temperature rise —which, given the current trend, could occur by the mid-twenty-first century— would be between 1.5% and 5% of current regional GDP (ECLAC, 2015).[18]

[18] See Stern, 2013; Galindo and others, 2014. These estimates are partial, with a high level of uncertainty, and they are conservative, are confined to certain sectors and regions and have a number of methodological limitations, such as difficulties in incorporating adaptation processes, loss of biodiversity and the potential effects of extreme climate events.

The economic losses would exceed those estimated if the mutual reinforcement of effects were taken into account. Not considering this aspect and analysing only the relationship between productivity and temperature, it is estimated that, in a scenario without mitigating actions, the per capita GDP of the countries of the region could decline considerably in just 10 years. According to estimates for the Caribbean and Central America, by 2030 per capita GDP could be 10% lower than in a scenario without climate change (Burke, Hsiang and Miguel, 2015) (see figure I.32).

Figure I.32
Latin America and the Caribbean: change in per capita GDP as a result of temperature rises, 2020, 2030, 2040 and 2050
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of M. Burke, S. Hsiang and E. Miguel, "Global non-linear effect of temperature on economic production", *Nature*, vol. 527, October 2015.

Note: Other impacts that should be considered include the effects of climate change on coasts (owing to sea level rises and their repercussions for infrastructure), the consequences of loss of biodiversity and ecosystems, and health effects. The change in GDP is calculated with respect to the per capita GDP that is estimated to exist with an inertial path. The inertial scenario (with climate change) is the scenario without mitigation.

(f) Disasters and extreme events: the particular vulnerability of Central America and the Caribbean

The situation in the countries of the Caribbean and Central America is a prime example of the asymmetry between a low contribution to global greenhouse gas emissions and high vulnerability to the effects of climate change that those gases cause, in particular the increase in the frequency and intensity of extreme weather events. According to the World Risk Index, which shows the level of exposure and vulnerability to extreme weather events, four countries in the subregion (Dominica, Haiti, Honduras and Nicaragua) have been among the 10 most affected in the world in the last 20 years, both because of exceptionally devastating events and because of their recurrence (Eckstein and others, 2019).

Between 1980 and 2010, the Caribbean was the subregion where, on average, disaster damage represented the largest percentage of GDP, exceeding 8% on six occasions; in Central America, meanwhile, disaster damage exceeded 8% of GDP on two occasions (Bello, 2017). Caribbean small island developing States generate just 0.36% of global greenhouse gas emissions,[19] but they are particularly vulnerable owing to their geographic, climatic, and socioeconomic conditions (including debt). In the 2008–2018 period, the Caribbean was the developing subregion with the highest average annual number of deaths and people affected as a

[19] Half of the Caribbean's annual emissions are accounted for by hydrocarbon-related activities in Trinidad and Tobago.

percentage of the total population, both by natural disasters linked to climate change (such as tropical cyclones) and by geophysical disasters (especially the earthquake in Haiti in 2010).[20]

The Intergovernmental Panel on Climate Change (IPCC) climate scenarios indicate trajectories that would lead to a 0.5°C–0.7°C temperature rise over the 2016–2035 period compared to the average for 1986–2005. In the 2081–2100 period an additional increase is forecast, of between 0.8°C and 3°C. Annual rainfall is also expected to decline by between 5% and 16% by the end of the century; both Central America and the Caribbean will be warmer and drier. Other harmful effects include sea level rises, which exacerbate the loss and erosion of coastal areas, and the deterioration of marine ecosystems, particularly coral reefs.

The human and economic costs of climate-related disasters are substantial. Between 1990 and 2018, the total cost of damage in the Caribbean was US$ 140 billion. In five individual years, 1998, 2004, 2010, 2016 and 2017, the damage cost more than US$ 5 billion. In fact, 87.2% of all asset destruction in the period occurred in those five years. The 2017 hurricane season accounted for 66.7% of the total damage for the period and cost US$ 93.5 billion. During that season, the total cost of Hurricanes Irma and Maria in the British Virgin Islands and Sint Maarten was more than double the GDP of those territories; in Anguilla, the cost exceeded GDP (ECLAC, 2019a).[21]

The worst disaster in Latin America and the Caribbean in 2019 and in the history of the Bahamas was Hurricane Dorian, which affected the islands of Abaco and Grand Bahama in the Bahamas, killing 67 and leaving another 282 people missing. The total cost of the impact of Hurricane Dorian is estimated at US$ 3.4 billion, of which 72% corresponded to damage, 21% to losses and 7% to additional costs. The effects of the disaster on the private sector represent 88% of the total. The total cost was equivalent to 25% of the GDP of the Bahamas. The housing sector suffered the greatest damage, while the tourism sector sustained most of the losses (ECLAC/IDB, 2020). Hence the initiative proposed by ECLAC for a portion of debt to be forgiven, to increase investment in adaptation and resilience to climate change. Multilateral institutions would forgive all of the debt of the smaller economies and the annual amount paid in local currency by the debtor countries would be invested in a resilience fund for the Caribbean, to finance mitigation and adaptation processes for 10 years. This fund, which would also support progress towards fulfilment of the 2030 Agenda for Sustainable Development, requires solidarity from the Latin American countries that have a voice and vote in global and regional financial institutions.

C. Concluding remarks

This chapter examined how the three structural crises of hyperglobalization —the economic crisis, the equality crisis and the environmental crisis— are expressed in the world economy and in the region. The pandemic has added to these three crises, exacerbating the region's economic and social difficulties, and manifesting its economies' chronic problems in severe symptoms. The need for an urgent response must not lead to structural problems being overlooked. Short-term responses should help to overcome long-term problems.

On the economic front, the region still needs to build the technological capacities that will support genuine competitiveness and, with it, a higher rate of growth with external equilibrium. Labour productivity and domestic technological efforts have not improved enough to raise this rate and achieve income convergence with advanced economies. The same is true of productivity in the use of energy, water and materials. If intermediate inputs (such as energy and water) were used more efficiently, there could be positive interactions between growth and its decoupling from emissions and environmental destruction. This would allow the growth rate that is consistent with the external constraint to approach the growth rate that is consistent with environmental sustainability.

[20] Haiti is consistently one of the most affected countries in the Caribbean. According to ECLAC (2010), in the 1990–2008 period, Haiti experienced 50.8% of the infrastructure impact, 26.0% of the economic impact, 15.1% of the social impact and 92.1% of the environmental impact of disasters on Caribbean countries.

[21] With the support of the World Bank, it was estimated that the total cost of Hurricane Maria in Dominica was more than double the country's GDP (Government of Dominica, 2018).

The pandemic has also widened the large gaps between different social groups in Latin America and the Caribbean in terms of health, education, income and wealth, as well as in the exercise of political and social rights, a situation that is exacerbated by various forms of discrimination. Since 2004, distribution trends had been improving, albeit at a slowing pace. Social policies and growth in income and formal employment were key to this. However, as a result of the pandemic, the prospects for expanding quality employment have worsened, with sharp contractions in GDP and employment and rises in poverty and inequality. As growth rates are expected to be low, there is an even greater need to build a welfare state as an instrument to promote equality and democracy, and to achieve convergence between the growth rate necessary for equality and the growth rate compatible with external balance and environmental protection.

Lastly, Latin America and the Caribbean clearly expresses the double asymmetry in environmental issues: the region accounts for a small percentage of global emissions, but is greatly affected by them, especially in the poorest strata. Moreover, its natural resource endowment is often exploited unsustainably, as the region's competitiveness depends more on those resources and on cheap labour than on technological capabilities. The harm caused by environmental destruction is already clear in low productivity, slow GDP growth, loss of biodiversity and natural disasters associated with human activities. The pandemic seems to have resulted in some respite from destruction of the environment, but policies must be implemented now to prevent destruction from accelerating when the economy starts to recover.

Because the economic, social and environmental dimensions interact with each other, thought must be given to the three crises and how to solve them together. Chapter II outlines an analytical framework to connect the three crises, and some policy scenarios.

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CHAPTER

II

A three-gap model and sustainable development scenarios

Chapter I identified three closely interlinked crises in the development model: economic, social and environmental. This chapter analyses these using a three-gap model based on recognition of the sharp technological, financial, institutional and power asymmetries in the international economy, which are reproduced endogenously, forming a centre-periphery system. The three-gap model forms a relatively simple analytical framework, which is used to examine the three crises and possible policy responses to both these structural trends and the impacts of the COVID-19 pandemic. The model also clearly shows the urgent need to rebuild global governance on a foundation of multilateralism, with the Sustainable Development Goals (SDGs) as the pillars.

The social, economic and environmental dimensions of sustainable development interact to form an integrated whole. These interactions can be studied by defining three growth rates: that which is consistent with the external constraint, that required by the pursuit of equality as a key goal of sustainable development, and the maximum rate that is consistent with planetary limits. The dynamics of these interactions depend largely on national policies and policies that shape international governance. Different combinations of policies generate different scenarios, several of which will be analysed in this section. Some of these scenarios lead to a technological and productive regression in the periphery, and to greater global tensions; others foster cooperation and help to narrow gaps. The implications of all of this in relation to forging a new development strategy are discussed in detail in chapter V.

A. Growth that is consistent with the external constraint

The structuralist school of economic thought recognizes that the international system is composed of very heterogeneous countries that can be divided into two groups, the centre and the periphery, characterized by different technological capabilities and per capita income levels. The centre has high per capita income and is positioned on or very close to the technological frontier, which enables the countries there to compete in the most technology-intensive sectors with the strongest demand and, consequently, to dominate world trade in those sectors. The technological capabilities at the centre also allow it to successfully create new processes, goods and services, thereby diversifying production. Thus, the centre builds up a complex and dynamic economic structure with diverse and sophisticated capabilities.

The opposite occurs at the periphery, which lags behind the centre in terms of technology. This gap results in sharp asymmetry between the two in terms of the capacities of enterprises. The technology gap also forces the periphery to rely mainly on static comparative advantages based on natural resources or low wages in order to compete in the international market. Fajnzylber (1983) called this type of competitiveness "spurious competitiveness", as opposed to "true competitiveness" linked to innovation and dissemination of technology.

Centre and periphery are ideal types that are each highly heterogeneous in the real world, and the assumption is that countries on the periphery, by adopting appropriate policies, can reposition within the system. Although the centre and the periphery are dynamic structures in constant transformation with many internal differences, they can nonetheless be characterized according to the elements they have in common relating to technology, specialization and the role of structural change in enabling them to leave the periphery.

To better position itself in the global market, the challenge for the periphery is to reduce the technology gap with the centre and to diversify its production structure. This is a difficult proposition because the existing pattern of specialization tends to become locked in over time. There is a virtuous circle at the centre whereby countries use their technological advantages to innovate and expand their market share, and can thus invest further in technology, which widens the gap with the periphery. The counterpart at the periphery is a growing gap.

The divergence between the centre and periphery is not unavoidable; it only occurs in the absence of policies that correct incentives and returns of different investment amounts and structures. Without development policy measures, investment incentives are biased towards sectors with static comparative advantages and reproduce the prevailing specialization pattern. The countries that have successfully transformed their production structures and overcome the centre-periphery dynamic by converging in technology and per capita income are those that have pursued policies that challenged their static advantages (Chang, 2003). Such policies redefine

investment incentives by changing their cost and price structure and by creating the institutions needed to absorb technology. The pattern of specialization changes when domestic and international policies combine to favour accumulation of capabilities on the periphery, so that international trade acts as an instrument of development rather than a multiplier of asymmetries.

The link between technology, production structures and convergence of per capita income between the centre and the periphery may be conceptualized succinctly by the notion of the external constraint on growth. Countries with production structures that are highly concentrated in low-technology activities tend to generate high import demand as they grow, while their exports do not respond as readily to changes in income in the rest of the world.[1] More advanced technology, capabilities and diversification raise the ratio of the income elasticity of exports (ε) to the income elasticity of imports (π).[2] The higher the ratio (ε/π), the faster the periphery can grow without an increase in its imports pushing up the deficit in the basic external balance (current account plus long-term financial flows) (see box II.1). The occurrence of an external deficit requires an adjustment, largely through a lower growth rate. The ratio of these elasticities defines the relative periphery and centre growth rates that are consistent with the external constraint $\left(\frac{y^E}{y^C} = \frac{\varepsilon}{\pi}\right)$, as a function of capacities and the production structure.

Box II.1
The external constraint

Sustained growth of peripheral economies depends largely on them being able to import the advanced capital goods that investment demands. To import, they must export, meaning that the growth of economies that do not issue international reserve currencies is restricted by their ability to obtain foreign exchange.

Countries face an external constraint when their performance on external markets and the response of financial markets to this performance delimit and restrict their space to pursue domestic policies to achieve full employment.[a] In simple terms, assuming a stable real exchange rate over the long term, the growth rate that is consistent with the external constraint is the result of dividing the growth rate of exports (the income elasticity of exports multiplied by the growth rate of the rest of the world) by the income elasticity of imports (Thirlwall's law): $y^P = (\varepsilon/\pi)y^C$.

Because of the external constraint, economies are unlikely to be able to maintain current account deficits for prolonged periods, unless they are recipients of significant foreign direct investment or official aid flows. In the long term, countries need to maintain equilibrium in their current account or basic balance (the current account plus long-term financial flows).

Source: Economic Commission for Latin America and the Caribbean (ECLAC).
[a] For a discussion of these equations, their determinants and the resulting empirical exercises see chapters 9 and 10 of Blecker and Setterfield (2019).

In some cases, the external constraint does not operate as described (for example, in a global scenario that is highly conducive to exports from the periphery) and economies grow less than their potential for external equilibrium. However, in most cases, the reverse occurs, especially for many Caribbean countries, given the substantial burden of their foreign debt service and repatriation of earnings.

The growth rate of the periphery consistent with the external constraint (y^E) is the maximum rate at which the periphery can grow without generating unsustainable disequilibria in the basic balance, given its pattern of specialization (reflected in the ratio ε/π) and the growth rate of the centre (y^C). If the centre grows faster, the periphery exports more and the external constraint eases; structural change at the periphery towards more technology-intensive and faster-growing sectors in the world market enables the periphery to export more (or the income elasticity of its

1 Thirlwall (2019), taking stock of the advances in the literature on externally restricted growth, concludes that "the supply side of an economy becomes extremely important because there is a growing body of evidence showing how the income elasticity of products is a positive function of the level of technology and the skill embodied in them".

2 The income elasticity of exports is the percentage rise in exports from the periphery when the GDP of the rest of the world increases by 1%; the income elasticity of imports is the percentage rise in imports by the periphery from the rest of the world when the GDP of the periphery increases by 1%.

imports declines). In both cases, the growth rate that is consistent with the external equilibrium increases. Structural change is fundamental to changing the relationship between elasticities and to alleviating the external constraint: without structural change convergence cannot occur except temporarily, for instance during rises in international commodity prices. Financial architecture is key since the external constraint does not apply to countries that issue an international reserve currency and are restricted by limits on external financing.

B. Growth for equality

How to achieve better income distribution has always been important in the thinking of the Economic Commission for Latin America and the Caribbean (ECLAC) and in the analytical framework of structuralism. The argument is as follows: (a) the undiversified structure of the periphery results in fewer spillover effects and less creation of quality jobs (high-productivity formal jobs); (b) this means that the employment structure of the periphery tends to have a larger proportion of informal or subsistence workers; (c) the high level of informality reduces the organizational and bargaining power of labour in relation to capital; (d) weak bargaining power means that wage growth does not keep pace with productivity gains, causing a deterioration of income distribution; (e) the inability of workers at the periphery to negotiate wage rises in step with productivity gains means that they do not accrue the benefits of technological progress, which instead translate into returns on capital or are remitted abroad.[3]

As early as the start of the 1960s, ECLAC took a stand against the prevailing idea in mainstream economics that inequality was necessary for investment and growth. The Commission stressed the need for agrarian and fiscal reforms that would enable better distribution of assets and income, leading to increased land productivity and expansion of the domestic market. Fajnzylber's "empty box" concept highlighted the idea that growth and equity could go hand in hand, and even reinforce each other.[4] However, attention was focused (except in the case of agrarian reform) on the link between growth and equity on the demand side. Income needed to be distributed to have a mass market that would absorb the emerging manufacturing output. In addition, economic integration of the region was supposed to help expand markets and upscale production.

More recently, ECLAC has refined the idea of "income equity" to embrace a wider concept of "multidimensional equality", which has been at the forefront not only of the policy agenda but of a broader analytical framework. This new perspective differs from the previous one in at least two key areas. The first of these is normative; the second is analysis of the determinants of productivity and growth.

On the normative side, equality is taken as a core value that encompasses, in addition to income, equal opportunity and access, and recognition of people's differences and dignity. ECLAC (2010a) has described this as "the abolition of privilege and the firm establishment of equal rights for all individuals, irrespective of their origins and of their gender, nationality, age, territory and ethnicity. It crystallizes in an idea of citizenship […]" and strengthens the need for the consolidation and expansion of political democracy, as one of the most important legacies of the modern age. Equality must be seen as an integral component of development itself.

For analytical purposes, it is argued that equality contributes decisively to capacity-building and is therefore a driving force of technological learning, improved productivity and stronger economic growth. Access to education, health and social protection, in addition to being desirable for their intrinsic value, should be seen as an investment in capabilities. Traditional mainstream economics treats social policies as compensatory measures aimed at preventing the losers in competition from reacting in a manner that prevents markets from functioning efficiently. ECLAC, in contrast, does not see social policies as palliative measures, but rather as part of the capacity-building required to integrate actors into high-productivity formal employment and innovation, thus accelerating technological progress. Even if a small group of enterprises and workers assimilate technological progress quickly, unless it is disseminated to the majority of firms and workers, the economy's overall productivity will remain very low. An economy with pockets of high productivity in an expanse of low technology and low productivity is an enclave economy, where market concentration predominates over dissemination of knowledge. Companies that lag behind disappear, markets become concentrated and a significant portion of the labour force moves into informal or precarious employment.

[3] Productivity gains are transferred abroad when such increases reduce the relative prices of the commodity exports of the periphery and the terms of trade deteriorate as a result.

[4] The term "empty box" describes situations where no country meets both growth and equity criteria (Fajnzylber, 1990).

In the model presented in this chapter, the growth rate necessary to reduce inequality, or growth rate for equality (y^S), is defined as the minimum rate needed to achieve the multidimensional equality goals required by the rights agenda and for capacity-building.

In addition to its direct effect on capabilities, inequality has an indirect effect on productivity, because it acts as a social and political brake on the design and implementation of development policies. There is a substantial difference in policy quality between unequal and egalitarian societies. This is rooted in the political economy and in power structures. In unequal societies, economic and political power are concentrated, and each form of power is used to amass the other. Upward mobility occurs primarily in egalitarian societies, since it is the social framework that determines the structure of opportunities, and not the other way around. Oligopolistic and privileged positions are defended with more resources and more effectively in unequal societies, generating a situation where mistrust prevails, barriers to cooperation become insurmountable, and policy design and implementation are more costly.

Conversely, in egalitarian societies, the tendency is to cooperate more, given that (i) there is more trust and there is an expectation that the fruits of cooperation will be enjoyed by everyone; (ii) it is easier to coordinate actors to finance the universal provision of goods such as education and health care (in highly unequal societies, the wealthiest are able and prefer to pay for those goods privately rather than contributing to the collective financing of them); and (iii) the risk of capture and distortion of public policies by the most powerful actors is lower.

As the speed of technological progress and the number of skills required for transformation of the pattern of specialization based on genuine competitiveness both increase, so do the benefits of egalitarian societies in terms of skills and policy improvements.

In short, lagging behind in technology and production fuels inequality because it limits growth and the creation of high-productivity jobs; inequality, in turn, limits growth because it builds economic and political barriers to the dissemination of technology throughout the production fabric.

C. The centre-periphery environmental frontier

The forms that economic growth has taken cannot be sustained without jeopardizing the stability of the planet. Environmental limits have already been reached, and overshooting them will undermine the development and well-being of future generations, as well as having increasingly harmful effects on current generations.

Emissions of greenhouse gases and other pollutants, and consumption of natural resources, depend on the rate of economic growth and the ability of technological progress to decouple economic growth from emissions and to reduce the intensity of natural-resource use. Put simply, the environmental problem concerns how to distribute a certain total capacity for emissions that the planet cannot exceed (a carbon budget) between two regions that compete for those emissions: the centre and the periphery. The faster the growth of the centre, the less environmental space will be left for the growth of the periphery, and the faster the environmentally-friendly technological progress at the centre and at the periphery, the more overall environmental space will be available for growth (less carbon emissions per unit of GDP).

The centre-periphery environmental frontier is the set of growth rates of the periphery (y^A) that is consistent with stability of the global ecosystem for each growth rate of the centre, given the rates of technological progress (which decouples growth from emissions and environmental destruction) at the centre and periphery. For the purposes of calculability and simplicity, in the following quantitative exercises the position of the centre-periphery environmental frontier is assumed to depend on the level of emissions that science deems necessary to keep the increase in global warming below 1.5°C (see box II.2). However, this is only an approximation of the broader concept of an environmental frontier, which refers to how the equilibrium of the whole ecosystem (not only climate change) is affected by human action.[5]

[5] See Althouse and others (2020). While the emissions-based approach is a limited one and should be seen as a proxy for the destruction of nature, curbing global warming entails promoting environmental initiatives to increase nature's capacity to regenerate land and oceans, and to reduce the burning of fossil fuels and the manufacture of products such as plastic and cement.

Box II.2
The centre-periphery environmental frontier

The centre-periphery environmental frontier (showing the growth rate of the periphery that is consistent with the global environmental equilibrium) is calculated by rewriting the Kaya identity with two regions,[a] the centre and the periphery (the population is normalized to 1):

$$H = H^C + H^P = Y^C\left(\frac{H^C}{E^C}\right)\left(\frac{E^C}{Y^C}\right) + Y^P\left(\frac{H^P}{E^P}\right)\left(\frac{E^P}{Y^P}\right) \quad (1)$$

Where H are emissions and production processes that pollute or destroy natural resources, Y is per capita income, E is energy used and the superscript letters C and P indicate whether the variables correspond to the centre or the periphery, respectively. Hereinafter, H is simply referred to as "emissions". Expressing equation 1 dynamically gives:

$$h = h^C(1-\alpha) + h^P\alpha = (1-\alpha)(y^C - z^C) + \alpha(y^P - z^P) \quad (2)$$

In equation (2) $\alpha = \frac{H^P}{H^P + H^C}$, (periphery's share of total emissions) and the lowercase letters are proportional growth rates (for example, $h^C = \dot{H}^C/H^C$, where $\dot{H}^C$, is the increase in the emissions of the centre over time), z represents the increase in environmental efficiency, defined as the reduction of emissions per unit of GDP (including, therefore, changes in emissions by type of energy, changes in the primary energy matrix and changes in GDP composition towards more or less emissions-intensive sectors). This variable evolves in line with the pattern of consumption, technological progress and dissemination of technology. Equation (2) simply expresses that the growth of total emissions depends on the centre and the periphery and on increases in environmental efficiency at both poles of the global system.

A sustainable path requires growth to be accompanied by a reduction in emissions, $h=-x$. The concept of reductions in emissions is understood in the broadest sense of environmental protection and not only in reference to climate change. The parameter x depends on scientific forecasts of the rate of emission reductions needed to stabilize the planet. By showing the growth of the periphery in equation (2), the following is obtained:

$$y^A = \frac{1}{\alpha}\left[\underbrace{(z^C - x)}_{a} + \alpha\underbrace{(z^P - z^C)}_{b} - \underbrace{(1-\alpha)y^C}_{c}\right] \quad (3)$$

Equation (3) represents the centre-periphery environmental sustainability frontier, defined as the set of growth rates of the periphery (y^A) that keeps the planet stable with a given level of technology, depending on the growth rate of the centre. The centre-periphery environmental frontier is negatively sloped because the growth of the centre —weighted for its share of total emissions (1-α)— leaves less room for the periphery to pollute with its own growth. Technology is key: increases in environmental efficiency and reductions in emissions brought about by technological progress shift the curve of the environmental frontier upward. The growth of the periphery can thus be accelerated for each level of growth of the centre without increasing environmental destruction; in other words, maintaining the rate x of emissions reduction (this rate is defined as that needed to keep the increase in the planet's temperature below 1.5°C).

In the concept of the centre-periphery environmental frontier, three economic growth-related factors can affect the environment: term *a* is the frontier's progress in environmental technologies (represented by the rate of increase in environmental efficiency at the centre) compared to the overall rate needed to stabilize the planet (estimated in scientific studies); term *b* is the rate of dissemination of environmental innovations to countries on the periphery, represented by the difference between the rates of increase in environmental efficiency at the periphery and the centre; and *c* is the pollution produced by the centre as a function of its own growth.

Source:Economic Commission for Latin America and the Caribbean (ECLAC).

[a] In the original Kaya identity, *H* refers solely to greenhouse gas emissions. Here, it has been attributed a content that better reflects the loss of resources and environmental services in a broad sense and takes into account the fact Latin America and the Caribbean makes a relatively small contribution to total emissions.

The centre-periphery environmental frontier encapsulates two key environmental problems of inequality. First is the need to protect the environment for future generations; that is, a matter of intergenerational equality. Second is the conflict between how much the centre and the periphery can each grow if environmental destruction is to be avoided; in other words, a problem of inequality between countries, which affects current generations.

Although the centre-periphery environmental frontier does not provide insight into what is happening within each country, it is important to recall that the poorest suffer the most from environmental degradation because they have the least resources to protect themselves or adapt. Therefore, it is crucial to consider this concept in conjunction with the minimum growth rate necessary to reduce inequality (y^S), since the latter includes in its definition the rectification of inequalities within each country.

The centre-periphery environmental frontier imposes a new perspective on the analysis of the centre-periphery technological gap. For companies and workers at the centre, a periphery that is closer to the technological frontier could be perceived as a threat to profits and jobs, at least in the short term. However, when technology is viewed in terms of environmental equilibrium, rapid dissemination of technology to the periphery creates more space for growth in both regions, without destabilizing the balance of the planet: it thus becomes possible for all countries to grow more within the same carbon budget. Dissemination of technology to the periphery is thus a strategy that benefits all, with important implications for the political economy of the international system, as discussed below.

D. Making external and environmental constraints compatible with growth for equality

External, social and environmental crises interact with and feed into each other. Can these interactions be reshaped so that they contribute to sustainable development? It is argued that this is possible, subject to implementation of certain policies and an institution-building effort, both in national economies and in the multilateral system. This analysis is performed with regard to a centre-periphery model, in which the periphery is Latin America and the Caribbean, and the centre is the rest of the world. This simplification, of course, disregards the fact that a huge part of the rest of the world is peripheral; this is nonetheless justified insofar as Latin America and the Caribbean is the focus here.

In the preceding section three growth rates were defined: that consistent with the external constraint (y^E), that needed to reduce inequality (y^S) and that consistent with the centre-periphery environmental frontier (y^A). The aim of public policy is for growth rates to converge to the level required for equality, because of the concept of development that guides the analysis and because of the positive effect on capabilities and technological progress.

As discussed below, in Latin America and the Caribbean, the rate needed for equality exceeds that allowed by the external constraint. There are two reasons for this. In a highly unequal region, with a sizeable percentage of the workforce in the informal sector, the minimum rate for equality is necessarily high. Moreover, given the pattern of specialization in natural resources and cheap labour, the ceiling formed by the external constraint is quickly reached and therefore the y^E rate is low. For these reasons, the rate for equality is higher than the rate consistent with the external constraint ($y^S > y^E$). The gap between the two is called the "social gap". These two variables depend on social, industrial and technological policies that can transform the production structure and levels of inequality. The greater the redistributive effort of the economy (for example, thanks to a very progressive tax system), the lower y^S is.

Even if y^E is low, given the growth of the rest of the world and the existing limited carbon budget, the growth rate in Latin America and the Caribbean that is consistent with the external constraint is higher than that stipulated in the centre-periphery environmental frontier; that is to say, $y^E > y^A$. The difference between these two growth rates shall be referred to here as the "environmental gap". While the evolution of y^E depends on how technological capabilities and structural change affect the dynamics of exports and imports, the evolution of y^A depends on how those same variables affect emissions and natural resource use. Social policies and

education can also help to change y^A; for example, by modifying consumption patterns and providing public services that reduce environmental impacts (such as in the areas of sanitation or public transport).

Lastly, the total gap between the minimum growth rate needed for equality and the maximum rate that is consistent with the environmental frontier is referred to as the "sustainability gap", since it is the gap whose closure ensures sustainable development in its three dimensions: economic, social and environmental. Sustainable development is achieved only when all three gaps are closed, and therefore: $y^S = y^E = y^A$. Development policy should aim to have the maximum rates relating to the environment and the external constraint converge towards the rate for equality, assuming that the latter is the highest of the three. Three types of policies can contribute to this aim:

- Social policies: by improving income distribution, they enable equality goals to be achieved with lower rates of growth. These policies reduce y^S and contribute to its convergence with the other rates.
- Industrial and technological policies: in combination with social and environmental policies, they improve genuine competitiveness and raise y^E.
- Environmental policy: in combination with the social, industrial and technological policies, they promote the decoupling of emissions from GDP and prevent predatory use of natural resources, raising the y^A.

To achieve the goal of equality, the conditions for equality must be met in this generation, between countries and within each country, as well as the conditions for intergenerational equality, respecting future generations' right to development. Achieving equality in the present generation requires the periphery to grow at least at the rate required to reduce inequality, and achieving it intergenerationally requires that the centre and periphery grow at most at the rates stipulated by the centre-periphery environmental frontier. Lastly, by achieving convergence between the growth rate consistent with the external constraint, the rate needed for equality, and the rate consistent with the centre-periphery environmental frontier, not only are equality goals met, but they are sustainable in open economies.

E. Adjustment paths depend on policy decisions

There are economic forces linked to competitive processes in goods and foreign-exchange markets that force economies to adjust to the external constraint. There are market mechanisms that make growth tend towards y^E. But there are no similar forces driving the economy to some point on the centre-periphery environmental frontier (y^A) or towards the growth rate for equality (y^S). In other words, economic incentives exist to change the behaviour of agents that prevent the economy from growing above the external equilibrium, but there are no similar incentives to prevent the destruction of the environment before it becomes irreversible, or to prevent many workers from remaining in informal employment. Achieving y^S and y^A depends on economic policy decisions. Policy decisions are the key to whether economies tend to narrow or widen gaps, and they also define possible scenarios.

Described below is a pair of scenarios that are the two poles of a continuum. While the existing cases (and those that are likely to take shape in the future) are at intermediate points in the continuum, the polar cases provide greater insight into the forces acting on the three gaps and help to identify the instruments that can change how they operate.

1. First scenario: the pursuit of environmental sustainability widens the centre-periphery gap

The first scenario is a continuation of the ecologically unequal exchange model that has characterized the development of Latin America and the Caribbean to date. In this scenario, the world economy moves towards the centre-periphery environmental frontier, and it is assumed that the commitment to keeping the temperature increase below 1.5°C is effective. Meanwhile, although the periphery meets the goal of sustainable development, it lags behind in technology and per capita income. The key features of this scenario are summarized below.

- The centre increases its productivity and technological advantages over the periphery. Technological change allows it to reduce its contribution to environmental degradation. It also adopts policies that change consumption patterns, penalizing emissions-intensive goods and processes, and putting up barriers to the importation of such goods.
- The technological gap of the periphery, environmental constraints on trade, and changes in consumption patterns at the centre that favour sustainable goods and processes combine to increase the external constraint on the periphery. As a result, the periphery must grow more slowly than in the past to avoid unsustainable disequilibrium in its basic balance.
- At the end of the process, the periphery has incorporated environmental innovations by importing capital goods and, to a smaller extent, through endogenous capacity-building. The periphery is greener, but the possibility of convergence becomes more remote and the growth rate is further from the one needed for equality (and therefore for sustainable development). While the gap narrows between the rate consistent with the external constraint and the environmentally sustainable rate, the distance from the rate needed for equality increases.

The main contributor to this undesirable outcome is the fact that the periphery pays for most of the adjustment for the global economy to position itself on the centre-periphery environmental frontier, by reducing its growth and greatly widening the social gap (the difference between growth required for equality and growth with external balance). This trend reinforces the double asymmetry: those who have polluted the most in the past suffer the least from the effects of pollution and adjust their growth rates the least to meet environmental protection goals. This reflects the political economy of inequality at the international level and the technological, market and financial power of the centre within the international framework. It also attests to the political economy of inequality within the periphery, because it demonstrates how sectors predominate by static comparative advantages, which hinder productive transformation.

This scenario is not stable, because it does not resolve the three crises. Firstly, it does not resolve the inequality crisis, because a low rate of growth at the periphery, with limited absorption of technology and slow structural change, makes it difficult to generate quality jobs, reduce informality, contain emigration or lessen political conflict. Both domestic and international political tensions are reproduced, amplified by the capacity of capital flows to restrict space for fiscal policy and for the welfare state. As a result, protectionist and isolationist tendencies in centre countries become more pronounced. The burden of poverty, informality and unemployment continues to weigh on political systems and on international relations.

There can be no stable environmental balance without endogenous capabilities at the periphery. To rein in destruction of the environment, local technological efforts are needed to adapt new environmental technologies to the physical, economic and social specificities of each region. While the effects of pollution are global, the forms it takes and the strategies to deal with it are often local. Ecological systems are complex frameworks for which no solutions can be applied without researching the context in which they are implemented. Some one-off measures may generate unexpected consequences, such as new imbalances that neutralize the initial intervention. Therefore, effective intervention in these systems requires local capacities and research.

An environmental strategy that is based on technology imports undermines the employment opportunities and income of the local population. A "technology package" that ignores these variables may face political barriers that make it unworkable. The recent rise in social protests in Latin America and the Caribbean show there is little societal tolerance for policies that worsen the already difficult situation of large segments of the population in countries with high levels of inequality. Without local capacities, actors will find incentives to resort to spurious competitiveness, through low wages and predatory exploitation of nature, seeking to generate jobs and income at any environmental cost. This threat is even more serious in light of the severe crisis caused by the COVID-19 pandemic, which has made the need for rapid recovery even more important in policy decisions.

In short, either because of a lack of endogenous capacities that would enable effective intervention in polluting systems or because of the need to prioritize employment and growth over environmental protection, progress in the environmental field would be transitory in this scenario unless there is international cooperation or policies that support progressive structural change in the periphery —defined as a transformation that is consistent with the goals of genuine competitiveness, equality and environmental protection.

2. Second scenario: common but differentiated responsibilities under the Global Green New Deal and the big push for sustainability

In an alternative scenario, the actors recognize their common responsibilities for environmental degradation and the right of future generations to a stable planet and understand that the inequality between current generations must be taken into account in policymaking. Environmental problems arise from the destruction of nature and emissions accumulated over many decades of development in the countries of the centre. They are mainly responsible for the build-up of carbon in the atmosphere and the destruction of forests and species in the past. Since the environmental liability was largely caused by the centre, it should bear the majority of the costs of mitigation, creating space for growth and convergence of the periphery. This is the idea behind the concept of "common but differentiated responsibilities": those who contributed most to creating the environmental problem should contribute most to solving it. In addition, in this second scenario, the periphery can adopt policies to transform its development pattern and promote equality, closing the three gaps.

This scenario is based on the following changes in the political economy and economic policy, which highlight the differences with the previous scenario (see also box II.3).

- As in the first scenario, technological efforts are made at the centre to obtain less polluting technologies, and trade rules and demand patterns are modified to penalize goods and processes that are more carbon-intensive, more polluting or that overexploit natural resources. But, unlike the first scenario, in this case, the centre opens more spaces for technological and financial cooperation with the periphery, as well as for industrial and technological policies in a strengthened multilateral system, and adopts fiscal coordination measures to prevent heavy imbalances in international trade. This is the international scenario suggested by the Global Green New Deal (Barbier, 2009), based on a new multilateral governance. These policies ease the external constraint and raise the potential growth rate of the periphery.
- The draw for the peripheral economy in this scenario must be the growth rate needed for equality, which countries must approach through an interlinked set of policies that ECLAC has called a "big push for sustainability". The periphery redesigns its institutions and policies to accelerate investment and build the local capabilities needed to solve its own particular ecological, economic and social problems, in a process that is closely related to construction of a welfare state.
- These policies help to reduce the external constraint, but also help to decouple growth from emissions and from destruction of the natural environment. As a result, the external and environmental gaps are narrowed. Here, the effort made at the periphery to assimilate frontier technology is neither an imitation nor a reflex, but rather a local creative effort, without which the dissemination and impact of technological progress are only superficial. The effort is also steered in a direction established by public policy, with ecosystem stewardship and inclusion as priorities. Public investment and regulation, by promoting and guiding growth in Latin America and the Caribbean, play a key role in redefining the pattern of development.
- Social policies contribute to building capacities and competitiveness. They must be seen not only as a means of reducing the growth rate necessary for equality, but also as a catalyst for learning and productivity in support of progressive structural change.
- Ultimately, the policies involved in a big push for sustainability bring together forces that help to narrow the three gaps in an integrated manner. These actions must be accompanied by the development of new metrics of economic performance that include dimensions other than GDP as indicators.

This second scenario combines adoption of policies at the centre that accelerate innovations in environmentally sustainable goods and products, adoption of industrial and technology policies at the periphery that promote rapid dissemination, adaptation and incremental improvement of frontier technology at the centre, diversification

of periphery capabilities at the same rate as its absorption of technological progress, the building of a welfare state at the periphery in keeping with technological capabilities, and international agreements that penalize the production and trade of polluting goods and processes and accelerate the dissemination of clean technologies to the periphery. Such agreements would form an international governance framework consistent with the targets that the international community set itself in the 2030 Agenda for Sustainable Development and with the negotiations on climate change.

The scenario of common but differentiated responsibilities requires close collaboration between institutions, public policies and international governance. Its stability depends on the synergies between social, economic and technological policies. The linkaging of these policies is complex and subject to trial and error, requiring domestic and international compacts to reduce uncertainty and investment instability.

Box II.3 contains graphic representations of the scenarios and how growth rates are adjusted.

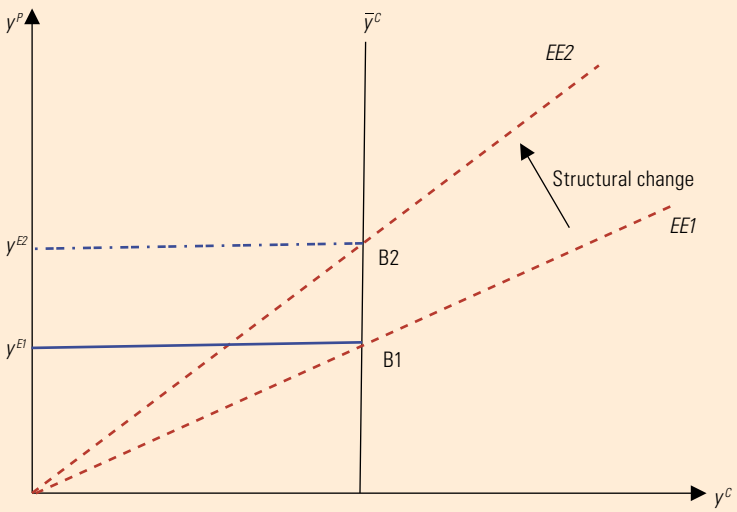
Box II.3
The three gaps and the policy scenarios: a graphic representation

1. The three growth rates and their determinants

The three growth rates and the factors that explain their movement, as well as a representation of the three resulting gaps, are presented graphically here.

Figure 1 illustrates the growth rate consistent with the external constraint (line *EE*). The greater the growth of the centre, the greater the import demand from the centre and the greater the exports from the periphery. This increases the growth rate compatible with external balance (that is, barring the emergence of an intractable current account deficit) of the periphery. The periphery has no control over the growth of the centre, which is given exogenously and is equal to $\bar{y}^C$. In turn, the slope of the line *EE* (which is the ratio of income elasticities of exports and imports, or ε/π) depends on the pattern of specialization. The production structure determines export capacity and dependence on imports: the more diversified and technology-intensive the production structure, the greater the relationship between the income elasticity of exports and imports in the long term, and the steeper the *EE* curve.

Figure 1
Technology, changing production patterns and shift in the ratio of elasticities



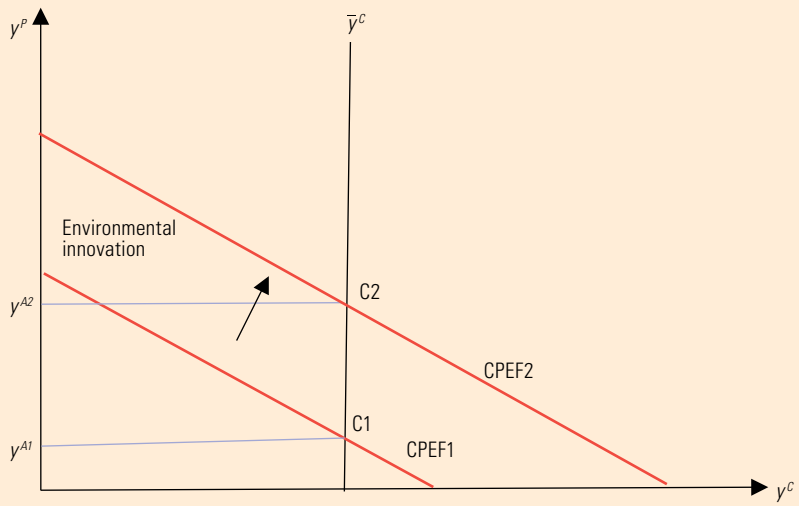
Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: y^P: growth rate of the periphery.
y^C: growth rate of the centre.
y^E: growth rate of the periphery compatible with external balance when the centre grows at the exogenous rate $\bar{y}^C$.
$\bar{y}^C$: exogenous growth rate of the centre.
EE: growth compatible with external balance, given by $y^P = (\varepsilon/\pi)y^C$.
B1: balance prior to structural change.
B2: balance subsequent to structural change.
EE1→*EE2*: structural change at the periphery moves the line from *EE1* to *EE2* and increases the growth rate compatible with external balance by easing the external constraint.

Box II.3 (continued)

The external balance is obtained at point B1. The line *EE1* would move to *EE2* if a structural change at the periphery made its structure more complex. The new balance at point B2 means that the rate of growth compatible with external balance is higher than it was before structural change occurred.

Figure 2 illustrates the centre-periphery environmental frontier (CPEF). The greater the growth of the centre, the lower the carbon budget remaining for the periphery. Thus —given the technology and the admissible emissions level— periphery growth (y^P) decreases when centre growth (y^C) increases. If the centre grows at the exogenous rate $\bar{y}^C$, the maximum growth of the periphery is y^{A1} (point C1 where the growth rate of the centre and CPEF1 intersect), assuming the scenario of a maximum 1.5°C temperature increase. However, CPEF can move to the right (from CPEF1 to CPEF2), opening up more room for growth for all countries, if technical progress reduces emissions per unit of GDP (through environmental innovations) or if consumption patterns shift to less carbon-intensive goods. Technical progress permits the periphery to grow at a higher rate (y^{A2}) without compromising planetary stability (point C2 in figure 2), given $\bar{y}^C$.

Figure 2
Technical progress and the centre-periphery environmental frontier (CPEF)



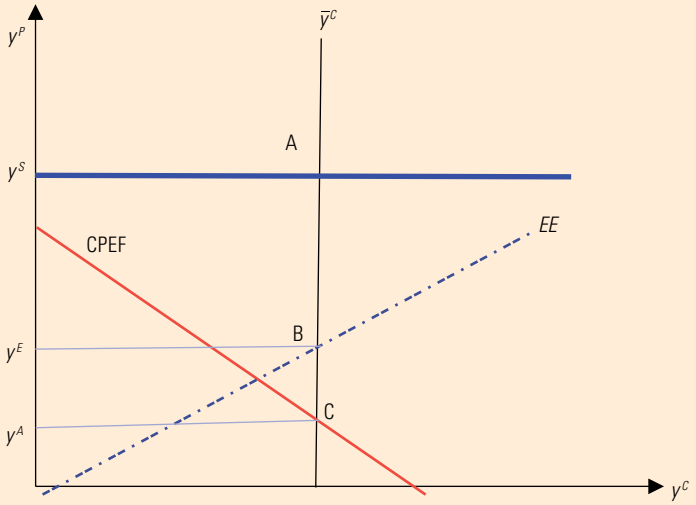
Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: y^P: growth rate of the periphery.
y^C: growth rate of the centre.
$\bar{y}^C$: exogenous growth rate of the centre.
y^A: growth rate consistent with environmental sustainability.
C1: balance prior to environmental innovation.
C2: balance subsequent to environmental innovation.
CPEF1→ CPEF2: upward movement of the centre-periphery environmental frontier as a result of environmental innovation.

If this frontier remains unchanged, growth of the centre leaves less environmental space for the periphery. Sustainable process and product innovation and sustainable changes in consumption patterns move the centre-periphery environmental frontier upwards. Consequently, the growth rate of the periphery consistent with the environmental constraint increases for each possible growth rate at the centre. If the centre growth rate is $\bar{y}^C$, the periphery growth rate changes from y^{A1} to y^{A2}.

Since the rate of growth required for equality is the highest —represented as a horizontal line in figure 3— it is the target with which the other rates must converge. The more effective a country's redistribution policy and the less unequal its initial position, the lower is the minimum rate of growth required to finance the correction of these inequalities and the creation of capacities.

Box II.3 (continued)

Figure 3
The three gaps of sustainable development



Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: y^P: growth rate of the periphery.
y^C: growth rate of the centre.
$\bar{y}^C$: exogenous growth rate of the centre.
EE: line of growth rate consistent with the external constraint, given by $y^P = (\varepsilon/\pi)y^C$.
y^E: growth rate of the periphery compatible with external balance when the centre grows at the exogenous rate $\bar{y}^C$.
y^S: the rate of growth required for equality.
y^A: growth rate consistent with global environmental balance.
A: balance consistent with a reduction of inequality.
B: external balance.
C: balance consistent with environmental sustainability.
Social gap: the distance between points A and B.
Environmental gap: distance between points B and C.
Sustainability gap (the three dimensions of sustainability): distance between points A and C.

Figure 3 shows the three gaps, given growth $\bar{y}^C$ at the centre: the social gap, which is the difference between the rate of growth needed for equality and the rate consistent with the external balance (difference between y^S and y^E, segment A to B); the environmental gap, which is the difference between the growth rate consistent with external balance and the sustainability frontier (difference between y^E and y^A, from B to C); and the sustainability gap, which is the difference between the growth rate required for equality and the growth rate consistent with environmental balance (difference between y^S and y^E, from A to C).

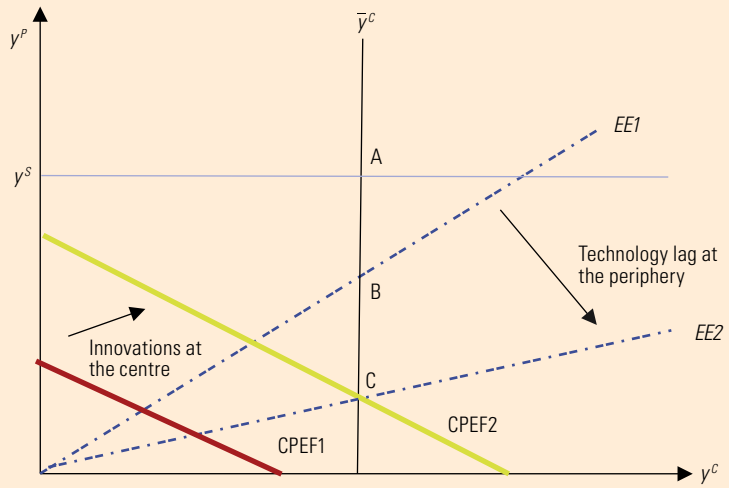
Sustainable development in all its dimensions is achieved only when $y^E = y^S = y^A$. In the diagram, for analytical purposes it is assumed that the growth of the centre is given and exogenous. However, this assumption will be lifted later to acknowledge that growth in the centre should be part of the negotiations between developed and developing countries regarding the environment, based on the principle of common but differentiated responsibilities.

2. Policy scenarios and the three-gap model: a graphic representation

The two extreme scenarios discussed above (reproducing an unequal model or a scenario with common but differentiated responsibilities) can be illustrated via a simple graphic representation of the three-gap model. Figure 4 shows the scenario in which the centre concentrates the research and development (R&D) effort and structural change towards new environmental technologies, while the periphery lags behind. The technological gap and protectionism at the centre cause the external constraint curve to move downwards (the greater the constraint, the greater the fall in ε/π, which reduces the slope of the *EE* line). The CPEF line moves upward because growth has a lower environmental cost (thanks to technical progress at the centre). The new balance compatible with the external constraint will be point C: low growth of the periphery with a more environmentally sustainable —but more unequal— world.

Box II.3 (continued)

Figure 4
A more environmentally sustainable but more unequal world: when adjustment heightens inequality

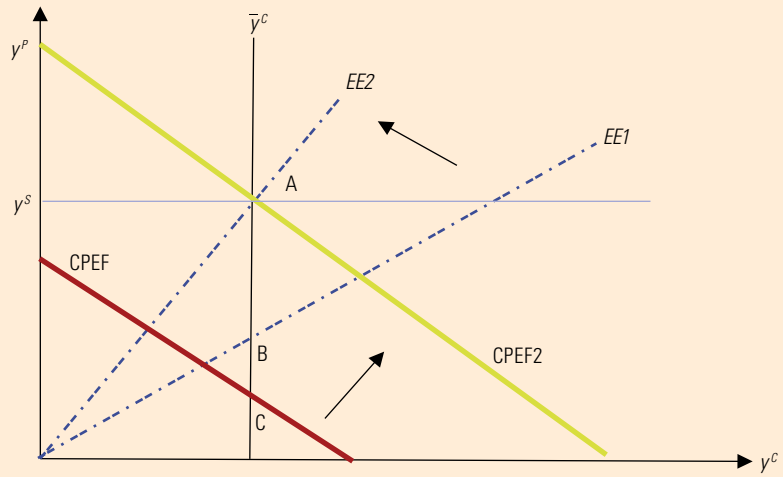


Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: y^P: growth rate of the periphery.
y^S: the rate of growth required for equality.
y^C: growth rate of the centre.
$\bar{y}^C$: exogenous growth rate of the centre.
EE: line of growth rate consistent with the external constraint, given by $y^P = (\varepsilon/\pi)y^C$.
EE1: initial growth consistent with external balance.
EE2: growth rate with external balance subsequent to an acceleration of technical progress in sustainable technologies at the centre, with the periphery lagging behind; clean technologies are imported by the periphery, with limited local capacity-building.
CPEF1: the environmental sustainability frontier prior to the implementation of innovation policies at the centre and changes in production and consumption patterns.
CPEF2: the new sustainability frontier.
Balance at point C: a world that is environmentally sustainable but socially and politically unsustainable because of high levels of inequality —sustainable development is not achieved (the distance between A and C remains significant).

Figure 5 illustrates a global economy that is sustainable in its three dimensions, creating a virtuous circle able to surmount the structural crises discussed in chapter I. In this representation, the international system has adopted a Global Green New Deal and policies for a big push for sustainability at the periphery. The external constraint is eased by the application of more favourable policies at the centre and greater technology absorption at the periphery (from *EE1* to *EE2*), which change the ratio between income elasticities of exports and imports. The centre-periphery environmental frontier, in turn, moves upwards (from CPEF1 to CPEF2) thanks to technological effort at both the centre and the periphery. Reaching point A requires that the same technological variables both promote environmental sustainability and support transformed production patterns and stronger international competitiveness at the periphery. The CPEF and *EE* lines must move upwards together. Since an environmentally friendly strategy that shifts the CPEF line but fails to change the elasticities ratio will not be able to bring about the growth rate necessary for equality with external equilibrium, then the basic condition for sustainable development —convergence towards the growth rate with equality— would be missing.

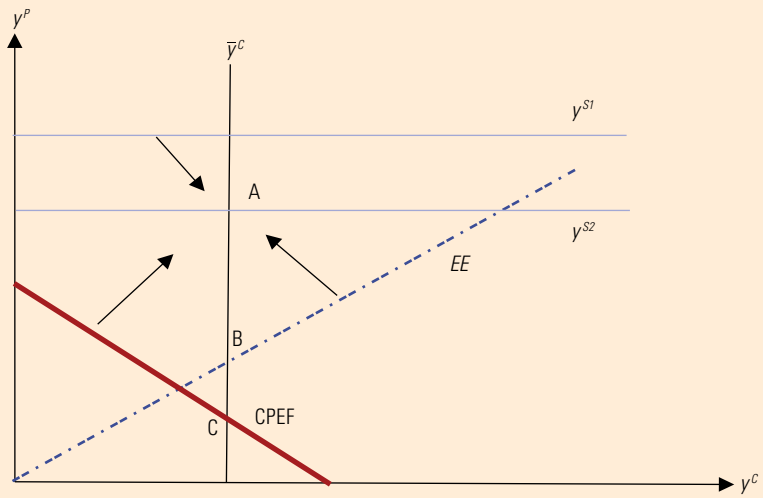
Lastly, figure 6 shows the complementarities between pro-equality social policies and international competitiveness and environmental protection policies. The impact of social policy should be seen not only as reducing the rate of growth needed for equality, but also as a stimulus for capacity-building. Pro-equality policies reduce the y^s rate and, at the same time, help to shift the CPEF and *EE* lines upwards, increasing the probability of closing the three gaps.

Figure 5
Common but differentiated responsibilities: the scenario of socially, economically and environmentally sustainable development



Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: y^P: growth rate of the periphery.
y^S: the rate of growth required for equality.
y^C: growth rate of the centre.
$\bar{y}^C$: exogenous growth rate of the centre.
EE: line of growth rate consistent with the external constraint, given by $y^P = (\varepsilon/\pi)y^C$.
CPEF: centre-periphery environmental frontier.
EE1→*EE2*: shift in the curve of growth compatible with external balance following the change in industrial and technology policy of the periphery towards the absorption of new technologies and green investments (big push).
CPEF1→CPEF2: change in the sustainability frontier subsequent to the policy change at the periphery.

Figure 6
Pro-equality policies also support technical progress



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Note: y^P: growth rate of the periphery.
y^S: the rate of growth required for equality.
y^C: growth rate of the centre.
$\bar{y}^C$: exogenous growth rate of the centre.
EE: line of growth rate consistent with the external constraint, given by $y^P = (\varepsilon/\pi)y^C$.
CPEF: centre-periphery environmental frontier.
Social policies lower the rate needed for equality from y^{S1} to y^{S2}. At the same time, they help to raise the *EE* and CPEF curves when combined with industrial and technology policies.

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

In short, sustainable development can only be achieved when the rate of growth compatible with external balance and the growth rate of environmental sustainability converge towards the rate of growth needed for equality. This convergence will not occur of its own accord, but only if social, industrial, technological and environmental policies are implemented in a coordinated manner. The sustainable development scenario also requires a new multilateral governance that recognizes the principle of common but differentiated responsibilities. Economies that are now considered developed must make room for the growth of the periphery and remove the barriers that prevent access to environmental technologies and their diffusion. Two opposite extremes were presented here: one in which technological, trade and power asymmetries are reproduced; and another in which multilateral governance and national policies are based on equality, with this and future generations in mind. What will happen in the next few years remains very uncertain and is likely to be a combination of both scenarios. Nevertheless, it is posited that only the latter scenario could create a global economy with stable, sustainable growth, in which the growing political and geopolitical tensions of recent years begin to subside.

F. The size of the three gaps in Latin America and the Caribbean

In the section above, the rate of growth consistent with the external constraint was argued to exceed environmentally sustainable growth, because it breaches the constraint of environmental balance. It is also lower than that the rate of growth needed for equality, insofar as it is unable to generate the quality jobs that, when combined with social policies, would reduce inequality. It therefore holds that $y^S > y^E > y^A$. This section measures the three growth rates in Latin America and the Caribbean and considers the preconditions for closing the three gaps, obtaining $y^S = y^E = y^A$, where the policy objective should be to cause all rates to converge at y^S.

1. The external constraint

The ratio between export and import income elasticities can be used to calculate the rate of growth compatible with external balance for Latin America and the Caribbean, given the growth of the rest of the world.[6] Table II.1 shows the results of the estimation of the elasticities ratio. While the results vary significantly by country, only in the case of Panama is the ratio close to 2. The average ratio of income elasticity of exports to imports in South America (ε/π) is approximately 0.7. This means that if global growth were to reach 2% in the next few years, this subregion could grow by 1.4% without increasing its external debt. In Mexico, which has a ratio of 0.8, the external constraint places a ceiling of 1.6% on growth. In both cases, this is far short of the growth required to make a real impact on poverty, even with the implementation of robust redistribution policies. The quantitative exercises carried out for the countries of the Caribbean Community (CARICOM) during the period 1990–2005 estimate an average rate of growth compatible with external balance of 3%. However, high levels of external debt in many of those economies suggest that this rate would be difficult to achieve as it does not take into account the impact of debt service.

6 It should be recalled that $y^E = (\varepsilon/\pi)y^C$, where y^C, is the growth rate for the rest of the world (see box II.2).

Table II.1
Latin America (17 countries) and Asia (3 countries): foreign trade elasticities, by country and subregion, 1993–2017

		A. Income elasticity of exports	B. Income elasticity of imports	Ratio A/B
South America	Argentina	0.9	1.5	0.6
	Bolivia (Plurinational State of)	1.7	1.3	1.3
	Brazil	1.0	1.7	0.6
	Chile	2.1	1.5	1.4
	Colombia	1.7	1.6	1.0
	Ecuador	1.1	1.2	0.9
	Paraguay	1.0	1.0	1.0
	Peru	2.0	1.4	1.4
	Uruguay	1.5	1.3	1.1
	Venezuela (Bolivarian Republic of)	0.4	2.4	0.2
Central America and Mexico	Costa Rica	1.8	1.1	1.6
	El Salvador	1.3	1.1	1.1
	Guatemala	2.0	2.2	0.9
	Honduras	1.3	0.9	1.4
	Mexico	1.8	2.3	0.8
	Nicaragua	2.9	2.0	1.4
	Panama	1.5	0.8	1.9
Asia	China	4.5	1.6	2.8
	Republic of Korea	3.7	1.5	2.5
	Viet Nam	5.0	2.1	2.3
South America		1.1	1.5	0.7
Central America		1.7	1.4	1.3
Central America and Mexico		1.7	1.4	1.3

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of data from World Bank and International Monetary Fund (IMF).
Note: Estimates of the income elasticity of exports were based on exports and global GDP at constant prices, and estimates of the income elasticity of imports were based on imports and each country's GDP at constant prices. The real exchange rate was used as a control variable for both equations. All variables were expressed in logarithmic levels.

The above values differ greatly from those of the most successful Asian countries, which all show an elasticity ratio greater than 2. For example, with hypothetical global growth of 2%, China could grow by as much as 6% without being affected by the external constraint.

2. The rate of growth required for equality

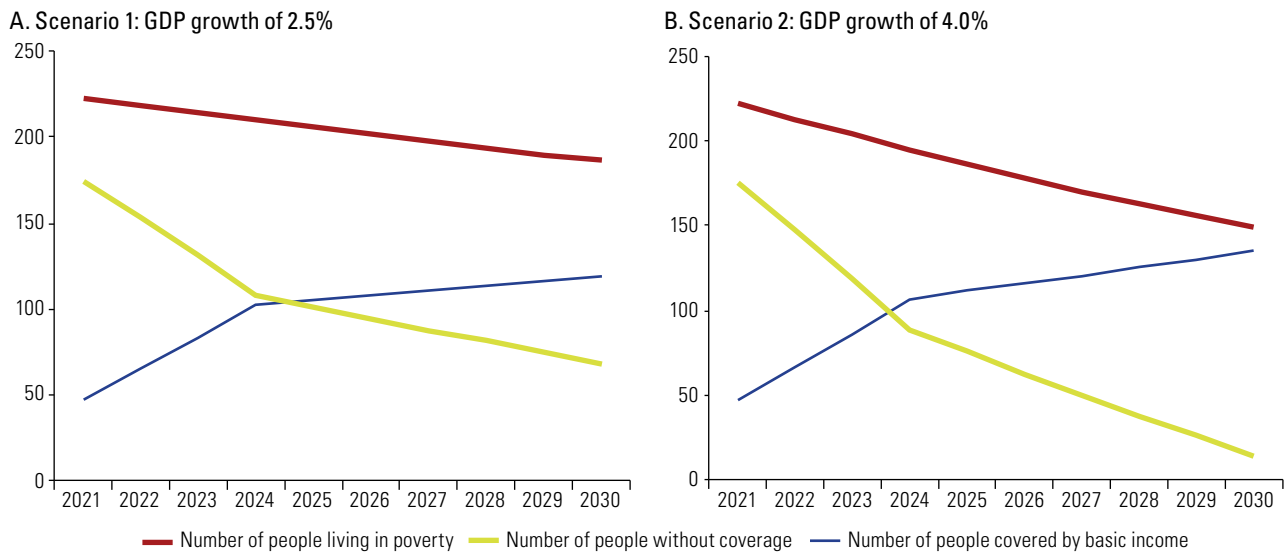
In order to achieve a significant and lasting reduction in inequality, growth must reach a critical rate or threshold at which quality jobs can be generated and social and redistribution policies financed. As a quantitative indicator of progress towards equality, the target used is the eradication of monetary poverty. This is an ambitious target, given that the pandemic has significantly increased the percentage of poor: it is estimated that number of people living in poverty could reach 231 million (37.8% of the population of Latin America and the Caribbean) in 2020.

The exercise below assumes the following redistribution policy: for the first year (2021), the government redirects 1.5% of GDP to the poorest households in the form of an emergency basic income consisting of a cash transfer equivalent to the poverty line, increasing the amount of the transfer by 0.5 points of GDP annually to reach 3.0% of GDP in 2024, whereupon it would remain constant until 2030. The number of poor will decrease over time, as GDP growth creates jobs and as the basic income transfers lift more and more people out of poverty. The latter effect is explained by the increase in the share of GDP allocated to transfers

between 2021 and 2024, and the fact that the increase in GDP means that while the same percentage is transferred, the monetary amount received is higher.

Figure II.1 shows the changes in the number living in poverty in Latin America and the Caribbean under two annual GDP growth scenarios: 2.5% and 4.0%. The GDP growth rate of 2.5% is a projected post-pandemic rate, which takes into account the impact of the pandemic and past trends in GDP growth. This is considered the business-as-usual growth rate. The 4.0% rate represents a more favourable scenario, which supposes a major boost in the region's competitiveness and technological capacities (increasing the ratio between elasticities, as discussed above). The red line in figure II.1 represents the total number of poor while the blue line represents the number covered by basic income. Thus, the gap between the blue and red lines indicates the number of people not covered by basic income and, therefore, living in poverty.

Figure II.1
Latin America and the Caribbean: redistribution policy and growth rates required to eradicate poverty in the region, 2021–2030
(Millions of people)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Simulations show that only with GDP growth of 4.0%, in combination with the redistribution policy outlined above, would Latin America and the Caribbean come close to the poverty eradication target (about 2.0% of the population would continue to live in poverty). Business-as-usual growth (2.5%) in combination with a redistribution policy would result in close to 10% of the population still living in poverty by 2030, while 4.0% growth without a redistribution policy would leave almost 20% of the population in poverty by the end of the period (2030).[7]

In short, with a combination of distributive policy (gradual increase in transfers from 1.5% to 3.0% of GDP) and economic growth (4.0% per year), it would be possible to eradicate poverty by 2030.

This numerical exercise focused on reducing the number of poor in order to illustrate how poverty could be eradicated by allocating a certain share of GDP to social spending and reducing inequality to an extent that is economically and politically feasible. In practice, countries could choose to allocate 1.5% of GDP to eradicating extreme poverty in the first year and progress towards reducing the number of non-extreme poor in subsequent years. This would eliminate poverty in a less "linear" manner than depicted in figure II.1 by 2030.

[7] In the scenario without a distributive policy, it is assumed that the Gini coefficient falls to the business-as-usual rate of the previous period, which was approximately 0.8% per year.

Distributive policies are likely to reduce inequality significantly. If the social transfer to the poorest 10% of the population were financed by taxes levied on the richest 10%, the ratio of the income of the richest 10% relative to the poorest 10% would shrink from 20 to 9, the Palma ratio (the income share of the richest 10% divided by that of the poorest 40%) would fall from 2.6 to 1.9, and the Gini index would drop from 0.46 to 0.40, bringing the region's Gini into line with that of Uruguay by 2030. Such reductions in inequality are not unattainable: while inequality would remain higher than in the countries of the Organization for Economic Cooperation and Development (OECD), it would be significantly reduced and poverty virtually eradicated.

Neither economic growth nor redistribution policies alone can be relied upon to reduce poverty: a combination of both is needed. Although GDP growth of 4.0% exceeds all the rates of growth compatible with external balance in the various subregions (South America, Central America and Mexico, and the Caribbean), it is within reach for some countries, such as Costa Rica and Panama. The pandemic has generated great uncertainty about future growth rates, making the scenario of an average annual growth rate of 4.0% through to 2030 seem overly optimistic, especially in the event of a prolonged recession in the global economy. This means that redistribution and social protection policies take on heightened strategic importance.

3. The growth rate consistent with preservation of the environment and nationally determined contributions

The growth rate consistent with the planetary balance is determined by the centre-periphery environmental frontier. In line with the Latin American and Caribbean focus of this document, this frontier is constructed distinguishing between two regions: Latin America and the Caribbean, and the rest of the world. In the exercises below, it is assumed that the principle of common but differentiated responsibilities is respected, and that Latin America and the Caribbean only has to meet nationally determined contributions (NDC), while the rest of the world makes the necessary adjustments to achieve the 2°C and 1.5°C targets.

Under the Paris Agreement, countries are required to define and implement their nationally determined contributions and to progressively increase their targets. These contributions are a key frame of reference for linking national policies that support the big push for sustainability with actions conducted under the international agenda to keep the world within the environmental sustainability frontier. Although countries have committed to significant reductions through their NDCs, even if all the commitments are met, that action is still far from what is required (UNEP, 2019). Furthermore, the outcomes of the twenty-fifth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 25) do not augur well for the future, as most of the major emitters of GHGs have not shown the required level of ambition.

Therefore, mere compliance with conditional NDCs is clearly inadequate as an emissions reduction target for Latin America and the Caribbean, even if it is accepted that the region bears less responsibility than the rest of the world for the environmental crisis. ECLAC is in favour of a significant strengthening of NDCs in the next few years and maintains that environmental policy must be a main focus of recovery. With this proviso, the NDC criteria are used in the numerical exercises as a first attempt to estimate the scale of the decarbonization effort and technical shift towards sustainability needed in the region over the next decade. The 33 countries of Latin America and the Caribbean have set out the goals for mitigation and adaptation, as well as the sectors to be prioritized and financing needs, in their first NDCs.[8]

On the basis of the NDCs adopted by the countries of Latin America and the Caribbean, table II.2 shows the projections for the total emissions for Latin America and the Caribbean and the rest of the world until 2030. These are then used to calculate the differences in emissions in a business-as-usual scenario and in four alternative scenarios: (a) unconditional reduction under the NDC; (b) conditional reduction under the NDC; (c) reduction needed based on scientific studies to limit the temperature rise to below 2.0°C; and (d) reduction

[8] Countries' NDCs can be consulted in UNFCCC (n/d). The intended nationally determined contributions (INDCs) of Ecuador and Suriname are available [online] at http://www4.unfccc.int/submissions/INDC/Submission%20Pages/submissions.aspx.

needed based on scientific studies to limit the temperature rise to below 1.5°C.[9] As the reductions in the NDCs were established as percentages with respect to the business-as-usual scenario prior to COVID-19, an additional calculation of a scenario of emissions excluding the pandemic is necessary for scenarios (a) and (b). The difference between the unconditional and conditional scenarios corresponds to the expected contributions of developed economies in the form of financing and technology transfer for the diffusion of clean technologies in the region.

The emissions projection relies on the close relationship between economic growth and emissions. For the period 1990–2019, average GDP growth in Latin America and the Caribbean was 2.5%, while emissions rose by 0.6%, resulting in annual decoupling rate of 1.9% (see table II.2). Although the carbon intensity of Latin America and the Caribbean (around 0.7 kg of emissions per dollar of GDP) is similar to that of the rest of the world, the region's decoupling rate is higher than that of the rest of the world. This is mainly attributable to the slowdown in deforestation in Brazil since 2005, a trend that has been reversed over the past two years.

Table II.2
Latin America and the Caribbean (33 countries) and the rest of the world: basic statistics, 1990–2019

Indicator	2019		Average annual growth rate, 1990–2019 *(percentages)*	
	Latin America and the Caribbean[a]	Rest of the world[b]	Latin America and the Caribbean[a]	Rest of the world[b]
Emissions *(gigatons of CO_2 equivalent)*	4.3	45.6	0.6	1.3
GDP *(billions of dollars at constant 2010 prices)*	5.841	77.112	2.5	2.8
Carbon intensity *(kg of CO_2 equivalent per dollar)*	0.7	0.6	-1.9	-1.4

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of J. Gütschow and others, *The PRIMAP-hist national historical emissions time series (1850-2017)*, vol. 2.1, GFZ Data Services; CEPALSTAT database; World Bank, World Development Indicators and Food and Agriculture Organization of the United Nations (FAO), Corporate Database for Substantive Statistical Data (FAOSTAT) [online] http://www.fao.org/faostat/en/.

Note: The sources of greenhouse gas emissions are the energy, agriculture and livestock, waste, industrial processes and land-use change and forestry sectors, according to the Intergovernmental Panel on Climate Change (IPCC) classification. Emissions figures for 2018 and 2019 are estimates.

[a] Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Bolivarian Republic of Venezuela, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Plurinational State of Bolivia, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago and Uruguay.

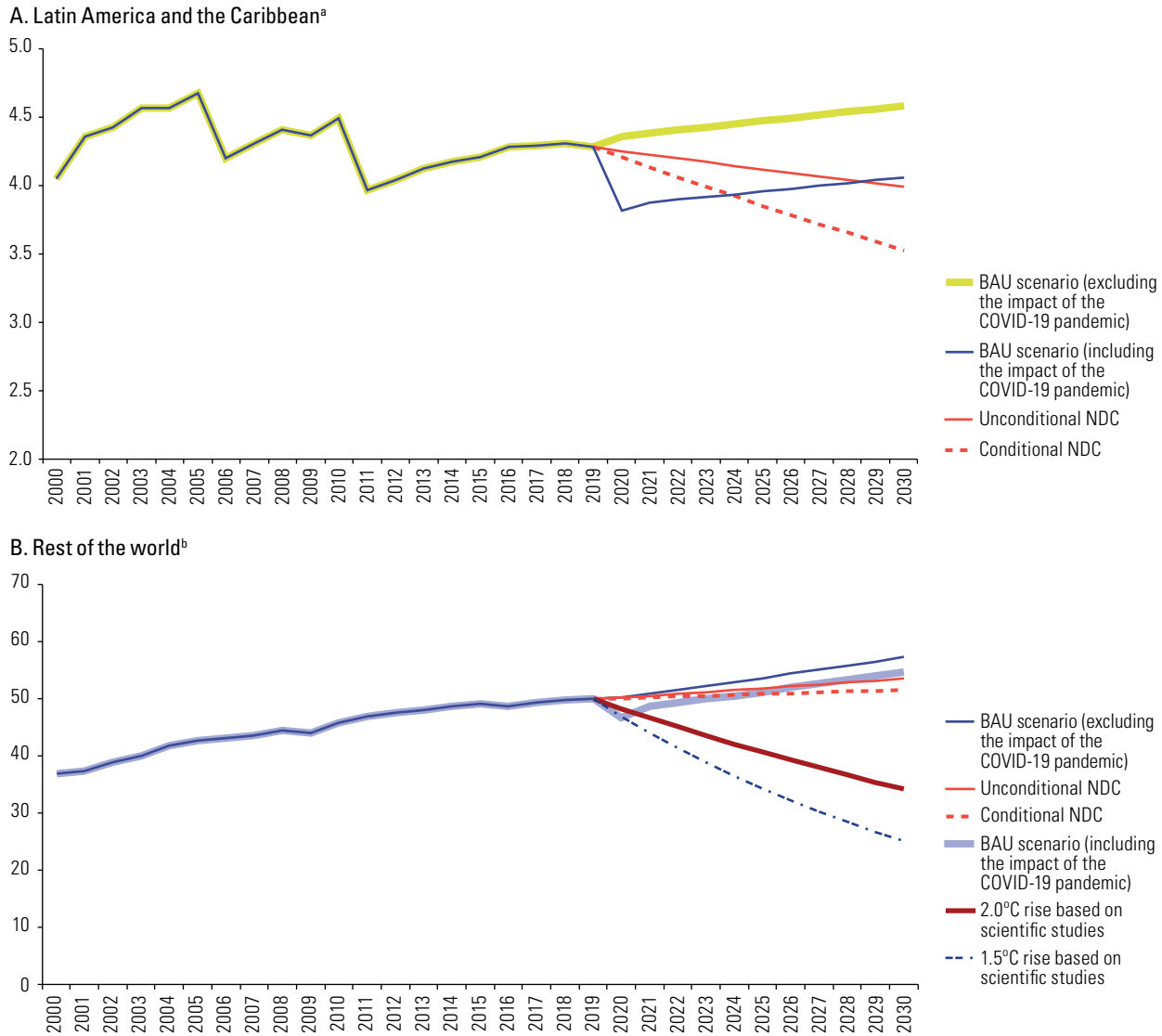
[b] Comprises 133 countries.

Figure II.2 shows the emissions pathways for Latin America and the Caribbean and the world to 2030 in accordance with the various scenarios. To construct the business-as-usual scenario that incorporates the effects of the pandemic, estimates of a 9.1% contraction of GDP for 2020 and 3.7% growth in 2021 are used for Latin America and the Caribbean; for the rest of the world, it is assumed that GDP will fall by 4.9% in 2020 and pick up by 5.4% in 2021. From 2022 to 2030, it is assumed that the economy's GDP and carbon intensity will maintain similar patterns to those recorded between 1990 and 2019. The scenarios consistent with the unconditional and conditional targets are calculated on the basis of the aggregated commitments of the countries of Latin America and the Caribbean (Samaniego and others, 2019) and the estimates of the *Emissions Gap Report 2019* (UNEP, 2019). As noted above, the percentage reductions for Latin America and the Caribbean reflect a scenario in which GDP is not affected by COVID-19, since the contributions were negotiated before the pandemic.

Given the assumption that Latin America and the Caribbean will only have to meet its conditional commitments while the rest of the world makes the necessary adjustments to achieve the 2°C and 1.5°C targets, the region's emissions would have to fall by 23% in the 2°C and 1.5°C scenarios, both of which have conditional NDCs, with respect to the business-as-usual scenario. For this to happen, emissions in the rest of the world would have to fall by 40% and 60% with respect to the BAU scenario, respectively, if the science-driven targets are to be met.

[9] The reduction of emissions is conditional upon the receipt of international support.

Figure II.2
Latin America and the Caribbean and the rest of the world: level of emissions in different scenarios, 2000–2030
(Gigatons of CO_2 equivalent)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of J. Gütschow and others, *The PRIMAP-hist national historical emissions time series (1850-2017)*, vol. 2.1, GFZ Data Services; CEPALSTAT database; World Bank, World Development Indicators and Food and Agriculture Organization of the United Nations (FAO), Corporate Database for Substantive Statistical Data (FAOSTAT) [online] http://www.fao.org/faostat/en/.

Note: The sources of greenhouse gas emissions are the energy, agriculture and livestock, waste, industrial processes and land-use change and forestry sectors, according to the Intergovernmental Panel on Climate Change (IPCC) classification.

[a] Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Bolivarian Republic of Venezuela, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Plurinational State of Bolivia, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago and Uruguay.

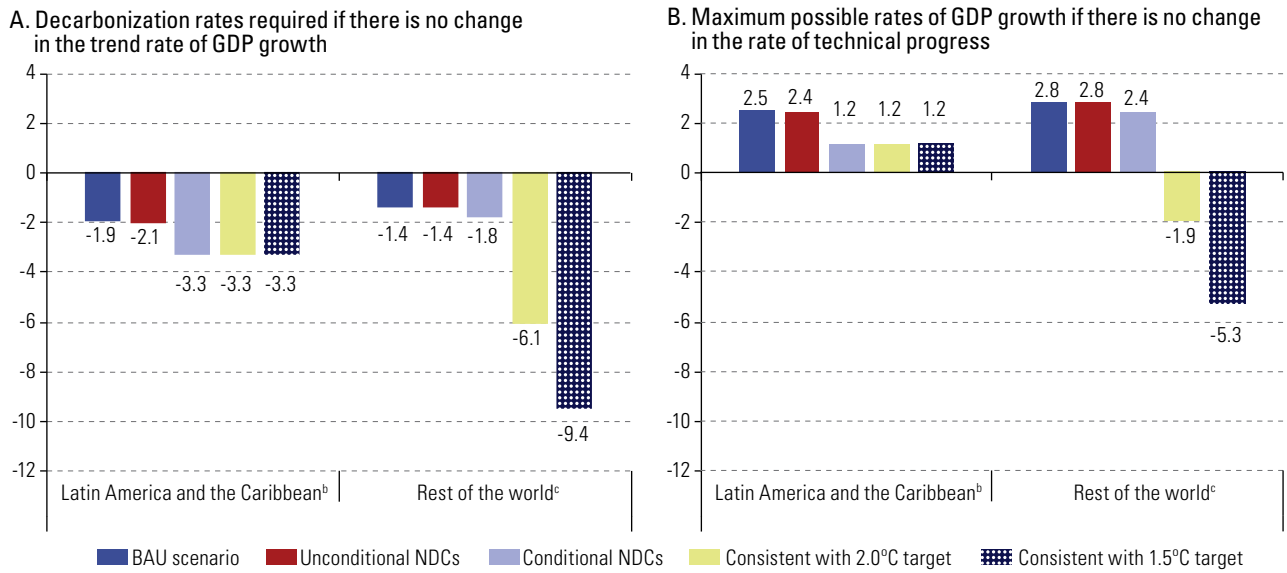
[b] Comprises 133 countries.

The dotted red line represents the emissions pathway Latin American and Caribbean countries undertook to follow in their conditional NDCs. This line transects the trajectory of the post-pandemic BAU scenario in 2024, which gives the region a four-year window of opportunity to redefine its energy, technology and production patterns and decouple emissions from economic growth. Graphically, Latin America and the Caribbean must jump from the blue line to the dotted red line, which means taking a new path of economic growth and changing the ratio between emissions and GDP. Given the severe impact of the pandemic on GDP, in the

next four years the region's emissions could fall below the levels it pledged to achieve in its NDCs, but the necessary changes will have to be made so as not to exceed those levels once the economy returns to its previous levels of GDP growth.

How can this reduction in emissions be achieved? There are two possible avenues and these may be combined to some extent. First, the growth rate can be maintained, but with an acceleration of technical progress and a decoupling of GDP growth from emissions. Second, the trend rate of technical progress (decarbonization) can be maintained, but with a lower growth rate. An exercise including both possibilities is shown in figure II.3.

Figure II.3
Latin America and the Caribbean and the rest of the world: technical progress and environmentally sustainable GDP growth, 2020–2030
(Percentages)[a]



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of J. Gütschow and others, *The PRIMAP-hist national historical emissions time series (1850-2017)*, vol. 2.1, GFZ Data Services; CEPALSTAT database; World Bank, World Development Indicators and Food and Agriculture Organization of the United Nations (FAO), Corporate Database for Substantive Statistical Data (FAOSTAT) [online] http://www.fao.org/faostat/en/.

Note: The sources of greenhouse gas emissions are the energy, agriculture and livestock, waste, industrial processes and land-use change and forestry sectors, according to the Intergovernmental Panel on Climate Change (IPCC) classification.

[a] Average annual growth.

[b] Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Bolivarian Republic of Venezuela, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Plurinational State of Bolivia, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago and Uruguay.

[c] Comprises 133 countries.

In panel A of figure II.3, the assumption is for average growth of 2.5%[10] and a faster pace of technical progress to meet the decarbonization rates needed to achieve the objectives. In the BAU scenario, decarbonization in Latin America and the Caribbean would occur at a rate of 1.9% per year. The region would have to increase its decarbonization rate to 2.2% to comply with unconditional NDCs, while decarbonization at an annual rate of 3.4% would be required to meet conditional commitments.

The rest of the world would decarbonize the economy at an annual rate of 1.4% in the BAU scenario. This rate is sufficient to meet unconditional commitments but would have to increase to 2.1% for conditional NDCs to be met. If the science-driven targets of keeping the temperature rise below 1.5°C and 2°C are to be met, economies at the centre would need to achieve a decarbonization rate of 6.1% and 9.4% per year, respectively.

Panel B of figure II.3 illustrates the centre-periphery environmental frontier as a restriction to growth. In this figure, the technical shift towards decarbonization coincides with 1990–2019 levels, but the economic growth rates are adjusted for emission reductions in each scenario. In this case, the projected annual growth

[10] Growth is assumed to reach 3.7% in 2021 and 2.5% (the historical growth level) from 2022 to 2030.

rate for Latin America and the Caribbean for 2021–2030 (2.5%) would have to be 0.1 percentage point lower for unconditional NDC targets to be met and more than 1 percentage point lower (annual growth of approximately 1.2%) for conditional NDC targets to be met. In the absence of an acceleration of the technical shift towards decarbonization, the growth rate corresponding to the conditional NDCs and business-as-usual in technical progress (1.2%) will be considered to be the environmentally sustainable rate.

4. The arithmetic of sustainable development: combining the rates of growth required for equality, growth compatible with external balance and the environmentally sustainable rate

The growth rate compatible with external equilibrium was obtained by calculating the income elasticities of exports and imports. The rate of growth needed for equality was obtained by combining income redistribution with growth. The environmental sustainability rate was obtained by analysing the changes in the ratio between emissions and GDP. When these three rates are compared, the magnitude of the sustainable development challenge and the synergy required between technical progress, structural change, social policy and environmental policy become apparent. While international assistance related to conditional NDCs can help to procure technology and financing for certain environmental projects, it is not enough to alter the rate of growth compatible with external balance.

Table II.3 summarizes the main results of the simple pathway simulation exercises carried out above. The first two rows show the 2020 levels and the targets for 2030 for poverty and GHG emissions. The intersections of the other rows with the poverty and emissions columns show how each variable changes under different scenarios of growth, distribution and investment in the decarbonization of the economy. These scenarios are defined based on the following criteria:

- GDP growth rates in Latin America and the Caribbean (4.0% and 2.5%);
- existence or not of redistribution policies for income transfers; and
- existence or not of investments in the decarbonization of the economy, which could double the historical decarbonization rate.[11]

Table II.3
Latin America and the Caribbean: estimates and scenarios for growth, equality and ecological and environmental sustainability, 2030

		Poverty *(percentages)*	Emissions *(gigatons of CO^2 equivalent)*	Required ratio between income elasticities of exports and imports
2020 (estimates)		37.3	3.8	
Target for 2030		0	4.0 (unconditional) 3.5 (conditional)	
Scenarios to 2030	Assumptions			
Growth + transfers (basic income)	4.0% GDP growth	2	4.6	1.4
	2.5% GDP growth	10	4.1	0.9
Growth without transfers	4.0% GDP growth	19.8	4.6	1.4
	2.5% GDP growth	24.8	4.1	0.9
Growth + transfers + decarbonization	4.0% GDP growth Basic income Duplication of decarbonization rate of the economy	2	3.9	1.4
	2.5% GDP growth Basic income Duplication of decarbonization rate of the economy	10	3.3	0.9

Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: A growth rate of 2.8% for the rest of the world is assumed for the calculation of the elasticity ratio of the external gap. Two growth scenarios are included: one of high annual growth of 4.0% and one of medium annual growth of 2.5%. The scenario excluding transfers assumes a downtrend in the Gini index of 0.8% per year.

[11] Doubling the historical decarbonization rate, which was -1.9% from 1990 to 2017, would, for example, increase the share of primary energy in the total energy supply matrix from the current 25% to 45%. Thus, accelerating the decarbonization of the economy requires taking action in different areas: renewable energy generation, energy efficiency, electromobility and modal shifts, reduction of deforestation, afforestation, sustainable agriculture and livestock, or waste management, among others.

The final column of table II.3 shows the ratio between the income elasticities of exports and imports required to achieve growth rates of 4.0% and 2.5% with external balance, assuming global growth of 2.8%. The estimated ratios should be compared with those observed in the different subregions of Latin America and the Caribbean. The results of the exercise are as follows:

- In order to achieve poverty reduction targets, high GDP growth rates must be combined with an increase in transfers (from 1.5% of GDP to 3.0% of GDP) between 2021 and 2030. On this basis, an annual growth rate of 4.0% would be the minimum rate needed for equality.
- However, this rate generates emissions above the level established in NDCs. This shows that the growth rate needed for equality (4.0%) exceeds the rate of growth consistent with environmental preservation (1.2% with business-as-usual progress in technology). The region would have to make major efforts in terms of technical progress and structural change towards decarbonization to bring the two rates into line.
- The growth rate compatible with external balance is lower than the growth rate needed for equality (4.0%) in South America and Mexico. To maintain external balance with a growth rate of 4.0%, the ratio between income elasticities of exports and imports would have to double from 0.7 to 1.4, assuming continued global growth of 2.8%. In some Caribbean countries, the ratio between the elasticities would allow growth of 4.0% maintaining external balance, but high debt levels mean that this calculation underestimates the effort that these subregions would have to make to attract foreign exchange in order to meet the growth targets without hitting the external constraint ceiling, as discussed in chapter I.
- In all cases, the growth rate consistent with environmental sustainability (1.2%, assuming that decarbonization follows the trends of the past decade) is lower than the rate of growth with external balance, even in South America, where it is lowest.

These outcomes derive from the use of the averages for Latin American and Caribbean economies, which hide significant differences. A higher percentage of poor requires a greater redistributive effort and higher rates of growth of GDP and employment to reduce that percentage. The exercises above illustrate the challenge of using a hypothetical average economy for the region and should be considered in the light of the specific context of each country.

G. Final remarks

This chapter defined three growth rates and three gaps. The objective of sustainable development in its three dimensions —economic, social and environmental— is to close these gaps. To this end, social policies, policies for structural change and bridging the technology gap, and environmental policies must be implemented in a coordinated manner.

Bringing the rates consistent with external balance and environmental sustainability into line with the growth rate needed to systematically reduce inequality will require a leap in genuine competitiveness in the region, as well as a shift in the direction and pace of technical progress, decarbonization and environmental protection. This path represents not only a radical change in the development pattern, which can only be achieved with an integrated package of strategies and policies such as those discussed later in this document, but also a major political economy challenge. At the international level, cooperation must prevail over geopolitical rivalry and conflict; at the national level, political agreements in a context of democracy must transform the culture of privilege into a culture in which equality and innovation go hand in hand. These issues will be addressed in detail in the following chapters.

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CHAPTER

III

Scenarios for a new development pattern

Introduction

Achieving a sustainable development process in all three of its dimensions requires a coordinated policy effort that, taken as a whole, represents a "big push for sustainability". These policies act upon a number of different variables whose non-linear interactions make it very difficult to foresee policy outcomes without the help of mathematical models. These models can provide a quantitative picture of policy impacts, as well as the direction of policy-driven changes. This chapter presents a number of different scenario-based simulations using various types of economic models.

In economics, mathematical models can be constructed using a wide range of different assumptions, and it is important to clarify what those assumptions are in order to understand which models will be useful under what circumstances and what their limitations are. In this chapter, different models based on differing assumptions will be used to explore a number of problems and contexts. In each case, the model's underlying assumptions will be outlined so that its applications, scope and shortcomings can be understood. This methodological pluralism contributes to the construction of more robust evaluations by making it possible to include multiple theories formulated under varying hypotheses which, in turn, represent the many different factors and contexts to which the analysis applies.

This discussion will begin with simulations conducted using the E3ME global macroeconomic model of socioeconomic, energy and environmental systems created by Cambridge Econometrics.[1] This is a hybrid model built out of top-down and bottom-up components in which outputs are driven by demand but subject to supply constraints. Changes in aggregate demand are translated into changes in production, employment, investment, international trade and prices. The interactions of these variables are validated against historical relationships expressed by econometric coefficients and the structure of the economy as reflected in input/output tables. The model has its origins in post-Keynesian economic theory and opens the way for analysing the effects of technical progress (based on cumulative investment and on research and development (R&D)) on emissions, energy consumption patterns and growth. It is used here to simulate the effects of national policies designed to give a big push for sustainability and global environmental policies.

The analysis will then move on to two case studies: one of the Brazilian economy using the E3ME model, and the other of the Chilean economy using a general equilibrium model. These case studies include certain dimensions that the previous models do not incorporate, such as, for example, these policies' impacts on individual sectors and on investment levels and the role of gender in job creation in renewable energy industries. In addition, the general equilibrium model also serves as a counterpoint to the other two models, in which disequilibrium and changing production patterns predominate.

The third model is an agent-based model (ABM) with heterogeneous agents, which is rooted in the evolutionary tradition. This model's starting point is the decisions taken by individual firms and how they interact in markets where they compete on the basis of innovation and technology diffusion. Under this model, the macroeconomic outcome is thus an emerging property of microeconomic dynamics. It focuses on the building of technological capacities and genuine competitiveness: each firm's share in the market is determined by the relative speeds of innovation (by pioneering firms) versus diffusion (learning by the firms that follow the pioneering firms' lead). Innovation and structural change influence the quantity and quality of jobs, and wages also change in response to technical change and market concentration. The E3ME and ABM models have some points in common,[2] but they also complement one another[3] because one focuses on demand dynamics while the other focuses on technological dynamics.

1 The E3ME model© copyright is owned by Cambridge Econometrics.

2 The points that they have in common are: (a) the inclusion of historical data and of path dependence phenomena in the analysis; (b) their flexibility in considering the effect of different institutional contexts on economic and technological variables; and (c) the attribution of a central role to policy in overcoming the inertia of production and consumption patterns that turn into low-growth and low-learning traps (with technological lags being perpetuated over time) and high-pollution traps.

3 The complementarity between Keynesian economics (demand-side factors that drive or curb growth) and evolutionary economics (supply-side factors that drive or curb growth) has already been explored in other ECLAC studies (see ECLAC, 2012).

It is important to note that the quantitative exercises that will be presented here represent only one side of the big push for sustainability. Numerous sectoral and cross-cutting measures are needed in order to bring about structural change, and those measures, taken together, are what engender the policies that drive the big push for sustainability. This is why the discussions and analyses presented in this chapter should be interpreted and examined in conjunction with chapters IV and V.

A. Sustainable development tools and policy packages

E3ME is a hybrid macroeconomic non-equilibrium simulation model of global environmental, energy and economic systems that can be used to derive estimates of different policies' impacts on these three systems. Its theoretical approach is a pluralistic one (Scrieciu, 2011), as it integrates contributions from various disciplines (e.g. climate science, engineering, history and ethics) and various academic traditions within the field of economics (e.g. post-Keynesian, structuralism, evolutionary economics and institutional economics) (Barker and others, 2012; Barker, 2008; Barker and Scrieciu, 2010; Scrieciu, Barker and Ackerman, 2013).

E3ME generates annual results for the principal energy, environmental and economic variables using econometric techniques of cointegration and error correction to analyse these variables' short-run fluctuations around their long-run relationship. The E3ME's structure is based on the standard national accounts framework, with links to energy demand and environmental emissions balances. This model covers 61 countries, territories and regions, including Argentina, Brazil, Colombia and Mexico as individual countries and the rest of Latin America and the Caribbean in the aggregate (Cambridge Econometrics, 2019).[4] It uses a detailed sectoral breakdown that includes 43 sectors for each of the world regions other than Europe, including Latin America and the Caribbean.

The economic module feeds measurements of economic activity and general price levels into the energy module, which then determines the levels of energy consumption and energy prices. This information is then passed to the environmental module to generate emissions levels and is also fed back into the economic module. In E3ME, the economy is demand-driven, while supply adjusts (subject to any constraints) to demand but not necessarily at maximum capacity. The model uses varying returns to scale based on the empirical evidence, with econometric estimates being computed for each sector and each country.

The four scenarios used for the E3ME model are shown in table III.1. The first is a baseline —or business-as-usual (BAU)— scenario. The second is constructed by adding exogenous shocks to the baseline that represent the effects of the COVID-19 pandemic. This COVID scenario, which is intended to capture the impacts of the pandemic, includes a high level of uncertainty about the outcomes, since the "old normal" has ceased to be a valid point of reference for the future. The third scenario simulates a recovery from the adverse effects of the COVID-driven crisis that is brought about by policies designed to generate a big push for sustainability. The purpose of the "big push" policy scenarios is to determine if the introduction of policies to boost investment in technologies having low levels of greenhouse gas (GHG) emissions with a view to fulfilling the commitments assumed under nationally determined contributions (NDCs) will not only help to protect the environment but also spur a recovery of economic activity and the achievement of the objectives of equality and welfare that are essential components of a sustainable development process. The fourth scenario simulates a world that complies with the NDCs and supports the climate change mitigation efforts of developing economies.

[4] The countries and territories represented in the aggregate for Latin America and the Caribbean are: Bolivarian Republic of Venezuela, Chile, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Nicaragua, Panama, Paraguay, Peru, Plurinational State of Bolivia, Puerto Rico, Suriname, Trinidad and Tobago, and Uruguay.

Table III.1
Latin America and the Caribbean and the rest of the world: scenarios simulated with the E3ME model and the instruments used

Scenario	Description	Latin America and the Caribbean	Rest of world
Business as usual scenario "The old normal"	Represents the antithesis of the big push for sustainability, as it reproduces the existing social, economic and environmental divides in Latin America and the Caribbean. Does not incorporate the effects of the pandemic.	No climate policies other than those already in place in Latin America and the Caribbean as noted in the Current Policies Scenario 2018 presented in *World Energy Outlook 2018* of the International Energy Agency (IEA, 2018). Does not include effects of the pandemic either.	No mitigation policies other than those already in place.
Coronavirus disease (COVID-19) scenario	Captures the impacts of the pandemic in a scenario that is subject to a high degree of uncertainty. No policies to promote a recovery based on a big push for sustainability.	New reference scenario based on the BAU scenario but with the addition of the impacts of the pandemic as projected by ECLAC (2020) for the countries of the region.	Negative economic shocks are in proportion to the IMF (2020) projections for each country. No measures are adopted pursuant to a global environmental agreement.
Unconditional big push scenario (without a global environmental agreement)	Only the countries of Latin America and the Caribbean introduce a recovery package based on policies intended to drive a big push for sustainability.	Introduction of policies to cut emissions by 13% by 2030 in line with the countries' unconditional NDCs: (i) Incentives for non-conventional renewable energy: – Public funding to cover 90% of capital costs of investments in 2020, with that subsidy being phased down to zero by 2030; – Non-conventional renewable energy subsidies (for wind, solar, biomass, biogas, geothermal and other energy sources). (ii) Incentives for low-carbon modes of transport: – Regulations establishing a low-emissions vehicle mandate (similar to those used by such countries as the United States) under which an annual 1.2% increase in the percentage of electric and hybrid vehicles sold each year is required from 2020 on. – Regulations establishing a mandatory minimum biofuel blend starting in 2020 that will be raised incrementally each year until, by 2030, the countries of Latin America and the Caribbean converge with the regulatory requirement in Brazil (27.5%). Meanwhile, Brazil continues to raise its standard following its historical trend. (iii) Yearly increases in public spending on health from 2020 to 2030 in: – Argentina: €2 billion; – Brazil: €7 billion; – Colombia: €300 million; – Mexico: €5 billion; – Other selected countries in Latin America and the Caribbean: €5 billion. (iv) Creation of fiscal space: – Phasing out of subsidies for fossil fuel consumption starting in 2022 in order to finance the measures outlined in (i) and (iii) above. – The measure indicated in (ii) above is a regulatory measure that does not generate direct fiscal costs.	Same as in the COVID scenario.
Conditional big push scenario (with a global environmental agreement)	The countries of Latin America and the Caribbean introduce an expanded recovery package based on policies intended to drive a big push for sustainability. The rest of the world also adopts measures pursuant to a global environmental agreement.	In addition to the policies envisaged under the unconditional big push scenario, the countries of Latin America and the Caribbean receive international support for investments in the reclamation of 3,918,444 hectares of forests in 2020–2030; this enables them to cut their emissions by 23% by 2030 in line with their conditional NDCs. Reforested areas: – Argentina: 83 000 ha – Brazil: 1 826 000 ha – Colombia 83 000 ha – Mexico: 705 600 ha – Other selected countries of Latin America and the Caribbean: 1 220 000 ha.	Environmental fiscal reforms reduce CO_2 emissions by 10% by 2030. This is done by introducing a tax of € 27 per ton of CO_2 and using those tax receipts to lower VAT and payroll taxes. International support is provided to the countries of Latin America and the Caribbean to help them to meet their conditional emissions mitigation commitments.

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of International Energy Agency (IEA), *World Energy Outlook 2018*, Paris, 2018; Economic Commission for Latin America and the Caribbean (ECLAC), "Addressing the growing impact of COVID-19 with a view to reactivation with equality: new projections", *COVID-19 Special Report*, No. 5, Santiago, 2020; International Monetary Fund (IMF), "A crisis like no other, an uncertain recovery", *World Economic Outlook Update*, Washington, D.C., 2020.

The business-as-usual (BAU), or baseline, scenario (without COVID) assumes that countries continue to follow a fossil-fuel-intensive development style and do not introduce any further mitigation policies in addition to the ones that are already in place. The description of the current development style is based on the Current Policies Scenario presented in the *World Energy Outlook 2018* published by the International Energy Agency (IEA, 2018), which reflects the public policies in effect as of mid-2018 and assumes that no new mitigation policies will be put in place. For example, it assumes that the European Union does not alter its Emissions Trading System in any way and that the cap and trade system introduced by the Republic of Korea in 2015 also remains unchanged. It also assumes that there are no incentives for the Latin American and Caribbean countries to switch over to low-carbon technologies and that their CO_2 emissions therefore rise steeply. Since the rest of the world does not introduce any additional mitigation policies either, CO_2 emissions also climb sharply elsewhere, and the goal of holding the rise in global temperatures at 1.5°C or below 2°C relative to preindustrial levels —as established in the Paris Agreement (UNFCCC, 2015)— is not met.

The COVID scenario is based on the incorporation of adverse consumption and investment shocks into the BAU scenario that are transmitted through foreign trade and the E3ME transmission channels. In each country, the shock is in proportion to the ECLAC impact projections (2020) for the countries of Latin America and the Caribbean and to the International Monetary Fund (IMF) projections (IMF, 2020) for countries in the rest of the world. Based on these shocks, new projections are generated of the impact of the crisis on socioeconomic variables (employment, investment, income, etc.), energy-related variables (e.g. use of fossil fuels) and emissions The COVID scenario serves as the point of reference for comparisons with the projections obtained for the big push scenarios.

Under the big push for sustainability scenarios, policies are adopted to help bring about a recovery in a way that will enable the Latin American and Caribbean countries to honour their conditional and unconditional nationally determined contributions (NDCs). Under the Paris Agreement, countries are required to define and implement their NDCs for the reduction of emissions. While it is acknowledged that the NDCs are not sufficient in and of themselves, it is understood that they represent commitments already assumed by the region and that they are therefore a good point of departure for the design of scenarios that offer an alternative to the predominant development pattern.

There are two types of big push scenarios. The unconditional big push scenario simulates policy mixes aimed at reducing CO_2 emissions in Latin America and the Caribbean by 13% relative to the baseline scenario by 2030, in line with the voluntary unconditional NDCs of the countries of the region. It is assumed that the rest of the world does not adopt any additional mitigation measures (IEA, 2018). Under the conditional big push scenario, the reduction in emissions in Latin America and the Caribbean is a more ambitious 23% by 2030 relative to the baseline scenario. Here, the assumption is that the rest of the world has made a commitment to reduce emissions by 10% (the composite rate derived from the rest of the world's countries' NDCs) by 2030 relative to the baseline and to provide financial and technological resources to assist the countries of Latin America and the Caribbean to introduce more ambitious mitigation measures in the form of reforestation initiatives (Samaniego and others, 2019). This second scenario entails the assumption that the world economy is functioning on the basis of a global multilateral agreement whereby the rest of the world applies a carbon tax to mitigate emissions which is counterbalanced by tax cuts in others areas (reductions in the value added tax (VAT) and payroll taxes, specifically), resulting in an environmentally focused, revenue-neutral tax reform.[5]

While this conditional big push scenario assumes the provision of international assistance for reforestation initiatives, it is important to note that access to technology and the periphery's possession of its own technological capacities are key components of global cooperation.

[5] These exercises are intended to illustrate the impacts of a fiscally neutral environmental policy. This does not preclude the levying of taxes in other areas as part of a tax reform package aimed at promoting income redistribution on a greater scale and an expansion of public investment.

Admittedly, on a global scale, the aggregate effect of the NDCs submitted by the countries falls short of what is needed to hold the increase in the earth's average temperature to under 2°C (UNEP, 2019). This is because the countries that are the source of the largest volumes of GHG emissions have not set sufficiently ambitious targets for themselves. In this respect, the scenario entailing a global environmental agreement does not go far enough. It is retained, however, because it reflects the countries' existing commitments and, as such, is a necessary starting point.

Dealing with climate change will require a new development pattern based on the new sectors and activities discussed in chapter IV. It will involve transcending "showcase modernity" (Fajnzylber, 1983), which perpetuates the (unsustainable) consumption patterns of rich societies without reproducing their productive and technological dynamism. The following sections will explore how a suitable mix of social, environmental, technological and industrial policies under some degree of international governance can help the Latin American and Caribbean region to fulfil its NDCs while at the same time promoting employment and improving income distribution.

The big push scenarios are intended to provide a way of gauging the potential for restoring economic activity, employment and income levels with the help of policies aimed at stimulating sustainable investments, especially in non-conventional renewable energy sources, the electrification of transport and reforestation. It is assumed that policies to promote sustainable forms of investment will start to be introduced immediately, in 2020, and the impacts of those policies are then analysed on an annual basis for the period up to 2030, thereby covering the established time frame for the Latin American and Caribbean countries' fulfilment of their NDCs and for the 2030 Agenda.

The reduction of emissions is the main objective in these public policy scenarios, but this objective must be sought as part of a transition towards sustainable development in a broader (social and economic) sense. This calls for policy packages that address an array of variables in addition to emissions. The following discussion will therefore encompass not only emissions but also growth, employment, the trade balance and income distribution, all of which are also dimensions of the sustainable development policies addressed in chapter V.

B. Impacts of "big push" policies under different international scenarios amid the COVID-19 crisis

1. The business-as-usual scenario and the COVID-19 scenario

The exercises and simulations presented below yield aggregate results for the region that do not represent any given country in particular. They should therefore be viewed as illustrations of the kind of influence that sustainable development policies could potentially have. The scale and timing of impacts may differ sharply across countries, given the heterogeneity of the region in terms of capacities, international integration and external vulnerability.[6]

The simulations start off from a baseline or BAU scenario that has been heavily impacted by the COVID-19 crisis. Table III.2 shows estimates of the pandemic's impacts on the GDP of countries and groups of countries in Latin America and the Caribbean and in the rest of the world. While these figures are still preliminary in nature, given the high level of uncertainty generated by the pandemic, they nonetheless serve as a point of departure for the construction of a new "with-COVID" baseline scenario. The projections shown in table III.2 have been generated by ECLAC, IMF and the E3ME model. The fact that the model points to a weaker recovery in 2021 than the IMF projections do may reflect the greater sensitivity of investment to the slump in aggregate demand in 2020 in the E3ME model.

[6] The results for individual countries and sectors may be made available to member countries of ECLAC upon request.

Table III.2
Latin America and the Caribbean and the rest of the world: impact of the pandemic on GDP growth rates as estimated by the International Monetary Fund (IMF), Economic Commission for Latin America and the Caribbean (ECLAC) and the E3ME model, 2020–2021
(Percentages)

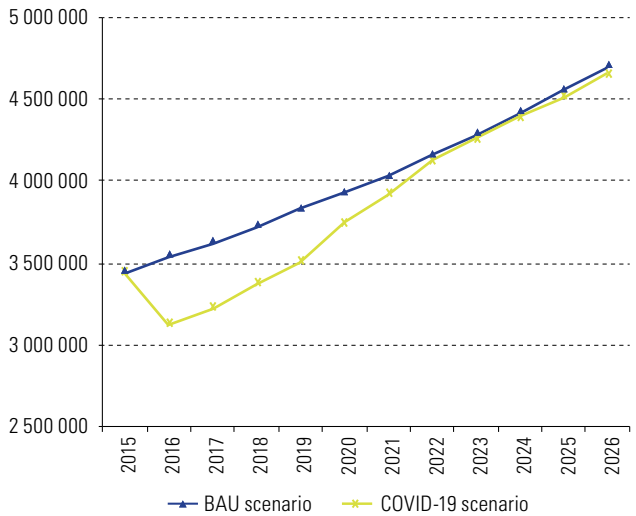
	2020 IMF	2020 ECLAC	2020 E3ME-COVID	2021 IMF	2021 E3ME-COVID
Argentina	-9.9	-10.5	-10.4	3.9	1.7
Brazil	-9.1	-9.2	-9.26	3.6	2.6
Mexico	-10.5	-9.0	-9.0	3.3	3.0
Colombia		-5.6	-6.3		3.0
Other Latin American and Caribbean countries		-9.1	-9.0		4.7
Latin America and the Caribbean	-9.4	-9.1	-9.1	3.4	3.2
World	-4.9	-5.2	-4.8	5.4	2.4

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of International Monetary Fund (IMF), "A crisis like no other, an uncertain recovery", *World Economic Outlook Update*, Washington, D.C., 2020; Economic Commission for Latin America and the Caribbean (ECLAC), "Addressing the growing impact of COVID-19 with a view to reactivation with equality: new projections", *COVID-19 Special Report*, No. 5, Santiago, 2020.

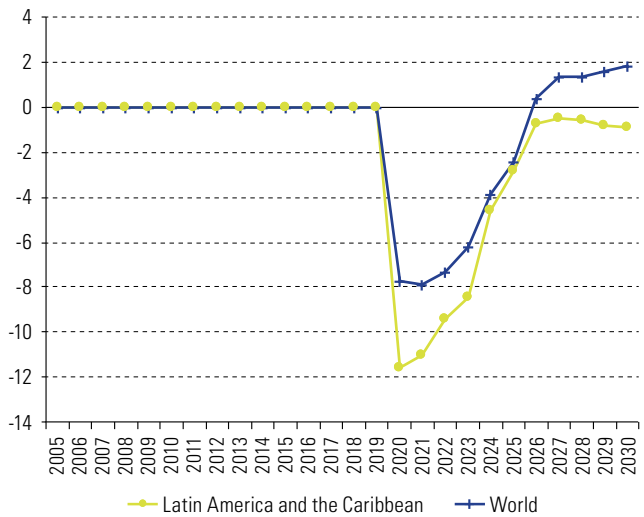
Figure III.1 shows the impact of the COVID-19 pandemic on GDP trends in Latin America and the Caribbean. The blue line in figures III.1A traces what GDP growth would have been if the pre-existing trend had remained unchanged. The green line plots the post-pandemic trend of GDP, which incorporates the steep drop in economic activity in 2020. The simulations indicate that the region will not have regained all the ground lost in terms of GDP growth during the crisis by the end of the period under analysis, although the shortfall is quite small. As for the rest of the world, on the other hand, the simulations indicate that it will be more successful in absorbing the impact of the shock and will have surpassed the long-term GDP trend in the absence of the pandemic by 2027.

Figure III.1
Latin America and the Caribbean and the rest of the world: absolute and relative impact of COVID-19 on GDP relative to the non-COVID-19 business-as-usual scenario

A. Absolute variation in GDP in Latin America and the Caribbean, 2015–2026
(euros at constant 2005 prices)



B. Variation in GDP relative to the business-as-usual scenario, 2005–2030
(percentages)

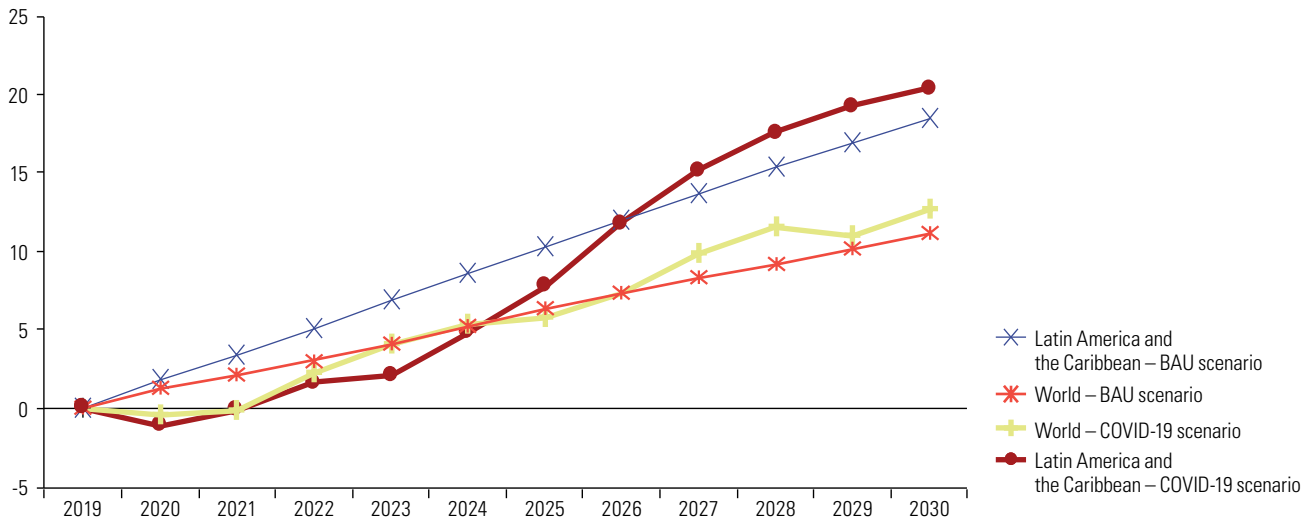


Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.

The income shock is also reflected in employment levels. Employment initially drops by 1.9%, but it then tends to rebound to the levels that it would have reached under the BAU scenario in the absence of COVID-19.

Figure III.2 shows emissions levels in Latin America and the Caribbean and in the world relative to 2019 emissions levels under the with-COVID-19 and without-COVID-19 scenarios.

Figure III.2
Latin America and the Caribbean and the rest of the world: variations in CO_2 emissions relative to 2019 under the business-as-usual and COVID-19 scenarios, 2019–2030
(Percentages)



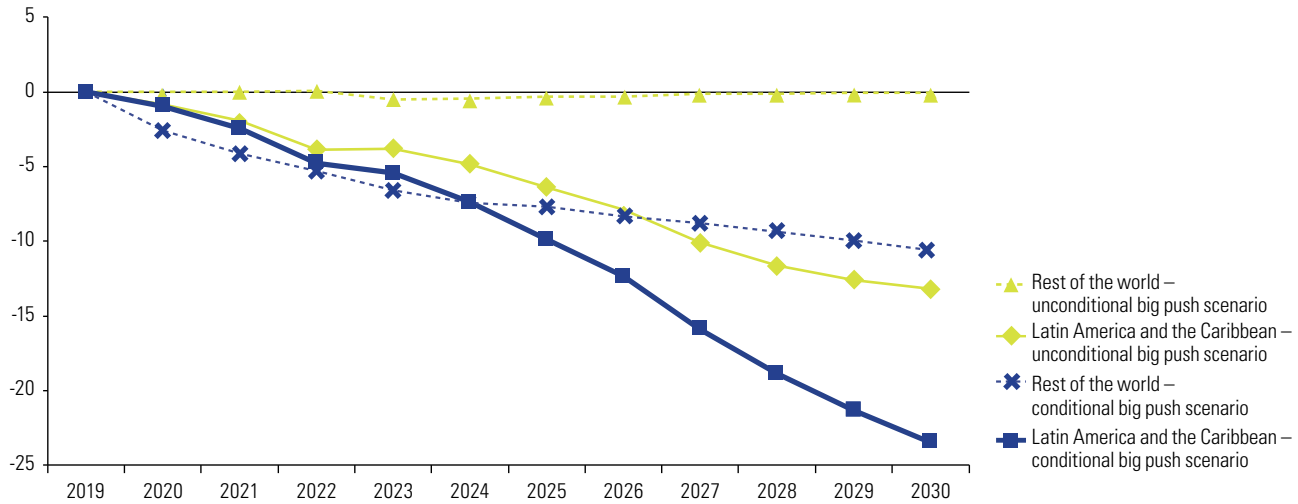
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.
Note: The COVID scenario is the BAU scenario with the addition of the impacts of the pandemic.

By 2026, the emissions levels of both the Latin American and Caribbean region and of the rest of the world are projected to be higher than they would have been under the BAU scenario in the absence of COVID-19. Furthermore, the emissions of Latin America and the Caribbean relative to the 2019 base year level rise more rapidly than in the rest of the world from 2025 on. This means that, under the baseline scenarios, the recovery would tend to be more reliant on the use of fossil fuels and that this tendency would be stronger in the Latin American and Caribbean countries. The pandemic's dampening effect on emissions would thus be temporary and would be more than offset in the following years unless the development pattern associated with the BAU scenario is supplanted by another type. The accelerating trend in the use of fossil fuels that was already projected under the BAU scenario becomes even steeper under the COVID scenario. The heightened carbon-intensiveness of the post-pandemic BAU scenario would presumably be the outcome of sagging petroleum prices and the use of installed capacity that was underutilized during the pandemic.

2. Scenarios with big push policies in the context of different levels of international cooperation

The effects of big push policies on some key economic, social and environmental variables will be analysed in this section. Figure III.3 plots the reduction in emissions in Latin America and the Caribbean and in the world brought about by these kinds of policies. In the scenario that envisages international cooperation, the Latin American and Caribbean region makes a greater mitigation effort than the rest of the world, on average. This points to the need for global agreements under which the countries of the rest of the world will set more ambitious NDCs for themselves. The current scenario for global cooperation is not designed to take into account either the greater responsibility borne by today's developed countries for the destruction of the environment or the twofold asymmetry whereby those that have degraded the environment the most are generally also those that are least affected by the ramifications of that degradation.

Figure III.3
Latin America and the rest of the world: variations in CO_2 emissions relative to 2019 levels under different big push scenarios, 2019–2030
(Percentages)

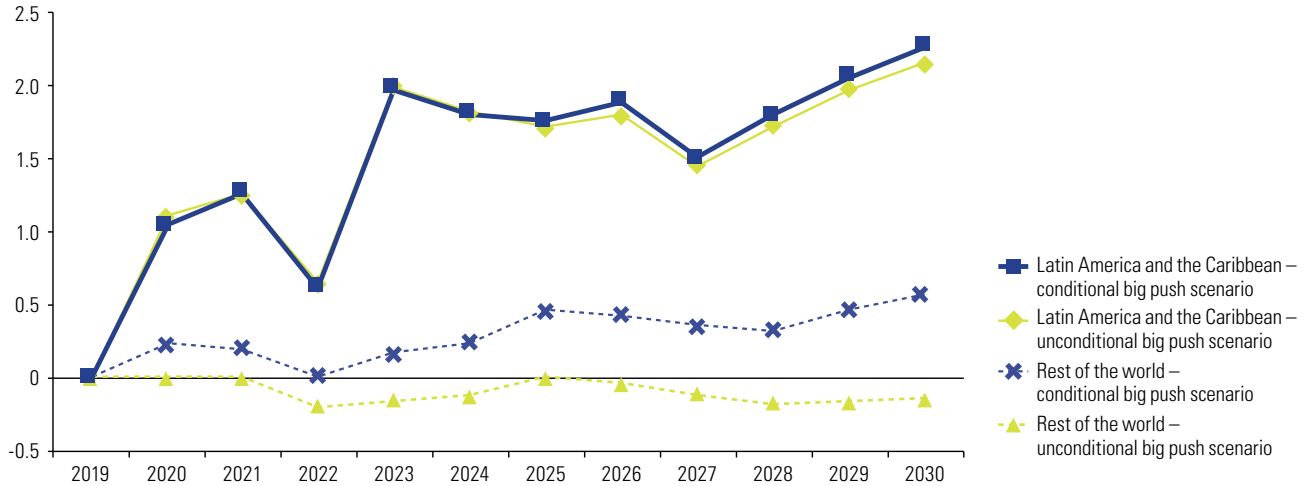


Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.
Note: The unconditional scenario for Latin America and the Caribbean represents the outcome of a situation in which environmental policies are applied to enable the countries of Latin America and the Caribbean to fulfil their unconditional nationally determined contributions (NDCs) in the absence of a global cooperation agreement for the mitigation of emissions. The conditional scenario for Latin America and the Caribbean represents the outcome of a situation in which a global environmental agreement is reached that enables the countries of the region to fulfil their conditional NDCs and the countries of the rest of the world to fulfil their NDCs and, in addition, international cooperation for mitigation is in place. The unconditional scenario for the rest of the world represents the outcome of a situation in which no global environmental agreement is concluded. The conditional scenario for the rest of the world represents the outcome of a situation in which there is a global environmental agreement under which the countries in the rest of the world fulfil their NDCs and the countries of Latin America and the Caribbean fulfil their conditional NDCs.

In both big push scenarios, there is a conspicuous decrease in the CO_2 emissions of land transport, with reductions in CO_2 emissions of 46.7% in the unconditional big push scenario and 48.1% in the conditional big push scenario by 2030, thanks to policies and regulations designed to boost the use of electric and hybrid vehicles and raise the biofuel blend requirement. With the expansion of the number of electric vehicles in the fleet, the demand for electricity will rise by 12.8% and 12.7% in the unconditional and conditions scenarios, respectively, yet despite this upswing in the use of electricity, the increase in the electrical power sector's emissions is comparatively small (no more than 6%). This, in turn, is attributable to a significant increase in investment in the electrical power generation capacity of facilities that use non-conventional renewable sources, which as of 2030 would be 68.6% and 64.8% higher than the level of these types of investments in 2019 under the unconditional and conditional big push scenarios, respectively. This surge in investment in non-conventional renewable energy sources is projected to increase their share in GDP from 0.09% in 2019 to 0.15% in 2030 (for both of these scenarios), which demonstrates how effective fiscal incentives (subsidization of capital costs) could be in spurring investment in these sources. These findings underscore the importance of coordinated policies for stimulating investment in different sectors at the same time. In the absence of incentives for investment in renewable energy sources, it is highly likely that the stronger demand for electrical power would be met by investment in fossil fuels as their prices weaken.

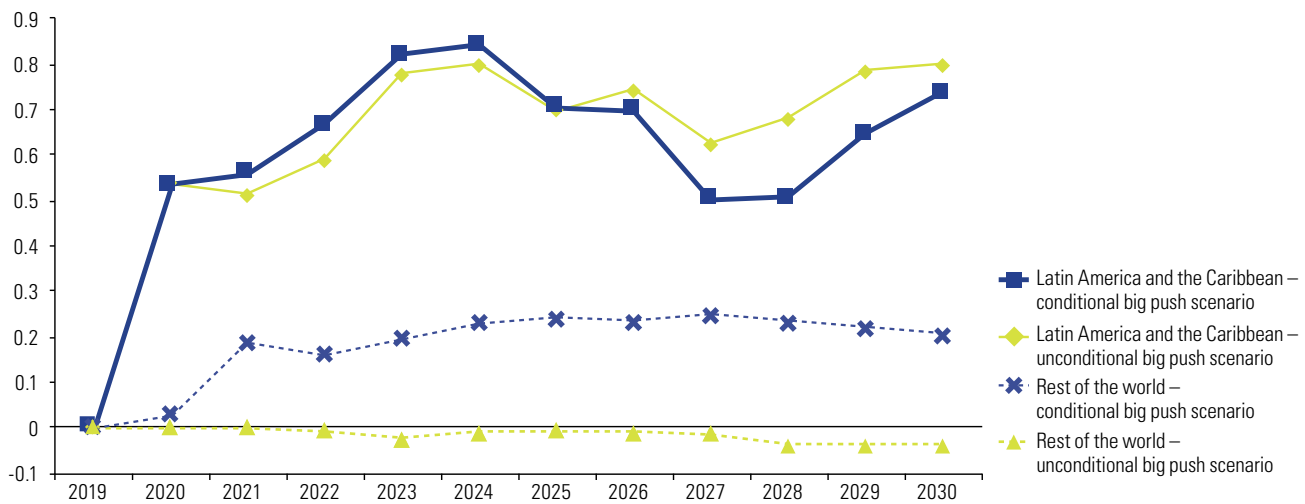
Figures III.4 and III.5 plot trends in GDP and employment, respectively, under the big push scenarios. The results are given as percentage differences relative to the COVID scenario for purposes of comparison. In all cases, big push policies have a positive effect in terms of GDP and employment as compared to the COVID scenario. The presence of a global environmental agreement tends to result in a slightly higher level of GDP than in the scenario where there is no such agreement, but it also tends to result in a slightly lower level of employment in Latin America and the Caribbean. The differences between the two big push scenarios are quite small, however.

Figure III.4
Latin America and the Caribbean and the rest of the world: GDP trends relative to the COVID-19 scenario with the application of big push policies in different international contexts, 2019–2030
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.
Note: The unconditional scenario for Latin America and the Caribbean represents the outcome of a situation in which environmental policies are applied to enable the countries of Latin America and the Caribbean to fulfil their unconditional NDCs in the absence of a global cooperation agreement for the mitigation of emissions. The conditional scenario for Latin America and the Caribbean represents the outcome of a situation in which a global environmental agreement is reached that enables the countries of the region to fulfil their conditional NDCs and the countries of the rest of the world to fulfil their NDCs and, in addition, international cooperation for mitigation is in place. The unconditional scenario for the rest of the world represents the outcome of a situation in which no global environmental agreement is concluded. The conditional scenario for the rest of the world represents the outcome of a situation in which there is a global environmental agreement under which the countries in the rest of the world fulfil their NDCs and the countries of Latin America and the Caribbean fulfil their conditional NDCs.

Figure III.5
Latin America and the Caribbean and the rest of the world: trends in employment relative to the COVID-19 scenario with the application of big push policies in different international contexts, 2019–2030
(Percentages)



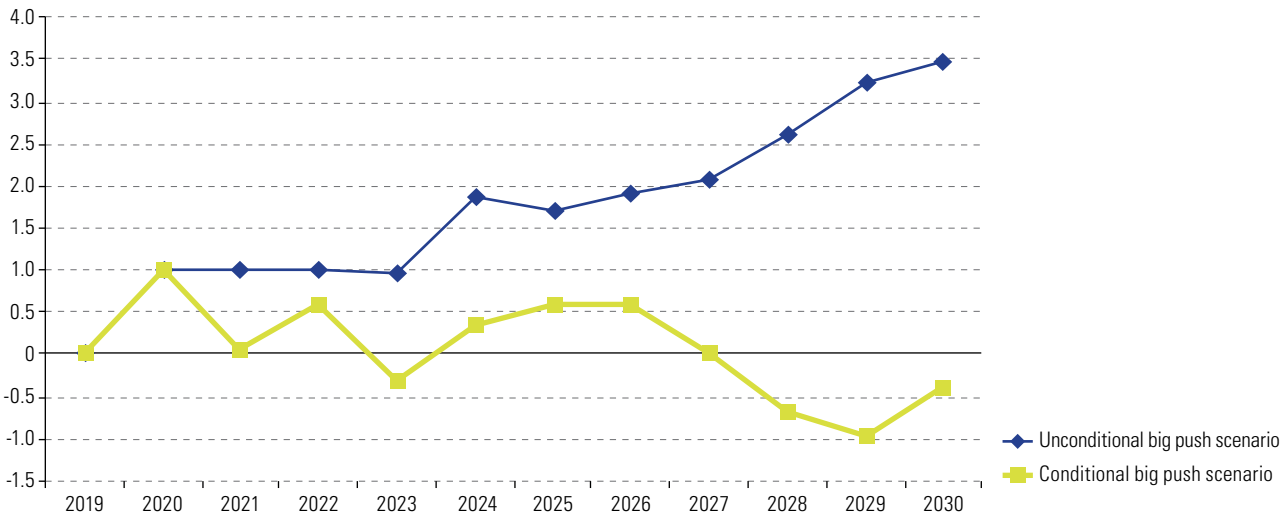
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.
Note: The unconditional scenario for Latin America and the Caribbean represents the outcome of a situation in which environmental policies are applied to enable the countries of Latin America and the Caribbean to fulfil their unconditional NDCs in the absence of a global cooperation agreement for the mitigation of emissions. The conditional scenario for Latin America and the Caribbean represents the outcome of a situation in which a global environmental agreement is reached that enables the countries of the region to fulfil their conditional NDCs and the countries of the rest of the world to fulfil their NDCs and, in addition, international cooperation for mitigation is in place. The unconditional scenario for the rest of the world represents the outcome of a situation in which no global environmental agreement is concluded. The conditional scenario for the rest of the world represents the outcome of a situation in which there is a global environmental agreement under which the countries in the rest of the world fulfil their NDCs and the countries of Latin America and the Caribbean fulfil their conditional NDCs.

In 2030, the unconditional and conditional big push scenarios yield levels of GDP 2.2% and 2.3% higher, respectively, than the COVID scenario does.[7] In terms of employment, the recovery under these two big push scenarios leads to the creation of 2.6 million jobs under the unconditional scenario and 2.4 million jobs under the conditional scenario in Latin America and the Caribbean as of 2030. These outcomes highlight the fact that these policies can enable the countries to fulfil their NDCs while having positive (although limited) impacts on GDP and employment. In the rest of the world, both GDP and employment are more robust in the scenario that includes a global environmental agreement thanks to the incentives for investment in renewable energy that are funded by a carbon tax in the rest of the world.

Big push policies also have implications for distribution. Spending on public health services in Latin America and the Caribbean rises and access to these services becomes less unequal under both the unconditional and the conditional scenarios. This increased spending on health should be only one facet of a much wider-ranging expansion of investment in this area in order to ensure that all members of the population can enjoy the highest attainable standard of health. The increased expenditure under this heading should not represent total expenditure on health, nor should it supplant other items of expenditure.

Under the unconditional and conditional scenarios, by 2030 real wages rise by 3.1% and 0.9%, respectively, relative to the COVID scenario, pushing up real income by 3.7% under the unconditional scenario and by 1.8% under the conditional scenario. To track trends in income distribution, figure III.6 plots out the differing trends in the ratio of the income of the fifth (richest) quintile of the population to the income of the first (poorest) quintile under the unconditional and conditional scenarios. As may be seen from this figure, income inequality increases when big push policies are applied unilaterally in Latin America and the Caribbean but declines slightly by the end of the period when such policies are applied pursuant to a global agreement.[8]

Figure III.6
Latin America and the Caribbean: trends in inequality relative to the COVID-19 scenario with the application of big push policies in different international contexts, 2019–2030
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.
Note: The unconditional scenario represents the outcome of a situation in which big push policies are applied to enable the countries of Latin America and the Caribbean to fulfil their unconditional NDCs in the absence of a global cooperation agreement for the mitigation of emissions. The conditional big push scenario represents the outcome of a situation in which a global environmental agreement is reached that enables the countries of the region to fulfil their conditional NDCs and the countries of the rest of the world to fulfil their NDCs and, in addition, international cooperation for mitigation is in place.

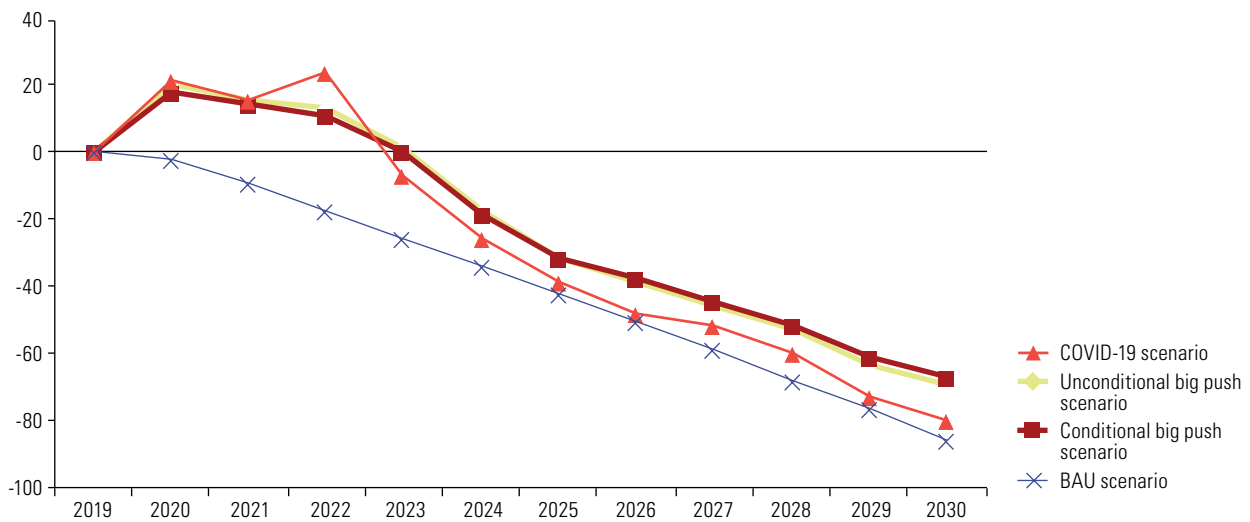
7 These increases are equivalent to €100.5 billion for the unconditional scenario and €105.8 billion for the conditional scenario.
8 The improvement in income distribution associated with the conclusion of a global environmental agreement may be accounted for by the following factors: smaller increases in electricity rates under the conditional scenario thanks to investment in renewable energy in the rest of the world, and lower prices for firewood, coal and other solid wood-based fuels as a result of investment in reforestation. These two categories of goods represent a larger proportion of the market basket for the first quintile than they do for the fifth quintile.

The fact that the trade deficit expands under both the BAU and the COVID scenarios reflects the presence of pre-COVID structural stress points in the balance of payments of the Latin American and Caribbean countries. The deficit narrows under the big push scenarios and narrows even further if a global environmental agreement is in place. Figures III.7 and III.8 show that when fossil fuel subsidies begin to be phased out (2022), this may have a negative effect on the trend in the trade deficit, but thereafter the deficit is around 5% less than it would be under the COVID scenario. The smaller increase in the deficit reflects a reduced reliance on fossil fuel imports (imports of manufactured fuels fall by 28% under the unconditional big push scenario and by 29% under the conditional scenario) and the greater competitiveness of the region's exports.

Figure III.9 provides an overview of the main results of big push policies with and without a global environmental agreement.

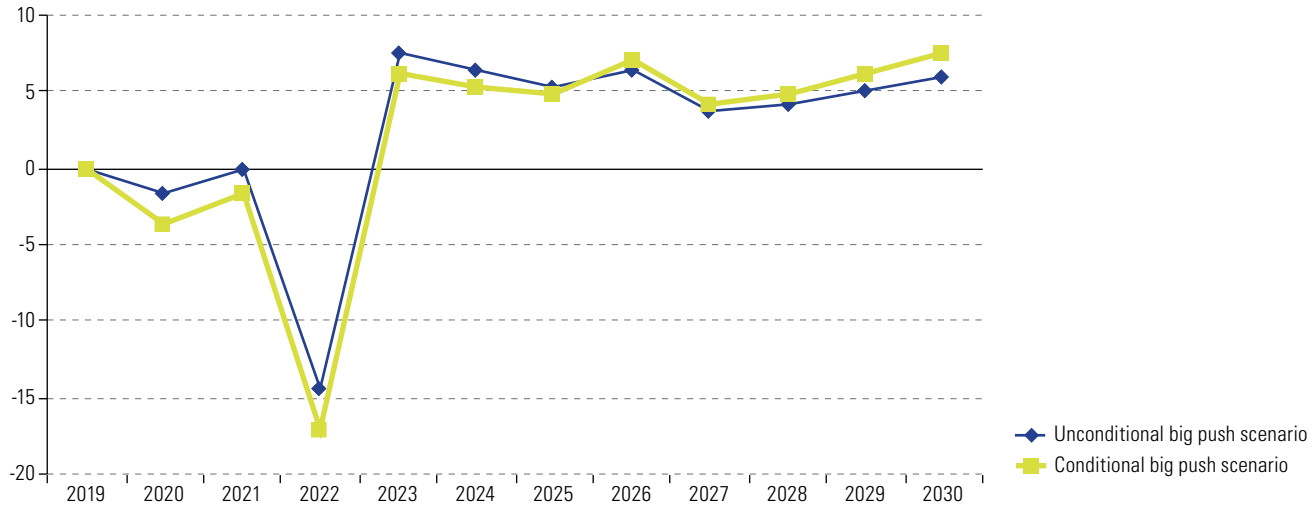
Figure III.9 shows that environmental policies that succeed in reducing emissions can go hand in hand with improvements in a number of different macroeconomic variables. The only exception is income distribution in the absence of a global environmental agreement, which demonstrates the importance of applying social policies together with policies that drive a big push for sustainability. In the presence of a global environmental agreement, the latter's regressive effects on income distribution disappear, and a very slight improvement in distribution occurs. Without an agreement, income inequality increases by 3.5% while, with an agreement, inequality declines by 0.4%.

Figure III.7
Latin America and the Caribbean: trends in the trade balance relative to 2019 under the business-as-usual, COVID-19 and big push scenarios in different international contexts, 2019–2030
(Percentages)



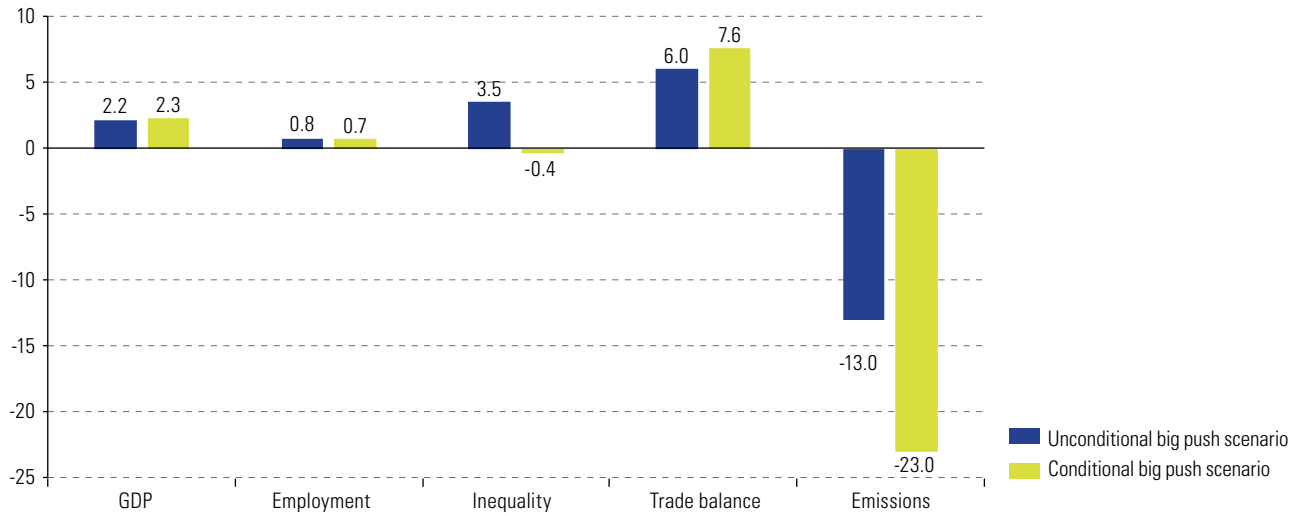
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.
Note: The unconditional scenario represents the outcome of a situation in which big push for sustainability policies are applied to enable the countries of Latin America and the Caribbean to fulfil their unconditional NDCs in the absence of a global cooperation agreement for the mitigation of emissions. The conditional big push scenario represents the outcome of a situation in which a global environmental agreement is reached that enables the countries of the region to fulfil their conditional NDCs and the countries of the rest of the world to fulfil their NDCs and, in addition, international cooperation for mitigation is in place.

Figure III.8
Latin America and the Caribbean: trends in the trade balance relative to the COVID-19 scenario under the big push scenarios in different international contexts, 2019–2030
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.
Note: The unconditional big push scenario represents the outcome of a situation in which environment policies are applied to enable the countries of Latin America and the Caribbean to fulfil their unconditional NDCs in the absence of a global cooperation agreement for the mitigation of emissions. The conditional scenario represents the outcome of a situation in which a global environmental agreement is reached that enables the countries of the region to fulfil their conditional NDCs and the countries of the rest of the world to fulfil their NDCs and, in addition, international cooperation for mitigation is in place.

Figure III.9
Latin America and the Caribbean: effects of big push policies on the main variables of the model relative to the COVID-19 scenario, 2030
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of E3ME model simulations.
Note: The unconditional big push scenario represents the outcome of a situation in which environmental policies are applied to enable the countries of Latin America and the Caribbean to fulfil their unconditional NDCs in the absence of a global cooperation agreement for the mitigation of emissions. The conditional scenario represents the outcome of a situation in which a global environmental agreement is reached that enables the countries of the region to fulfil their conditional NDCs and the countries of the rest of the world to fulfil their NDCs and, in addition, international cooperation for mitigation is in place.

The foregoing discussion leads to a number of conclusions. First, policies designed to help the Latin American and Caribbean economies recover from the impacts of the COVID19 pandemic by generating a big push for sustainability will have a positive impact on job creation and GDP growth while at the same time reducing emissions in line with the conditional and unconditional NDCs. A combination of these types of policies and a global environmental agreement is the approach that has the greatest effect on emissions while at the same time boosting aggregate world demand.

Second, big push policies tend to heighten inequality relative to the BAU scenario when they are applied unilaterally in the region, but this effect disappears when international cooperation is forthcoming. Without such cooperation, social transfer policies become an even more important tool for averting an increase in inequality, as discussed in chapter V.

Third, under the BAU scenario, the trade deficit tends to deepen owing to the region's low level of structural competitiveness. This trend weakens when the region introduces big push policies and weakens even further if the rest of the world also makes a commitment to lower emissions. Nonetheless, although these policies do curb this trend, they do not actually reverse it. Hence the pivotal importance of including industrial and technology policies in the long-term recovery package for the region. This issue is explored further in chapters IV and V.

C. Two case studies: the transition towards sustainable economies in Brazil and Chile

Two case studies lend themselves to a more detailed examination of specific types of big push policies that could not be analysed at a regional level for lack of sufficiently granular information on all the Latin American and Caribbean countries. The first is a study of Brazil based on estimates computed using the E3ME model; the other is a study of Chile based on a computable general equilibrium (CGE) model called ECOGEM-Chile. These two models make some different assumptions about how the economy works and focus on different variables as well. Yet while they differ conceptually, both models contribute to a fuller understanding of certain aspects of the impacts that big push policies can have. In the case of Brazil, the model clarifies certain facets of the industrial structure while, in the case of Chile, the model sheds light on the interrelationships between environmental oversight and emissions trading and their sectoral and distributional implications and impact on gender equality.

1. Brazil: E3ME simulations

Industrially oriented economic recovery policies that set in motion a big push for sustainability can yield significant socioeconomic benefits, as will be seen in the following case study of Brazil.[9] Policies that promote low-emissions investments in manufacturing can help to power a recovery in the short run and to narrow structural divides in the long run.

The first step is to construct a baseline scenario in which Brazil continues to make an increasingly intensive use of fossil fuels. This scenario is based on the work done by IEA (2014). The impact of COVID19 is not taken into account, as it is assumed, for the sake of simplicity, that this crisis will not have lasting effects or that those effects will fade over the long term. Brazil remains on the periphery of the world economic system, and its exports diversify very little, thus continuing to be composed chiefly

[9] This section is based on Gramkow and Anger-Kraavi (2019).

of natural-resource-intensive primary products. In this baseline scenario, Brazil remains heavily reliant on external markets for high-technology products and for supplies to meet its increasing demand for fossil fuels. Its economy's growth falls short of what is needed to meet its poverty reduction goals yet, at the same time, its CO_2 emissions continue to rise.

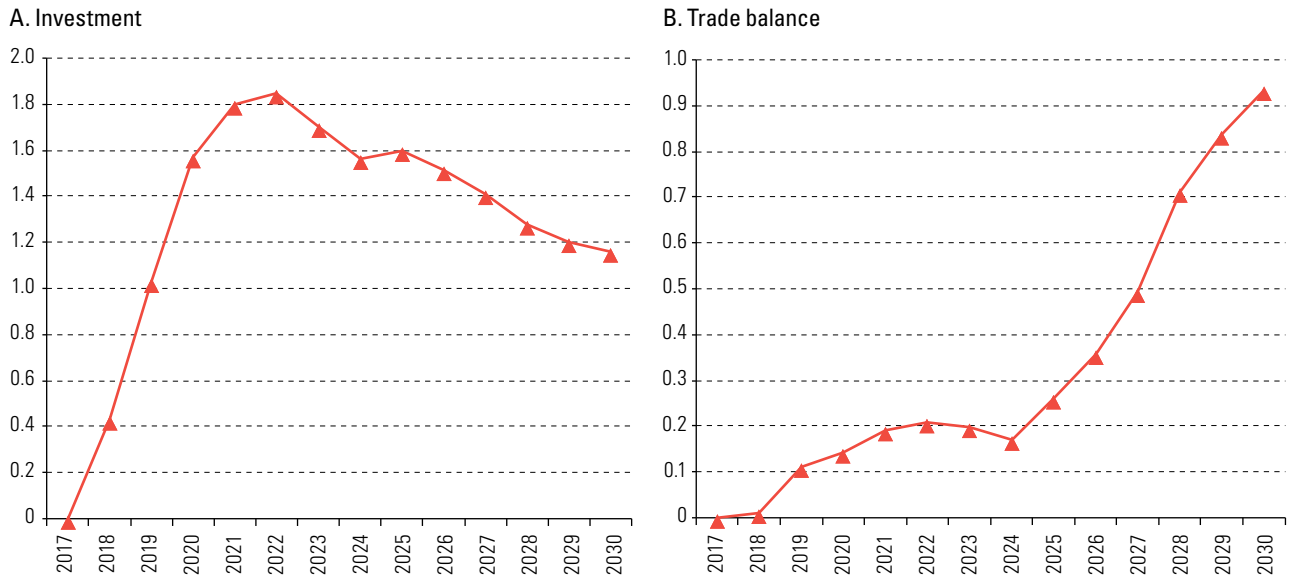
This baseline scenario can then be compared with green fiscal reform scenarios under which the country follows an alternative development path involving the introduction of a policy portfolio designed to stimulate low-carbon investment. These policies include an economy-wide carbon tax in combination with tax exemptions and concessional financing for investments in low-carbon manufacturing technologies. The carbon tax is calibrated so that it will create sufficient fiscal space to offer green fiscal incentives without negatively affecting public accounts. Green fiscal reforms are introduced that establish tax incentives that shift the tax burden onto carbon-intensive technologies and lower the cost of low-carbon technologies in manufacturing sectors in order to redirect technologies towards an environmentally more sustainable development path. The application of a number of different but aligned fiscal policy tools for promoting sustainability (carbon taxes, tax reductions and concessional financing for green investments) creates an institutional setting that reduces uncertainty and investor risks. On the basis of Gouvello (2010), the following types of investments in low-carbon technologies were considered: investments in energy efficiency, recycling and materials use reduction (circular economies), switching from more carbon-intensive fuels to natural gas, renewable energy substitution (biomass and solar energy), shifting from non-renewable biomass (deforestation) to sustainable biomass (tree plantations) and biomass cogeneration.[10]

Separate simulations of each "mini" green fiscal reform targeting a specific kind of low-carbon investment are conducted in order to gauge the impacts of each individual technology. Then broader ranges of green fiscal reforms are simulated so that the various types of technologies can be looked at together by undertaking an incremental simulation whereby, for each scenario, other technologies are added to the array of policies one at a time. The most complete scenario, which includes all the types of low-emissions technologies listed in the preceding paragraph, represents the maximum potential of mitigation policies in Brazilian industry (Gouvello, 2010). In all, 11 alternative green fiscal reform scenarios were simulated, but only the results of the broadest scenario will be reported here for the sake of brevity. The E3ME model was used to simulate the BAU scenario (which is based on the predominant trends and does not include the impact of the pandemic) and the alternative scenarios.

Since the green fiscal reforms are designed to trigger a new cycle of investment in low-carbon technologies, investment is the fastest-growing component of GDP, with investment climbing by as much as 1.16% in 2030 over its baseline level (see figure III.10A). The trade balance improves by up to 0.93% in 2030 (see figure III.10B) because the country is less dependent on fossil fuel imports and its exports —and especially its industrial exports— are more competitive. Direct, indirect and induced macroeconomic interactions and feedback further accelerate GDP growth, which forges ahead, outstripping baseline GDP growth by 0.42% (see figure III.11A), while the country's total CO_2 emissions fall by up to 14.5% by 2030 (see figure III.11B).

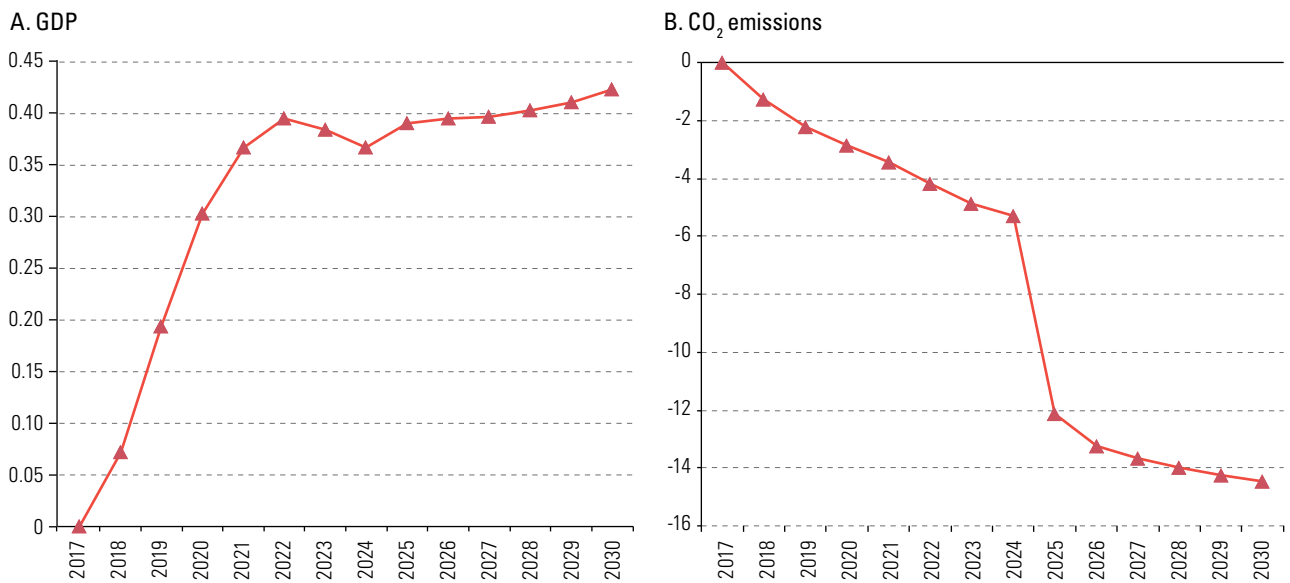
[10] This is a larger set of scenarios than were analysed before. It was developed by Gramkow and Anger-Kraavi (2019) based on more detailed data on the cost and impact of investments in various low-carbon technologies several different manufacturing industries. Comparable types of data are not available for other countries in the region.

Figure III.10
Brazil: impact of a sustainable development strategy on investment and the trade balance, expressed in terms of divergence from the baseline scenario, 2017–2030
(Percentages)



Source: Gramkow, C. and A. Anger-Kraavi, "Developing green: a case for the Brazilian manufacturing industry", *Sustainability*, vol. 11, No. 23, Basel, Multidisciplinary Digital Publishing Institute (MDPI), 2019.

Figure III.11
Brazil: impact of a sustainable development strategy on the decoupling of GDP and CO_2 emissions expressed in terms of divergence from the baseline scenario, 2017–2030
(Percentages)



Source: Gramkow, C. and A. Anger-Kraavi, "Developing green: a case for the Brazilian manufacturing industry", *Sustainability*, vol. 11, No. 23, Basel, Multidisciplinary Digital Publishing Institute (MDPI), 2019.

Growth is being driven by manufacturing industries, and their value added climbs by 2.1% over its level in the baseline scenario by 2030 (see table III.3). This is more than 10 times as much as the increase in the value added by commodities and over 20 times the increase seen in the services sector. The manufacturing industries whose value added rises the most are precisely those that are investing most heavily in low-carbon technologies, such as the basic metals industry (up by 9.2%) and the chemicals industry (up by 3.9%). These figures indicate that green fiscal reforms can serve as engines of growth and as a strategy for reorienting the industrialization process by expanding the relative size of manufacturing within the overall production structure.

Table III.3
Brazil: sectoral effects of the broadest green fiscal reform package as measured against the baseline scenario, 2030
(Percentages)

Sectors	Value added	Exports	Imports
Commodities	0.2	0.6	-5.0
Manufactures	2.1	0.6	0.1
Natural-resource-intensive manufactures	2.3	0.8	-0.7
Low-technology manufactures	2.5	0.0	0.6
Intermediate-technology manufactures	2.0	0.9	0.2
High-technology manufactures	0.6	0.3	0.1
Services	0.1	0.1	-0.1
Total	0.5	0.4	-0.1

Source: Gramkow, C. and A. Anger-Kraavi, "Developing green: a case for the Brazilian manufacturing industry", *Sustainability*, vol. 11, No. 23, Basel, Multidisciplinary Digital Publishing Institute (MDPI), 2019.

These green fiscal reforms also have different effects on the various sectors' foreign trade activity. The relative share of exports of manufactured goods expands, especially in the case of mid-level technologies (up by 0.9%). Exports of high-technology manufactures also rise (up by 0.3%) as the economy becomes more capital-intensive and accumulates production and technological capacities that boost its competitiveness in more complex products. The largest increase in high-technology manufactures is in electrical engineering and instruments (up by 1.7%) and, in mid-level technologies, chemicals (up by 5.6%). The outcome is that the country's exports become less concentrated in commodities. Total imports decline by 0.1%, with the steepest reduction being brought about by a downswing in the use of imported fossil fuels (especially coal), which plummet by 41%.

The main conclusions that may be drawn from this analysis are as follows:

First, recovery policies based on incentives for investment in low-carbon technologies in manufacturing sectors can bring about a significant reduction in CO_2 emissions while also helping to improve economic performance by boosting the level of activity, contributing to the diversification of the production structure and improving the trade balance. Environmental protection and genuine competitiveness go hand in hand in this case, as discussed in chapter II.

Second, big push policies considerably expand the relative size of industry in the economic structure. The value added by all manufacturing sectors rises, but it rises the most in low-technology and intermediate-technology industries. Big push policies may thus provide a way of reindustrializing Brazil.

Third, fairly low carbon taxes may be highly effective when combined with stimulus policies for investment in new green technologies. In the simulations conducted in this study, a tax of €7.4 per ton of CO_2 is enough to cover the cost of the fiscal incentives included in the broadest green fiscal reform scenario. That tax rate is sufficient to finance US$ 100 billion in incentives for low-carbon investments in

Brazil's manufacturing sector. Without green fiscal incentives (tax exemptions and concessional financing), the carbon tax needed to achieve the same level of CO_2 emissions mitigation would probably be so much higher that it would be politically unviable.

Fourth, considered individually, the most effective policies in terms of GDP growth are those that promote investment in energy efficiency, but the best results are obtained when the policy package combines incentives for different types of technologies.

Lastly, policies that focus entirely on replacing firewood and coal harvested from native forests with those same fuels taken from tree plantations have a sizeable impact in mitigating emissions but do not help to diversify the economy and steer it towards intermediate- and high-technology sectors, and they are therefore less promising as a means of furthering integral development processes. When manufacturing industries are incorporated into mitigation policies, then a broader strategy can be fashioned that takes industrial sectors into consideration and opens up opportunities for a type of growth that is compatible with environmental goals.

2. Chile: ECOGEM-Chile simulations

A case study of Chile was conducted that helps to round out the picture provided by the case study of Brazil in three ways. First, it includes an additional international dimension (carbon emissions trading). Second, it uses an economic model that is based on very different assumptions from those underlying the E3ME model, which makes it possible to determine how robust the positive results of big push policies are to changes in a model's assumptions.[11] Third, the analysis of alternative policy scenarios incorporates gender inequality, which the other model does not.

The simulations use the social accounting matrix for 2013, which contains 111 economic sectors and pollutant emissions factors based on the 2013 Pollutant Release and Transfer Register. The period under analysis extends up to 2050, and the 2020 updates of Chile's NDC is taken into account so that unconditional and conditional emissions reduction targets can be distinguished from one another. This distinction makes it possible to estimate the percentage of tradable emissions certificates that are available on the international market.

The baseline assumptions are a population growth rate of 1% and labour productivity gains of 0.7% per annum. The effects of COVID-19 are incorporated into short-run variations in GDP, which falls by 7.9% in 2020 (ECLAC, 2020) then rebounds by 4.4% in 2021 (Scotiabank, 2020). Over the long term, average annual growth amounts to 2.8%. For 2013–2019, actual economic data for Chile are used. The tax structure and the structure of transfers hold steady all along the path. Investment in each period is determined by the savings-investment identity and relative profitability ratios across sectors. For the production function, energy sectors are imperfect substitutes, as is also the case for capital and labour, while the rest of the sectors function as inputs with fixed coefficients.

The dynamic structure of the model permits disinvestment in less profitable sectors while capital is funnelled into the more buoyant ones. The baseline already incorporates Chile's US$ 5 carbon tax. Efficiency and productivity gains, combined with the effects of the existing tax, yield a baseline where the carbon intensity of GDP drops by around 12% by 2030 and is down by 28% by 2050 (these are more conservative estimates than those derived from other sources). The results cover seven ways of generating electricity, a gender division of labour, income by quintiles (including various indicators of inequality) and emissions of carbon dioxide, sulfur oxides, nitrogen oxides and particulate matter. The following alternative scenarios were simulated:

[11] The ECOGEM-Chile dynamic general equilibrium model is used (Beghin and others, 1996; O`Ryan and others, 2005; Pereira and others, 2009; De Miguel and others, 2011).

(i) Green growth: The tax on carbon emissions is raised from US$ 5 to US$ 50 per ton of carbon from 2020 onward. These tax receipts boost the level of public savings available for investment in the economy;

(ii) Green fiscal reform: The tax on carbon emissions is raised from US$ 5 to US$ 50 per ton of carbon from 2020 onward and VAT is lowered by an amount equivalent to the revenues from that tax;

(iii) A just environmental transition: The tax on carbon emissions is raised from US$ 5 to US$ 50 per ton of carbon from 2020 onward and the revenues are used for the implementation of social transfer policies (domestic social justice). Emissions permits exceeding Chile's unconditional NDC are sold (international justice);

(iv) Green recovery: This scenario is equivalent to the green fiscal reform scenario with the addition of the effects of COVID-19. External savings equivalent to 6.5% of GDP (equal to the amount of pension fund management company (AFP) withdrawals authorized in August 2020)[12] are used for this purpose but these funds are eventually replenished.

The effects of the tax on GDP growth vary depending on how the revenues from that tax are used and on whether the principle of common but differentiated responsibilities can be applied via the sale of emissions permits.

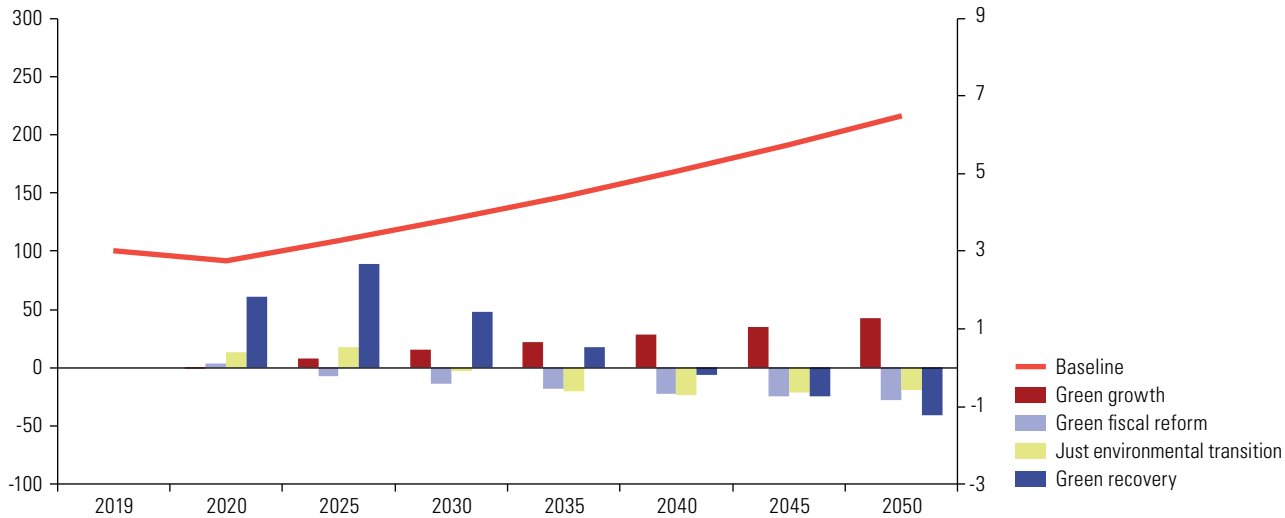
Using the carbon tax revenues for investment would further the transition towards clean energy generation and away from coal production, its use as a fuel and various components of the cement production chain. Heightened efficiency would reduce the need for electricity transmission and distribution in relative terms. The availability of financing for investment would promote the expansion of the more profitable sectors of the economy and especially those that are based on natural resources, such as mining, aquaculture, fisheries and canning, construction, civil engineering works and infrastructure. It would also contribute to the expansion of the part of the shipping industry that transports those sectors' exports. The outcome would be an above-baseline growth rate, particularly over the long term. If VAT is lowered, the outcome is different, since such a reduction would buoy short-term consumption to the detriment of investment, which would have implications for long-run growth. While the same sectors would still benefit, the reduced investment capacity would dampen the expansion of production, particularly in the most dynamic sectors. As may be seen from figure III.12, the economy's growth rate differs only slightly from the baseline in all the scenarios. Policies for promoting investment are seen to be the most effective ones for driving GDP growth.

A just transition would result in faster growth, driven by rising consumption, in the early years of the period under analysis, but that trend would be reversed as time goes by. By the end of the period under study, assuming climate commitments have been fulfilled and the sale of emissions permits has begun, the growth trend would reach a positive turning point. In sectoral terms, the winners and losers would stay the same, with effects on their activity situated somewhere between those associated with the green growth model and the fiscal neutrality model. Under the green recovery scenario, future consumption is sacrificed for the sake of present consumption and GDP growth is higher than the baseline trend for the coming two decades. The sectors that benefit from environmental policy would be joined by those that produce final goods (meat, dairy products, canned food, bread and flour, alcoholic and non-alcoholic beverages, tobacco, paper products, fuel, telephony and communications, leasing services and private health care). In some sectors, the effect would be reversed towards the end of the study period.

In the baseline scenario, electrical power generation up to 2050 would be distributed almost evenly between renewable energy (45%) and non-renewable energy (55%). Taxing the externalities would make it possible to redirect investment towards renewable sources. If this is done, their share would expand under all the scenarios, rising to around 63% by the end of the period under analysis. In addition, heightened energy efficiency would cut electricity demand by between 10% and 15% towards the end of the study period.

[12] Escenario central (Banchile Inversiones, 2020).

Figure III.12
Chile: GDP trends and variations in GDP growth relative to the baseline scenario under different policy strategies, 2019–2050
(Growth indices and percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: The left scale shows the GDP growth index, while the right scale indicates the growth rate relative to the baseline scenario.

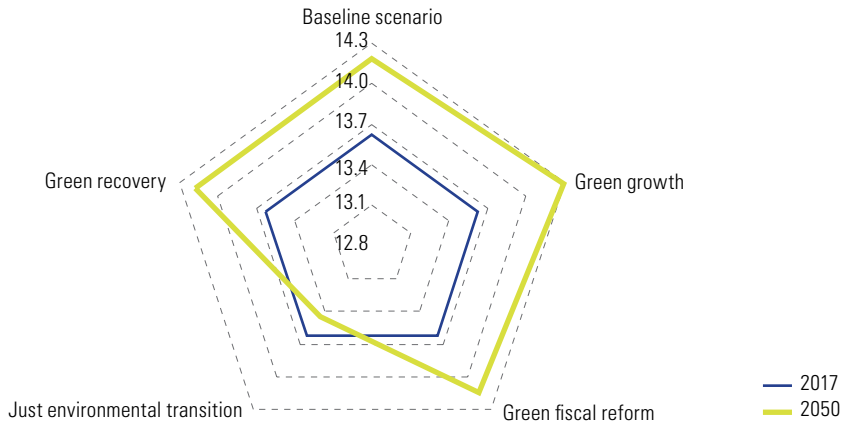
A sizeable reduction (between 32% and 34%) in carbon emissions by 2050 relative to the baseline is seen in all four scenarios. This attests to the effectiveness of an environmental tax and means that the region's carbon intensity would be approximately 35% less by 2030 and around 52% less by 2050. A worldwide tax on emissions would also have implications for local emissions levels: by the end of the study period, emissions of sulfur oxides would be considerably lower (down by between 9% and 13%); emissions of nitrogen oxides and particulate matter would also be lower but the decrease would be smaller (between 2% and 4%). These results would have significant co-benefits because of the impacts that these pollutants have on local mortality and morbidity rates, whose economic effects are not embedded in these results but which are generally higher among the most vulnerable population groups.

The transition towards a less carbon-intensive economy would also have distributional implications owing to the associated production composition and income effects. Under the baseline scenario, there would continue to be a high degree of inequality as measured by the ratio between the richest and poorest quintiles. Income inequality relative to the baseline would decline only under the just transition scenario, thereby demonstrating the importance of the role played by social policy, but it would still be quite stark (see figure III.13). Gender inequality, on the other hand, diminishes by the end of the period under analysis, without any major differences being seen in that regard across the various policy scenarios. The outcome for women under the green growth scenario is less positive, however, and it would therefore be important to introduce complementary policies to promote gender equality (see figure III.14).

In sum, no very marked differences are seen in the extent to which the growth rate diverges from the baseline in any of the scenarios involving a tax on carbon dioxide emissions. That being said, the green growth scenario is the one in which the greatest impact is observed over the long run. This is because, in that scenario, emphasis is placed on raising the level of investment relative to consumption. In the E3ME model, the assumption is that the expansion of aggregate demand paves the way for an upturn in investment, whereas in the ECOGEM-Chile model, it is assumed that investment is encouraged by the availability of savings. That is why policies that use a carbon tax as a source of revenues for use in boosting consumption will produce positive environmental and health-related effects but lead to somewhat slower growth in the long run. The larger the percentage of those tax revenues that is used to pay for social policies (in this case, transfers), the

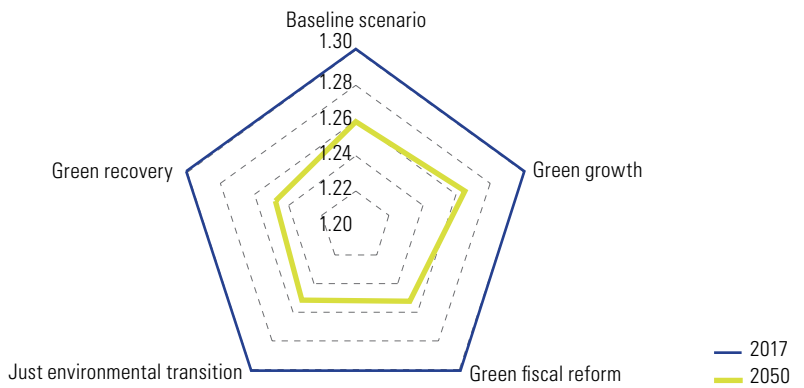
greater the impact on distribution will be, and this will reduce the quotient between the income of the richest 20% of the population and the income of the poorest 20% and the wage gap between men and women. The just transition scenario has a considerable distributional impact, but income inequality nevertheless remains high, and environmental policies are therefore not enough to bring about that transition. This corroborates the conclusions drawn from the E3ME model concerning the need to supplement environmental policies with redistributive policies to offset the tendency towards inequality exhibited by the various scenarios, with the exception of the just transition scenario. In addition, international agreements will be needed to drive additional mitigation efforts via the carbon offset market, which should facilitate the injection of resources into economies that have done little to cause climate change. This will call for the types of social and international cooperation policies proposed in chapter V.

Figure III.13
Chile: income inequality as measured by the ratio between the income of the richest 20% and the poorest 20% of the population, 2017 and 2050



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Ministry of Social Development and Family, 2017 National Socioeconomic Survey [online] http://observatorio.ministeriodesarrollosocial.gob.cl/casen-multidimensional/casen/casen_2017.php; and simulation scenarios.
Note: The ratio is between the 20% of highest-income households and the 20% of lowest-income households.

Figure III.14
Chile: gender inequality as measured by the ratio between men's and women's income levels, 2017 and 2050



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Ministry of Social Development and Family, 2017 National Socioeconomic Survey [online] http://observatorio.ministeriodesarrollosocial.gob.cl/casen-multidimensional/casen/casen_2017.php; and simulation scenarios.
Note: Gender income inequality is calculated on the basis of the ratio between men's and women's average incomes from their principal occupation.

D. Economic growth with innovation: the greening of the economy as an opportunity for building technological and productive capacities

This section focuses on an evolutionary agent-based model (ABM) that sets out the conditions required for an economy to transition from a reliance on fossil fuels to a renewable energy base while continuing to grow and to keep its external sector in equilibrium. The model builds on the one used by Ciarli and others (2019) by adding an energy sector and a centre-periphery dynamic that reflects international technological asymmetries. The advanced centre country is represented by another sector that buys commodities from the periphery and sells capital goods to it. Technological innovation and diffusion are core components of the model, in which firms and consumers are both heterogeneous. Some firms have higher-level technological capabilities than others and some succeed in innovating, while others either catch up by imitating those innovations or fall behind. The economic system is in a perpetual state of flux, with shifts in market shares and firms' capabilities having strong implications for labour demand and income distribution.

As was seen earlier, under the E3ME model, the trade deficit/GDP ratio tends to increase, both in the BAU scenario and in the scenario in which policies are geared towards a big push for sustainability. Building domestic capabilities is crucial for correcting external imbalances and preventing external constraints from halting the transition towards renewable sources of energy. In this section, the process of building these capabilities and capacities will be discussed in more detail. The focus on technology and structural change harks back to the early insights of Fernando Fajnzylber,[13] who argued that the absence of a competitive capital goods sectors in Latin America had limited the region's ability to generate technical change and overcome the external constraint (Fajnzylber, 1983, pp. 185–190). The key issue of how to go about building new capabilities for the transition towards a sustainable economy is explored in this section by means of an analysis that places innovation and technological diffusion at its very centre.

1. Energy, green capital goods and investment in renewables

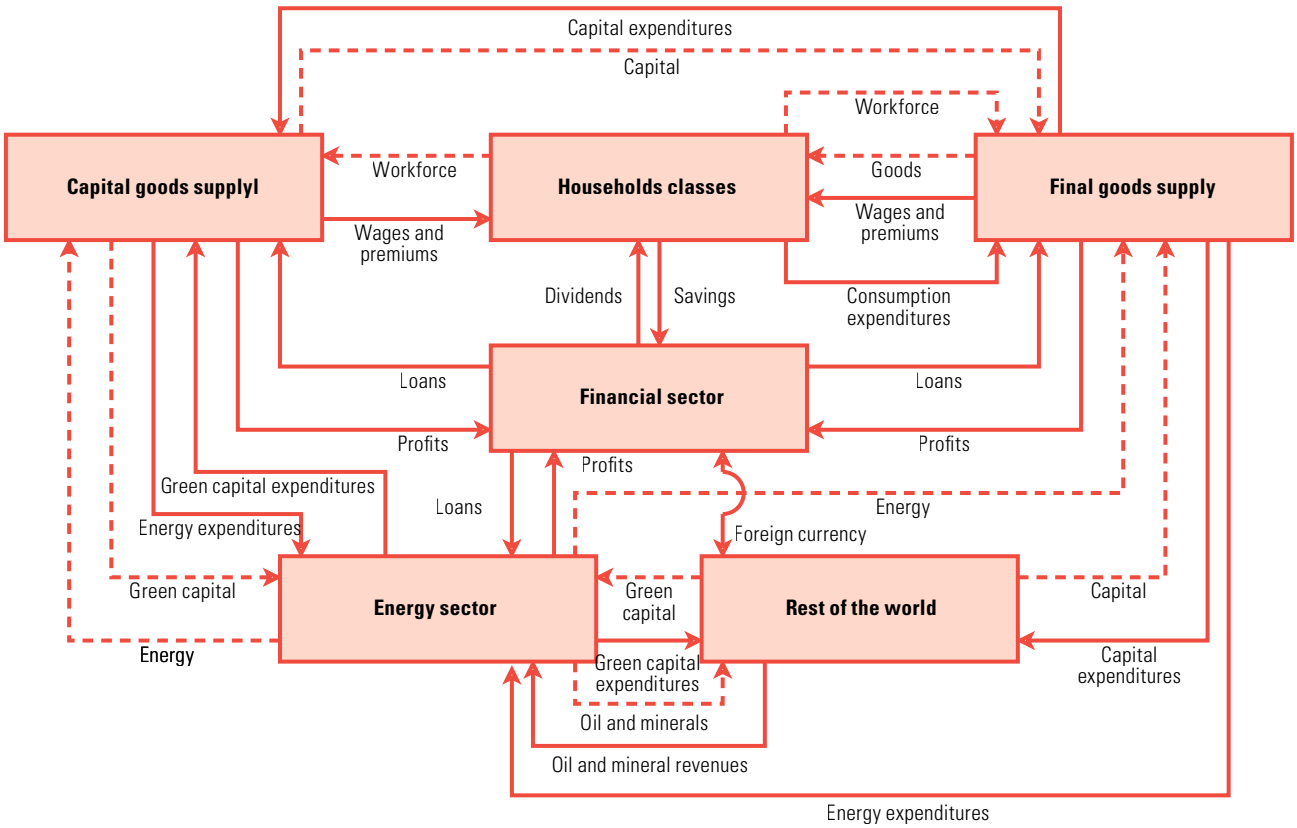
The economy on the periphery contains the following sectors: a final goods sector that is divided into 10 industries, each of which is populated by a changing number of heterogeneous firms producing those goods; a capital goods sector populated by a fixed number of heterogeneous firms producing capital goods of different vintages for both the energy sector (green capital goods) and the final goods sector (regular capital goods); an energy sector made up of a single firm producing brown energy from fossil fuels and green energy based on green capital goods; a consumer sector populated by households whose members work in the final and capital goods sectors; and a financial sector which manages financial flows between households and firms. The periphery has an endowment of commodities that can be either exported or used as an input for the production of brown energy, while renewable energy is produced using green capital goods and renewable natural resources.

Income distribution is endogenous: as a firm innovates, it grows and develops new capabilities, and new tiers of better-paid workers are created within the firm. Technical change drives the creation of jobs and defines the skill intensity of those jobs.

[13] "At variance with the crucial role that the industrial sector plays in developed countries, as a source of a surplus in foreign trade, in Latin America it explains the structural nature of the trade deficit, and as a result, its growing resort to foreign debt" Fajnzylber (1983, pp. 207 and 208).

Diagram III.1 depicts the main sectors of the economy and the physical (including energy) income and financial flows between these sectors and the centre economy (labelled as "rest of the world"). The model includes a periphery which exports commodities to the centre and imports capital goods from it. The periphery also produces two types of capital goods: green capital goods used in the energy sector, which boost energy productivity, and capital goods used in the final goods sector, which raise labour productivity and energy efficiency in the production of those goods. Energy productivity is defined as the units of energy produced per unit of green capital goods; energy efficiency is defined as the units of energy consumed per unit of production of the final good; and labour productivity is defined as the units of the final good produced per worker. Energy productivity depends on technical change in green capital goods and on access to renewable natural resources. Access to natural resources is assumed to exhibit diminishing returns.

Diagram III.1
Flow diagram of the model of a multisectoral economy using different types of capital and sources of energy



Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: Dashed lines represent goods or services exchanged between agents; solid lines represent money flows.

The key concern in this model is the impact of a sharp rise in domestic investment in renewables (to replace oil) on growth, emissions (proxied by the amount of oil burned to produce energy) and income distribution. The increase in investment in renewables stems from the shock generated by policies aimed at driving a big push for sustainability (the big push scenario), as discussed in previous sections. As mentioned earlier, there is only one firm in the energy sector. If this is a State-owned firm, then the policy

shock is generated by the government's decision to raise public investment in renewables. If it is a private sector firm, then the policy shock derives from the adoption of regulations in the energy market that drive up the demand for renewable energy. The model tracks how such a rise in the demand for renewable energy will affect the main macroeconomic variables of an economy in which technical change and growth depend either on imports of capital goods from the rest of the world or on the level and targeting of R&D efforts by domestic producers of capital goods.

An upswing in investment in renewables will at some point run up against an upper bound created by the balance-of-payments constraint. The energy company will resort to domestic suppliers of green capital goods to produce renewable energy if the energy productivity of the capital goods produced domestically reduces the cost of renewable energy to a point where it is lower than the cost of producing brown energy. Domestic production of capital goods will respond, giving rise to a positive multiplier effect on demand, which will also have an impact on the final goods sector. A rebound effect may emerge, as the multiplier may raise the consumption of energy and emissions despite the increased share of renewable sources in the energy mix. Such a rebound effect may be reversed by the intensity of technical change embodied in new vintages of green capital goods (see below).

E. Energy transition, the balance-of-payments constraint and the role of capacity-building

This section will look at two different scenarios for innovation, technological diffusion and capacity-building on the periphery. One is the BAU scenario, while the other deals with a sharp increase in investment in renewable energy: the big push for sustainability scenario. Outcomes in terms of growth, investment, productivity, emissions and income distribution are discussed. In the BAU scenario, the desired level of investment in renewable energy climbs at an annual rate of 0.12%; in the big push scenario, the desired level of investment in renewable energy rises at an annual rate of 0.6%. Simulations were run for 750 time steps, which represent a time span of approximately 60 years.

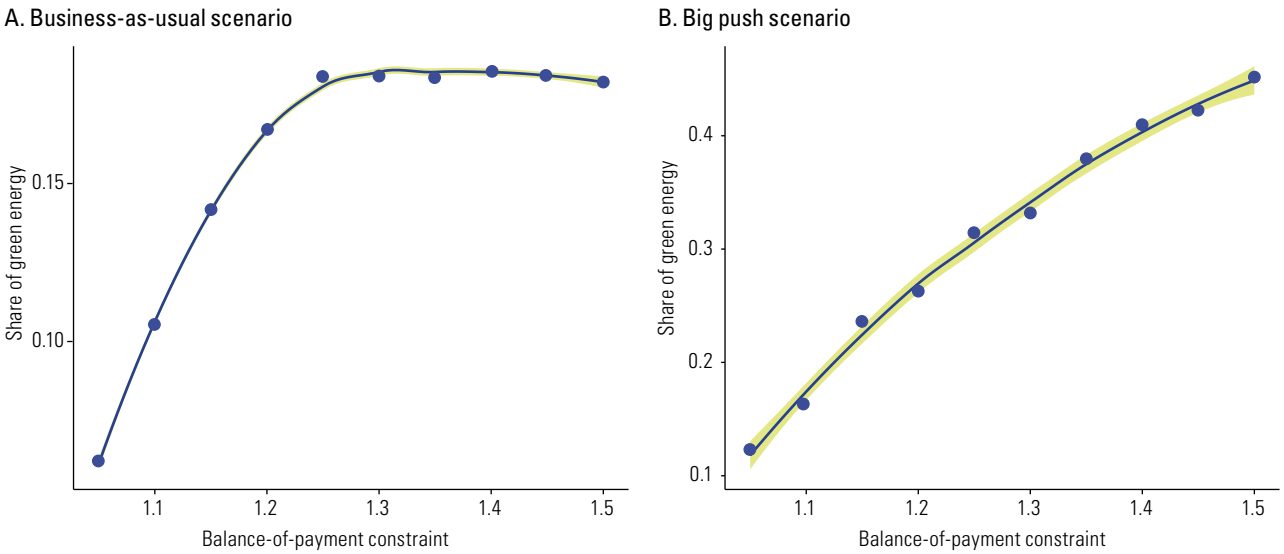
The focus of the simulations is on two parameters: the capacity of the country to export commodities, and the impact on energy productivity of R&D expenditures. These two parameters were chosen because they represent key determinants of the external constraint, namely, the capacity to export based on natural resources, and competitiveness based on innovation and national capabilities and capacities. Thus, broadly speaking, they represent "spurious" and "authentic" competitiveness, respectively.

1. The balance-of-payments constraint under the two regimes

In the model, the economy exports a given ratio of the commodities used to produce brown energy. The impact of easing the balance-of-payments constraint is studied by increasing this ratio from 1 to 1:5. This increase of 50 percentage points expresses a positive exogenous supply-side shock in commodity exports resulting from discoveries of new deposits of natural resources, which allows the periphery to increase its foreign currency earnings. These funds can then be used to import capital goods for the energy and final goods sectors. Figure III.15 shows how the balance-of-payment constraint eases from left to right along the X axis. The main impact of the balance-of-payments constraint on the green transition is seen midway through the period under study, and average figures are thus reported for the time steps from 200 to 500 (between 20 and 40 years). Using averages makes it possible to factor out the impact that business cycles have over the process of structural change.

Figure III.15 plots the relationship between the balance-of-payments constraint and the share of renewable energy in the energy mix. The first result is that, as expected, in the high renewable investment target scenario, the share of green energy is significantly larger than it is in the BAU scenario for all levels of the balance-of-payments constraint. Thus, the second scenario can be regarded as being equivalent to a big push in investment for sustainable development in the peripheral economy.

Figure III.15
Latin America and the Caribbean: share of green energy in total energy consumption as a function of the balance-of-payments constraint



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

The easing of the balance-of-payments constraint under the BAU scenario allows for a larger share of renewable energy up to a point (when the export ratio reaches approximately 1.3) and ceases to be an influential factor thereafter. The question therefore arises as to why the availability of foreign reserves fails to raise the share of renewable energy after this critical level of the export ratio has been reached. The answer is that, in a low-investment economy, the multiplier effect is weak and therefore does not result in a steep upturn in the demand for renewable energy or for the capital goods used to produce it. More voluminous reserves of foreign exchange do not boost this demand per se. Conversely, the investment drive under the big push scenario ensures that a rapidly expanding domestic economy can use all the added foreign exchange to pay for imported capital goods and to develop domestic capabilities and capacity to produce competitive capital goods for use in generating renewable energy. The overall result is a higher level of domestic investment than under the BAU scenario.

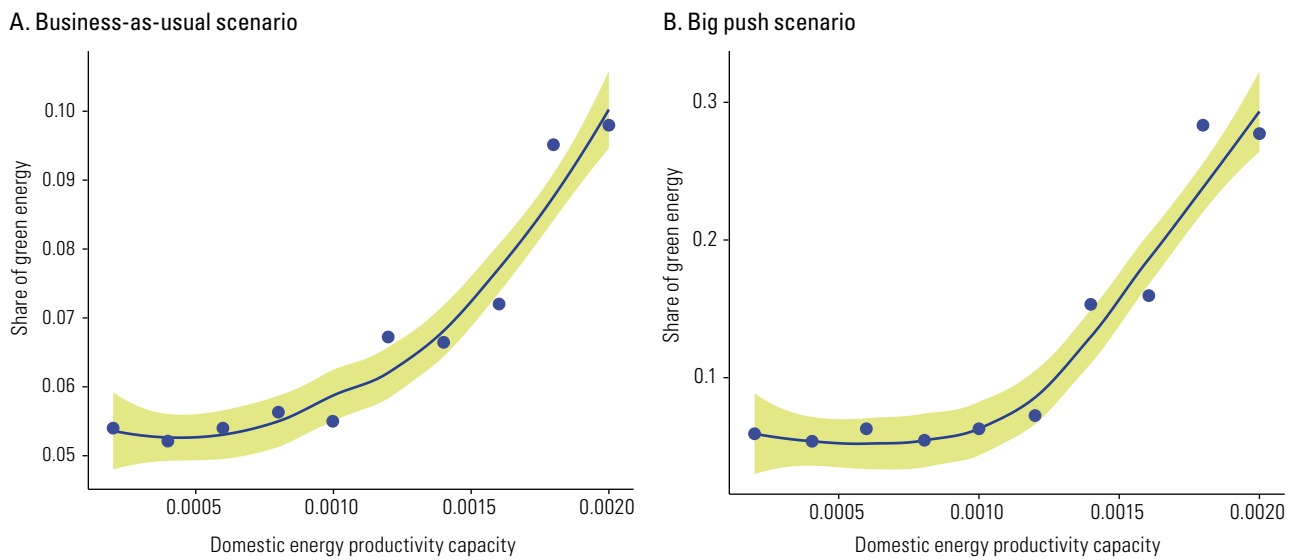
The critical lesson to be learned from this exercise is that, in the context of a big push for sustainability, removing the balance-of-payments constraint will play a crucial role in sustaining the expansion of the share of green energy in the total energy supply. Both external assistance and export diversification will be necessary in order for a country or region to succeed in moving towards and along a low-carbon path.

2. Domestic capabilities matter: energy productivity under the two scenarios

In this model, firms in the capital goods sector invest in R&D to increase the energy productivity of the vintages of capital sold to the energy-producing sector (green capital goods). When R&D efforts are successful and lead to an innovation useful to firms specialized in energy innovations, then energy productivity will increase. For the purposes of this discussion, two different levels of technological capability will be assumed. In the presence of a low level of capability, an innovation will give rise to a small increase in energy productivity, whereas, when the level of capability is high, the impact of innovation on productivity will be much greater. Consideration will also be given to what happens when the capacity to produce green capital goods is strengthened, as reflected in an increase in the parameter of the model that translates innovation (in those goods) into higher levels of energy productivity. The increase in this parameter implies that the country is bolstering its industrial and technological policies (for instance, by investing more in the education of the labour force, universities and R&D institutions) and hence enhancing its technological capabilities.

Figure III.16 traces the share of total energy consumption in the economy represented by renewable energy at increasing levels of domestic technological capabilities under the low investment in renewables (BAU scenario) and high investment in renewables (big push) scenarios, respectively. After running the simulation for 750 time steps (approximately 60 years), the value for the average green energy share attained in the last 50 time steps is reported. The progression from left to right in the figure signals movement towards policies and institutions that support the building of national capacity for technical change.

Figure III.16
Latin America and the Caribbean: share of renewable energy in total energy consumption as national technological capabilities increase



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

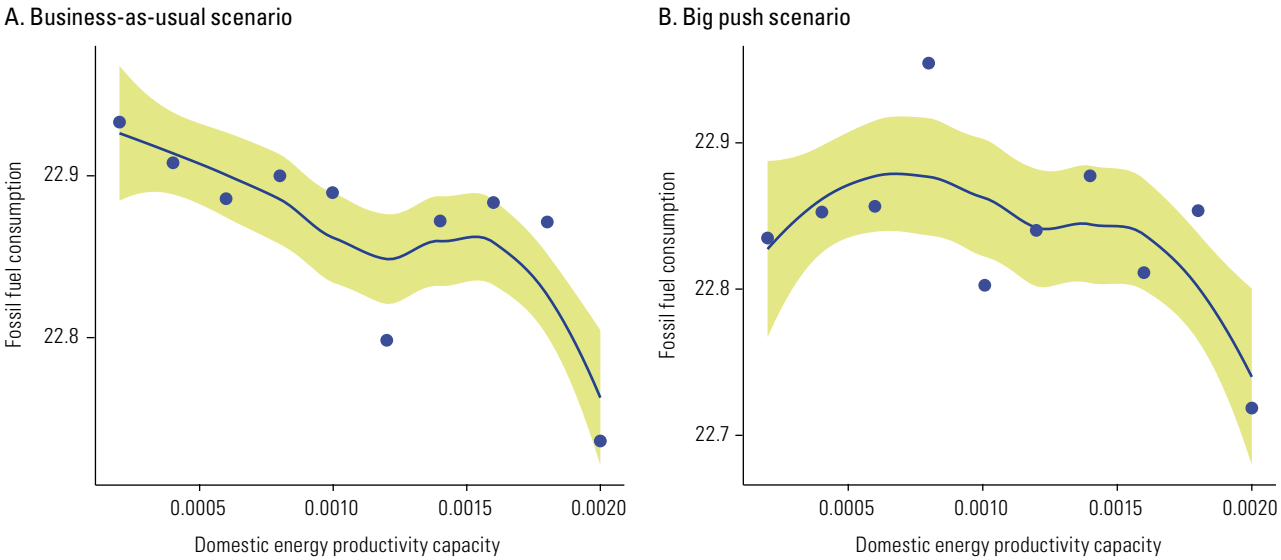
As expected, under the big push scenario the share of green energy is greater than it is under the BAU scenario. In both scenarios this share increases at an accelerating rate in step with the capacity parameter (i.e. with the adoption of policies to encourage technical change and learning). When the share of total

investment in output is considered (not shown in the figure), the results for the two scenarios diverge. In the BAU scenario, this share does not change significantly, while in the big push scenario, it continues to expand in step with the level of technological capabilities and capacity (which raise energy productivity).

In other words, a policy aimed at improving the technological capabilities of domestic producers of capital goods for the green energy sector will have a larger impact on both the share of investment and the share of renewable energy under the big push scenario than under the BAU scenario.

What does this mean in terms of the consumption of fossil fuels? Figure III.17 plots total consumption of fossil fuels averaged over the last 50 time steps (in logs) for different levels of the technological capacity parameter. In the BAU scenario (left-hand panel, figure III.17), pollution increases with small advances in technological capabilities in the capital goods sector, probably as a result of a rebound effect (a multiplier effect associated with the increase in total production), but the consumption of fossil fuels peaks and then begins to recede. Something similar occurs under the high-investment scenario (right-hand panel, figure III.17). The difference is that, in the big push scenario, the increase in domestic capabilities leads to a much steeper drop in pollution than it does in the BAU scenario. The rebound effects of innovation are overcome when energy productivity increases at a high rate.

Figure III.17
Latin America and the Caribbean: trends in fossil fuel consumption as national capacity for energy innovation increases



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

In sum, changing the share of the total energy supply that is represented by green energy is the core component of the energy transition. If the suppliers of renewable energy capital goods at the technological frontier are in the centre, access to foreign exchange will help to increase the share of renewable sources in the energy mix. However, under the BAU scenario, the positive effect of access to foreign exchange is limited by the low level of investment (and hence the weak demand for capital goods), thereby hampering the energy transition. Domestic capabilities for increasing energy efficiency have a significant role to play in boosting the share of investment in GDP and the share of renewable energy in the total energy supply. Strengthening these domestic capabilities is indeed key for a successful transition towards a sustainable economy.

F. Conclusions

A number of quantitative exercises have been presented here in an effort to gauge the impact that differing scenarios based on different policy mixes would have on growth, distribution and emissions. They all underscore the need to coordinate macroeconomic, social, technological, industrial and international trade policies in order to transform the region's development pattern in ways that will narrow the existing environmental, social and sustainability gaps that were explored in chapter II.

In the exercises that used the E3ME model, the key policy measures chosen to generate a big push for sustainability were the elimination of subsidies for the use of fossil fuels, the establishment of regulations mandating the use of electric vehicles and biofuel mixes, and the use of the fiscal space created by the elimination of subsidies to invest in non-conventional renewable forms of energy and to extend the scope of the right to health. These measures give rise to more favourable trends in GDP than those observed in the scenario where big push policies are not applied, and they also help to boost employment and curb the expansion of the trade deficit. They do not, however, have an appreciable impact on income distribution. It is therefore essential for big push policies to be paired with social policies aimed at rectifying the inequality that persists in the region.

Industrial and technology policies must also redirect incentives towards new sectors and R&D, as explained in chapter IV. The agent-based model shows that capacity-building, R&D and innovation that raise energy productivity play a pivotal role in boosting investment and driving the transition towards renewable energy sources. Investment in renewable energy needs to be backed up by a parallel effort to build capacities that will enable the region to shed its reliance on imported capital goods and to diversify its exports. Otherwise, this transition may be cut short by external constraints.

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CHAPTER

IV

Sectors that drive sustainable development

Introduction

As previous chapters have indicated, a progressive structural shift is required for Latin America and the Caribbean to overcome the limitations imposed by its development style. Knowledge-intensive sectors with higher rates of demand and employment growth must form a larger part of the production structure. This must be achieved without sacrificing the quality of natural resources and the environment or the services they provide. These changes call for a coordinated set of policies, summarized by the Economic Commission for Latin America and the Caribbean (ECLAC) as a big push for sustainability.

This big push for sustainability needs to be based on the coordination of technological and industrial, fiscal, financial, environmental, social and regulatory policies. It must aim to establish a new structure of incentives for investment, the creation of higher-productivity jobs and the development of production chains. At the same time, it should result in a smaller environmental footprint and in the restoration or better maintenance of the productive capacity of the natural heritage, including its environmental or ecosystemic services.

The processes and products capable of contributing to a big push are not developed in isolation, but within systems whereby each innovation creates problems that need resolving and new solutions that bring new and more complex processes in their wake (Freeman, 2008).

This chapter analyses seven sectoral systems that can provide the basis for a big push for sustainability in its three dimensions: (i) non-conventional renewable energy, (ii) urban electromobility, (iii) digitization, (iv) the health-care manufacturing industry, (v) the bioeconomy, (vi) the circular economy and (vii) tourism. As will be seen in the following sections, there is ample scope in the sectors considered to generate better-quality jobs, pursue innovation, incorporate technological progress, diversify exports, adapt to and mitigate the effects of climate change and undertake regional cooperation efforts. In short, these sections analyse the structure, behaviour and performance (i.e. the industrial organization model) of relevant sectors with a view to closing external, environmental and social gaps in the region.

This selection of sectors is meant as a guide to a transformation of the production structure in which each country, in accordance with its characteristics and priorities, will determine the activities it is to concentrate on, the combinations between them, the approach taken to implementing development policies and the way other sectors are incorporated into the logic of progressive structural change and the big push for sustainability.

A. The energy transition: non-conventional renewable energies

1. The primary generation and electricity mixes

Non-conventional renewable energies (biomass, solar, wind, geothermal and biogas) accounted for 5% of total primary energy consumption in Latin America and the Caribbean in 2018, while the world average was 4%.[1] In sectoral terms, transport is the largest final energy consumer in the region: 99% of the energy it uses comes from fossil fuels.[2]

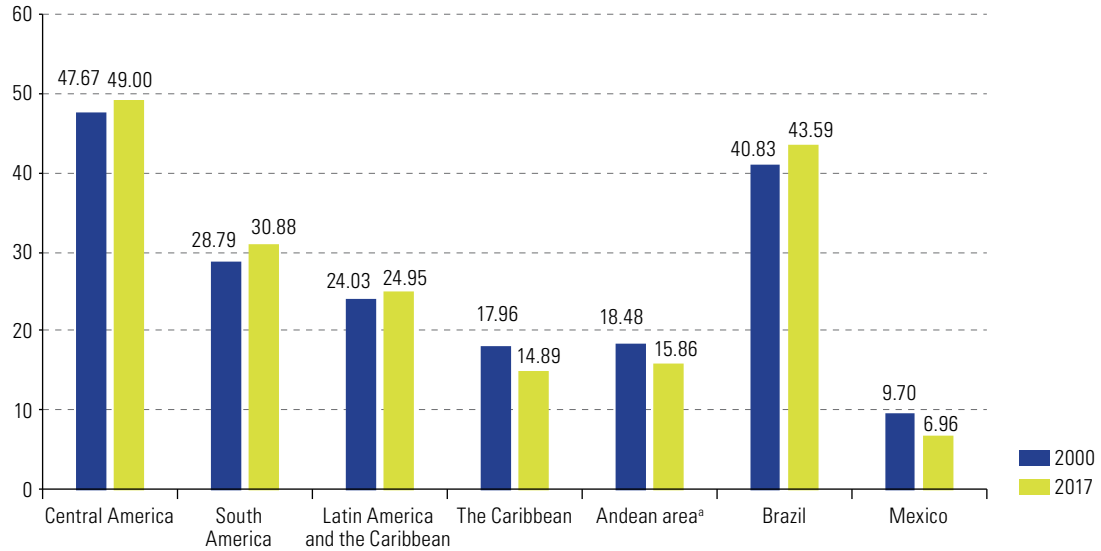
The share of non-conventional renewable energies in the region's electricity production increased from about 4% in 2010 to about 12% in 2018, which represents average annual growth of 23.6% over the period (BP, 2019). This development was led by certain countries: Costa Rica, El Salvador, Guatemala, Honduras

1 The concept of primary energy refers to the different energy sources as obtained in nature, whether directly (hydraulic, wind and solar energy and that produced from wood and other plant fuels) or after an extraction process (oil, coal, geothermal energy, etc.). The total primary energy supply is defined as energy production plus imports minus exports minus international strategic reserves, and plus or minus changes in stocks. Final energy consumption is the total energy consumed by final users such as households, industry and agriculture. It is the energy that reaches the final consumer, excluding wastage and energy used by the energy sector itself.

2 The expansion of non-conventional renewable energies is good for environmental sustainability and energy sovereignty and reduces external vulnerability (especially for countries that are net importers of fossil fuels). It also creates opportunities for universalization of electricity access (because these types of energy are modular and decentralized), technological learning and economic growth (because of the investments involved).

and Nicaragua in Central America, and Brazil, Chile and Uruguay in South America. Despite this, the share of renewable sources in the primary energy supply mix grew by less than 1% between 2000 and 2017. Moreover, the renewability index, defined as the percentage of the total energy supply provided by renewable primary energy, decreased in the Andean area,[3] Mexico and the Caribbean (see figure IV.1). Between 2000 and 2017, total hydropower generation decreased by 15%, while generation from fossil fuels increased by 7.5%.

Figure IV.1
Latin America and the Caribbean: renewability index of the primary energy mix
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Latin American Energy Organization (OLADE), Energy Information System of Latin America and the Caribbean (sieLAC) [online database] http://sielac.olade.org/.
[a] The Bolivarian Republic of Venezuela, Colombia, Ecuador, Peru and the Plurinational State of Bolivia.

2. Climate change is limiting hydroelectricity production

World demand for electricity is expected to grow by up to 90% by 2040 (IEA, 2018), while the increase for the region is projected at 91% (Balza, Espinasa and Serebrisky, 2016). Hydropower, which accounted for about 55% of electricity generation in 2017, and thermal power, which depends on water to cool generators, are vulnerable to climate change.[4] Together, they account for almost 90% of electricity generation in the region (OLADE, 2018). Water consumption for power generation (hydroelectric and thermoelectric) could double in the next four decades, increasing scarcity and competition for water with different sectors of the economy such as agriculture and urban consumption (Olsson, 2012).

Using data from 24,515 hydroelectric and 1,427 thermoelectric plants worldwide to model hydrological and electricity production systems, Van Vliet and others (2016) predict that water flows will decrease by between 61% and 74% for hydroelectric plants and by between 81% and 86% for thermoelectric plants between 2040 and 2069, with consequent reductions in power generation. Studies of the effects of climate change on power generation in Brazil indicate a reduction of between 29% and 31% in firm energy from hydroelectric plants (the part that can be provided 100% of the time in the driest period) and a loss of generating reliability (i.e. greater variability), requiring the installation of backup generating capacity and creating additional costs for the system (Barroso and others, 2016). In the case of Chile, the projection is for hydroelectric generation to decrease by between 14% and 18% by 2100 (Ellena, 2013). The findings for the Plurinational State of Bolivia are similar, with a reduction of between 18% and 20% by the end of the century (Machicado, 2014).

3 The Bolivarian Republic of Venezuela, Colombia, Ecuador, Peru and the Plurinational State of Bolivia.
4 There are also major risks relating to displacement of indigenous communities in hydropower production areas and the impact on small farmers.

These data indicate that risk and vulnerability assessments should be carried out on a regional scale and include climate change adaptation options aimed at securing a sustainable flow of water. The restoration of forests and of damaged river basins and agricultural management based on soil conservation will be essential to maintain the security of the energy–water system and the reliability of the water supply in the coming decades. According to data from IRENA (2018), the ratio between hydroelectric power generation and installed capacity in several regions of Latin America and the Caribbean decreased from 2006 to 2016. One explanation for this is the negative change in precipitation in most countries of the region.

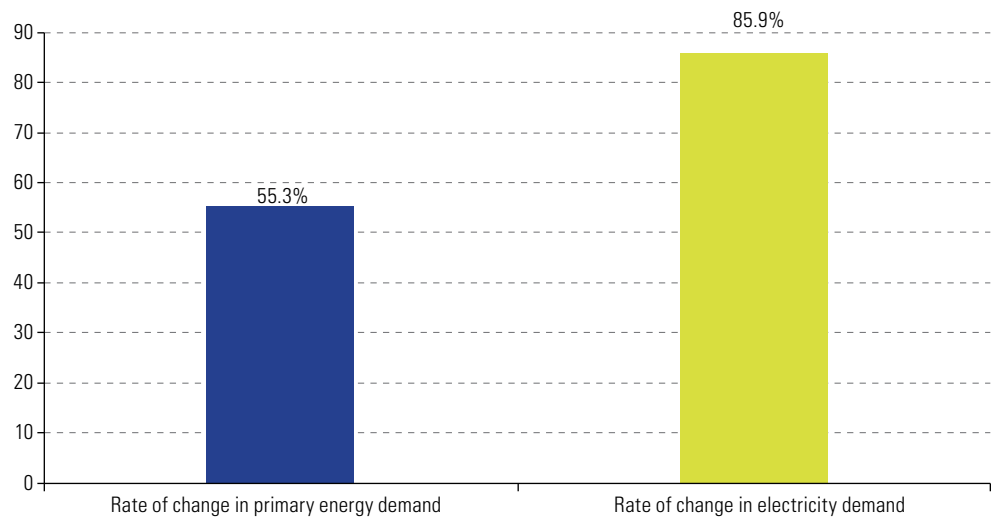
3. The future of energy demand: the role of electricity

Rapid growth in demand amid concerns about energy security and increasing climate impacts is an opportunity for the countries of the region to reshape their energy mix. Given the trend towards electrification of the transport, residential and industrial sectors, the most efficient way is to focus efforts on the main supplier of this input: the electricity sector.

While demand for energy is growing, however, the impact of COVID-19 and the measures taken to control it resulted in an overall reduction in electricity demand in both commerce and industrial production throughout the region between March and July 2020. In Chile, for example, electricity demand in the industrial sector was already down by about 4% in March compared to the week before COVID-19 appeared in the country (O'Ryan, 2020). As the impact of the pandemic grew, electricity consumption in commerce and industry dropped sharply, with an average reduction of between 20% and 40% between May and July.[5]

To give an idea of the scale of the challenge involved in meeting growing demand, ECLAC drew on 13 prospective studies to prepare an average projection that could be used to create a baseline scenario for primary energy and electricity demand. The conclusion is that the regional electricity sector will have to practically double its output to meet projected demand (see figure IV.2). Consequently, in a scenario that envisages the transport and industrial sectors as fully electrified, the initiatives needed to bring stability and flexibility to the region's electricity systems will have to be very substantial and will call for a great deal of public investment and regulation.

Figure IV.2
Latin America and the Caribbean: rates of change in projected primary energy and electricity demand, 2016 to 2040
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

5 ECLAC estimate from changes in the load curves for 10 countries of the region.

4. How to meet growing energy demand with clean and sustainable electricity

ECLAC, in partnership with the Latin American Energy Organization (OLADE), the International Renewable Energy Agency (IRENA) and the Inter-American Development Bank (IDB), prepared a study on the complementarity of electrical systems and the use of renewable energies in the region. As part of this initiative, the PLEXOS simulation tool was used to model the electricity sector.[6] The baseline scenario for the exercise are the long-term expansion plans of the region's countries and data from OLADE, updated to 2017. Three scenarios were analysed: (i) a baseline scenario, where the penetration of renewable energies is based on national energy plans and there is little integration of transmission between countries to meet the demand projected for the region by 2032, (ii) a scenario which incorporates a high proportion of renewable energy (80%, including large-scale hydropower) but maintains the same interconnections as in the baseline scenario (RE) and (iii) another scenario with high penetration of renewables and a high level of interconnection (RE+INT).

The conclusion is clear: decarbonizing the electricity sector must mean replacing fossil fuels with renewable energies, promoting and strengthening complementarity initiatives in the regional electricity network and concentrating efforts on making the management of national electricity networks more flexible. This flexibility is one of the great requirements if a synchronous hydrothermal generating system is to give way to one that includes variable and asynchronous renewable sources, which were not provided for in the design of these electricity networks.[7] The complementarity of these sources with hydropower and the potential use of long-term electricity storage is crucial for the system to operate properly.

The main results in terms of the level of penetration of renewable sources are:

- Baseline scenario: energy planning by countries in the region (2018–2032), with renewables (solar, geothermal, mini hydro, biomass and ocean (0% in 2018), not including large-scale hydropower) increasing their total share of electricity generation from 12.7% to 24.6%.
- RE scenario: renewables (excluding hydropower) increase their share of the total from 12.7% to 41.1%.
- RE+INT scenario: renewables (excluding hydropower) increase their share of the total from 12.7% to 39.5%.

For larger percentages of variable renewable sources to be incorporated into the electricity network, it is necessary to increase the dispatchable generation of base energy, emphasizing the use of hydropower. It should be noted that, from a technical point of view, variable renewables with storage (i.e. any current or future technology that enables energy produced from variable renewable sources to be stored) can be treated as dispatchable base energy and deliver auxiliary services (integrity, quality and operational safety) which are essential to the operation of an electrical power system. Although the costs of renewables are trending downward (e.g. the average price of photovoltaic modules fell by almost 61% between 2011 and 2017), the current costs of large-scale storage, which range from US$ 1,000 to US$ 5,000 per megawatt hour, limit their use on a massive scale. In the long term, however, storage costs may make greater direct penetration of renewables possible, with expected values of between US$ 100 and US$ 900 per megawatt hour.[8] The challenges thus created by rising electricity demand over the coming decades look even greater when the need to electrify transport and industry is taken into account.

6 PLEXOS Integrated Energy Model is simulation software designed by Energy Exemplar for energy market analysis. It was originally developed as a simulator for the electricity market. Its functionality was subsequently extended so that the latest versions integrate electricity, gas, heating and water. It follows the methodology used in the "Grid of the future" study (see Paredes, 2017).

7 Variable renewable sources, such as wind and solar energy, are fluctuating in nature and not always available; i.e. they are not constant over time.

8 ECLAC calculations based on the methodology of Schmidt and others (2019).

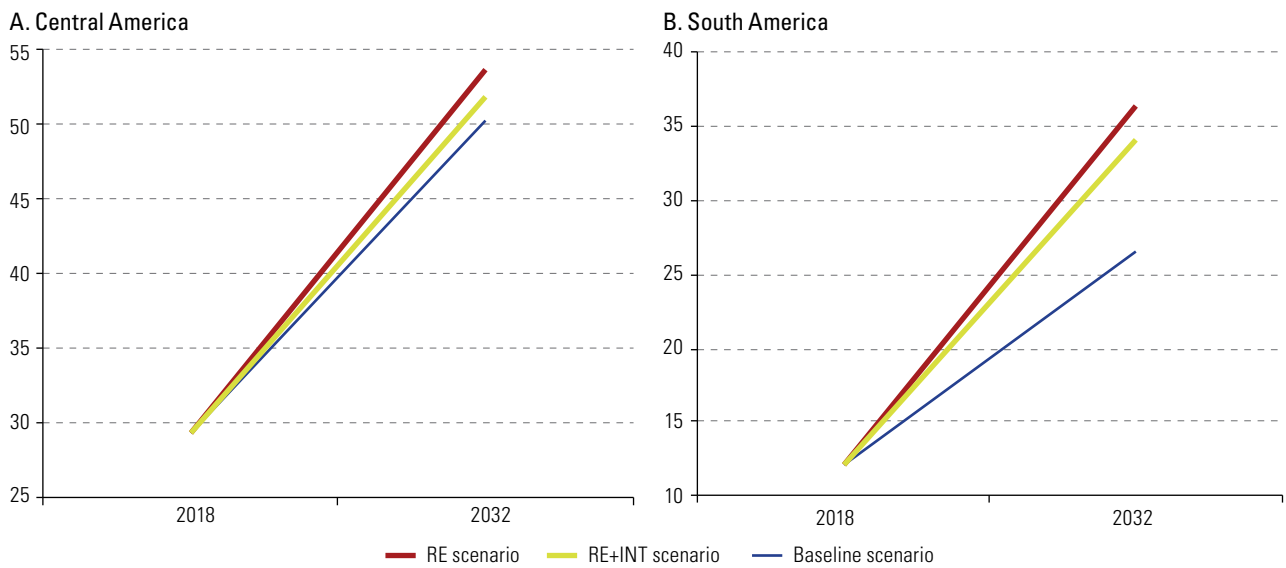
5. Subregional analysis

To obtain a comprehensive and disaggregated view of the results of the regional exercise, an analysis by subregions was carried out, with Brazil and Mexico being studied separately in view of their large shares of the region's energy sector.

In the baseline scenario, Central America achieves 50.2% penetration of non-hydro renewable energy in the electricity generation mix by 2032, thus becoming the subregion with the largest share of renewable energy. Mexico achieves only 12.5% penetration of non-hydro renewable energy, mainly because of the low price of shale gas imported from the United States. On the face of it, this limits its chances of meeting its target of 35.8% renewable energy use by 2024. However, in the RE and RE+INT scenarios, it achieves a penetration of non-hydro renewables of about 57%, a situation that could become more likely if its interconnection with SIEPAC takes place, opening up new opportunities for the regional electricity market and renewable energies.[9] In the other subregions (Brazil, and South America excluding Brazil), the share of non-hydro renewables is well over 20%, which shows the effort they are expected to make to decarbonize their electricity mix (see figure IV.3).

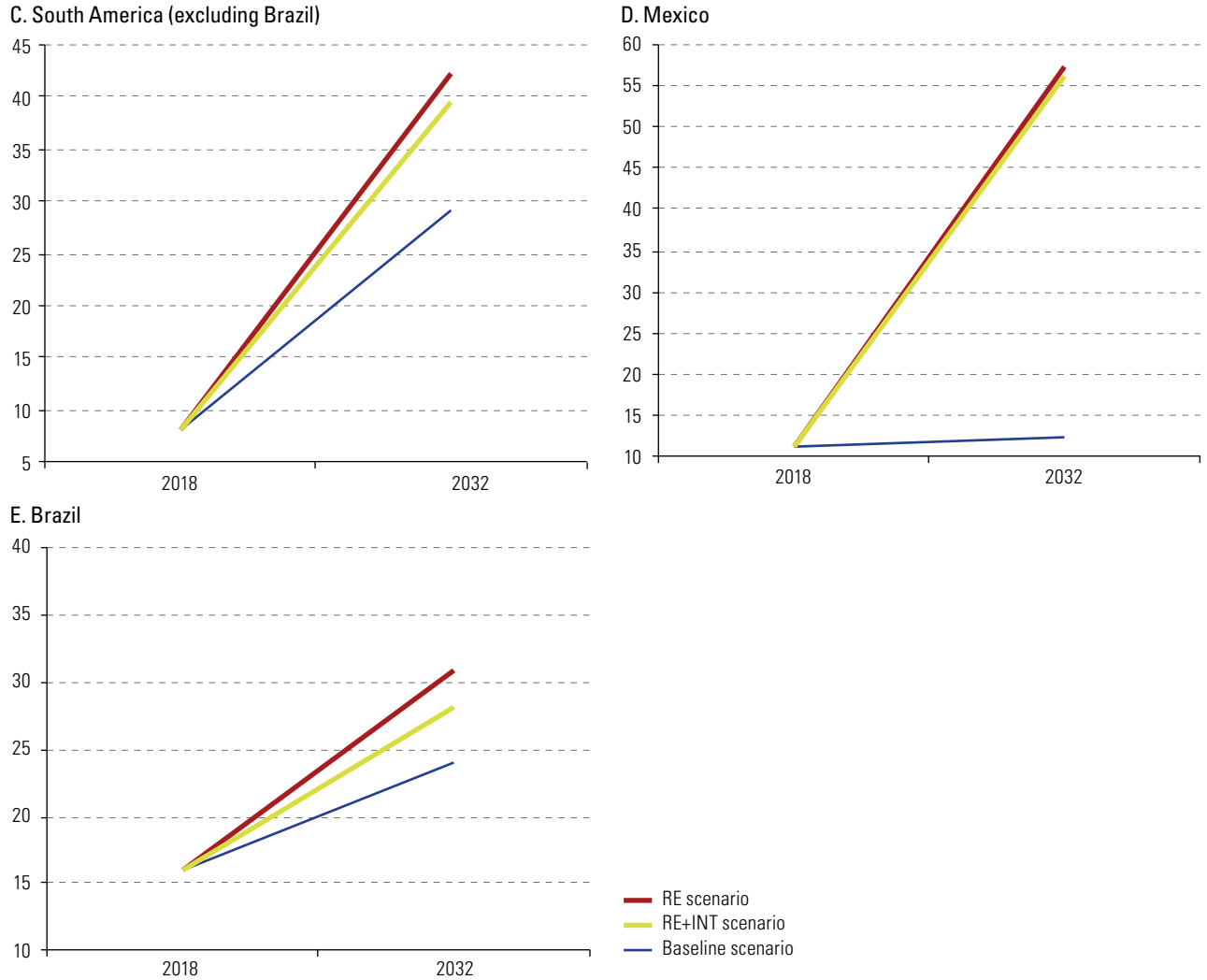
It is notable that, in the RE and RE+INT scenarios, South America excluding Brazil exceeds 40% penetration of non-hydro renewable energy sources by 2032. The regional figure is only 35% when Brazil is included, since that country attains only 30% penetration of renewables in the RE scenario owing to increased use of natural gas and the reforms anticipated in that sector, which are expected to lower its price.

Figure IV.3
Latin America (subregions, Brazil and Mexico): shares of non-hydro renewable energies in the electricity mix
(Percentages)



[9] In compliance with the 1993 Protocol to the General Treaty of Central American Economic Integration, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama created the Electricity Interconnection System for the Countries of Central America (SIEPAC) to consolidate a regional electricity market with legal, institutional and technical mechanisms that facilitate private sector participation in the construction of the electricity network. SIEPAC includes transmission lines, compensation equipment and substations. It has some 1,800 km of 230 kW transmission lines, designed to accommodate possible expansion to a second circuit. These lines connect 15 substations through 28 access bays.

Figure IV.3 (concluded)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

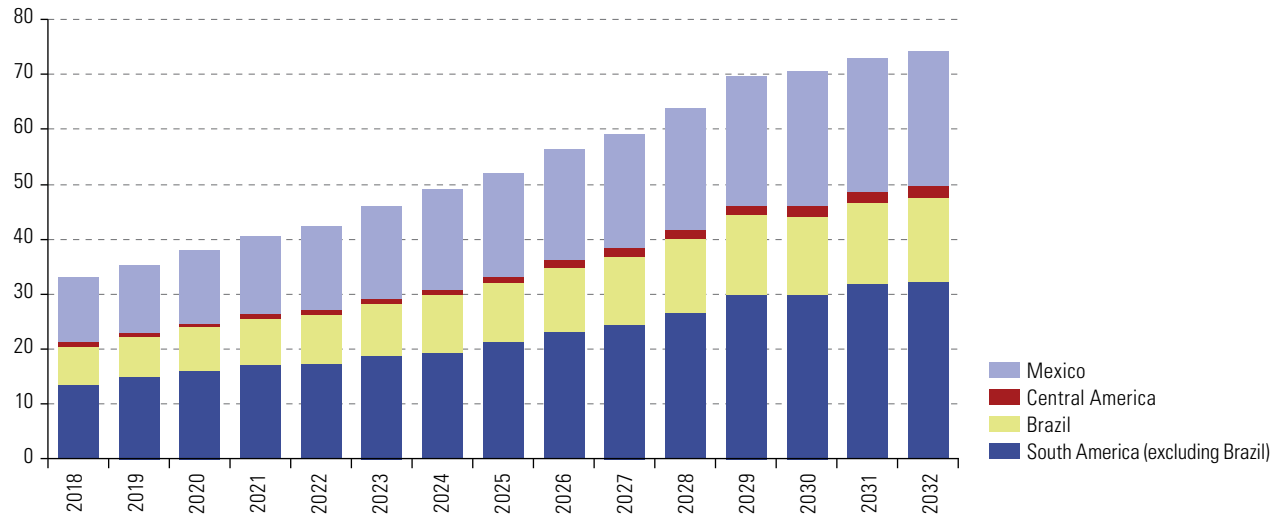
6. Costs and emissions by scenario

The necessary investment in new electricity generating capacity to meet the region's demand between 2019 and 2032 in the baseline scenario is US$ 852 billion, a figure that falls to US$ 817 billion and US$ 811 billion in the RE and RE+INT scenarios, respectively. In general, the differences between the various scenarios in the investment costs involved in implementing and commissioning new generating capacity (solar, wind, geothermal and other technologies) will depend on the expansion of the network, which varies with assumptions about expected trends.[10] Therefore, the complementarity between renewables, added to the low cost of this technology, results in an RE scenario which requires less investment than the baseline scenario.

[10] Trends are influenced, among other things, by the expansion of installed capacity, future energy demand, fossil fuel prices, the costs of investing in conventional technologies and the cost curves for renewable technologies, which by 2025 should be much cheaper than the conventional alternatives. The simulations also include resource availability, power plant maintenance plans, wind/solar profiles, hydrology and atmospheric conditions and even the impact of climate change on expected values and variability.

The RE+INT scenario is the lowest-cost one, because constructing the new transmission lines would allow a number of countries to access the generating surpluses of other countries, so they would not need to build new power plants. This would probably increase the efficiency of the system by reducing wastage and enabling better use to be made of energy resources. As a result, the regional electricity system's emissions would decrease.[11] In the RE+INT scenario, achieving a 39.5% penetration of variable renewable sources, with their corresponding infrastructure and maintenance, would require annual investments of close to 1% of the region's GDP from 2019 to 2032, which is less than in the baseline scenario. Lastly, in the RE+INT scenario, investments in Brazil and Mexico would account for 53.4% of the regional total, with the penetration of renewables and electrical integration increasing as a result (see figure IV.4).

Figure IV.4
Latin America (subregions, Brazil and Mexico): value of new investments in the RE+INT scenario
(Billions of dollars)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Announcements of foreign direct investment in the energy sector were used to obtain an indicator of investment there and compare it with the results of the model. Investment in the sector between 2005 and 2018 was US$ 257.79 billion, 56% of which was in fossil fuels and 44% in renewables (Financial Times, 2020). Investment in fossil fuels decreased by US$ 10 billion between 2005 and 2018, and investment in renewables exceeded it by almost US$ 1 billion in the last year. However, the trend towards investing less in fossil fuels could be reversed, given the new energy policies being implemented in Brazil and Mexico, new oil reserves in Guyana, and unconventional oil and gas reserves in Argentina. In the same period, just over US$ 99 billion was invested in non-hydro renewables, whereas investment in hydroelectric power stations was practically nil. Although the development of more efficient storage technologies may result in a greater share for variable renewable energies (solar and wind), there is a need to increase secondary ancillary services to maintain the stability of the electricity grid.[12]

In addition to the energy security and environmental benefits, the development of a sustainable electricity infrastructure to promote regional interconnection based on renewable energy is an opportunity to create approximately 7 million new skilled and unskilled jobs in the region by 2030.[13] Moreover, if the renewable

[11] In the baseline scenario, accumulated emissions are 4.8 gigatons of CO2 equivalent by 2032. In the RE scenario there is a 30.1% reduction compared to the baseline scenario, and in the RE+INT scenario there is a 31.5% reduction.

[12] Ancillary services in the electricity supply sector are defined as services provided by network operators to customers, in addition to the transmission and distribution of electricity, to ensure the safe operation of the system. These can include: frequency control (primary, secondary and tertiary control), voltage support, compensation of active power losses, black start and island operation capability, system coordination and operational measurement, among many others.

[13] Calculated by ECLAC on the basis of the deployment of solar, wind and biomass technologies. The figure includes construction, installation, operation and maintenance costs for the period 2020–2030. Bárcena and others (2020) show, with data for Chile, that jobs in variable renewable energies are much more productive than those in fossil and even hydro energy.

energy capital goods industry were located in Latin America and the Caribbean, just the manufacture of the necessary solar panels and wind turbines would create almost a million new jobs.[14] [15]

Overall, investment in renewable technologies is an opportunity for rapid, inclusive and sustainable post-COVID-19 economic recovery. This becomes even more important if we consider that, by the nature of their systems, variable renewable energies are more resilient than other electricity generation technologies to impacts such as close contacts, since they operate remotely and are based on digital platforms; therefore, they have a competitive advantage.

7. Policies for a sustainable energy transition

The future of the energy sector in the region must be based on two pillars. The first pillar is strategic and indicative planning that involves rethinking or redesigning policy, maintaining all or some of the objectives already formulated, incorporating aspects linked to the big push for sustainability and taking account of new instruments and actors. The second pillar is integration and complementarity in the energy transition, which should help to solve structural problems and deficiencies by way of an industrial transformation that adds value, innovation and technology. On this basis, it is necessary simultaneously to increase infrastructure investment in all links of the energy chain and to revitalize regional integration. Complementarity between countries can boost large-scale and infrastructure investments to make regional electricity integration viable. Renewable energy projects and their complementarities can give rise to virtuous technical and political processes leading to regional electricity integration, thereby increasing the security and sustainability of supply.

Increased energy efficiency makes energy consumption more effective and lowers greenhouse gas (GHG) emissions by reducing hydrocarbon use. It requires technical standards that allow better household appliances and equipment to be combined with improved building codes conducive to greater efficiency. There is also a need to strengthen the capacity of the metrology bodies that set technical standards and certify the technologies to be used.

Chapter I highlighted the slow progress being made with energy efficiency in the region. This, together with the still small average share of renewable energies,[16] makes it difficult to achieve decarbonization goals for the energy mix that are compatible with the growth rate needed to close the social divide and with the environmental frontier defined by nationally determined contributions, as described in chapter II.

According to the RE+INT scenario, increased generation of electricity from variable renewable sources would allow the region's economies to grow at a rate closer to that required to meet social goals. It would also help to ease or even avoid the external constraint if a growing share of the production chains for generation based on renewables were located in the region.

The use of renewables entails a paradigm shift. For example, power purchase agreements (PPAs) must evolve to reflect the new situation of renewables and the energy transition. While they used to be long-term contracts between suppliers and users of large volumes of energy, this has been changing with distributed generation, since end users will be able to obtain electricity directly from producers. This model has clear economic and environmental potential, as each end consumer can access renewable energies through corporate PPAs. They can thus source energy from solar plant and wind farm operators, thereby streamlining the sector's operations and displacing traditional fossil-based generators. This mechanism would also help to avoid the limitations of traditional transmission systems, which can curtail renewable electricity generation and increase its costs. Lastly, account must be taken of the technology used and its performance attributes, especially in traditional and long-term corporate PPAs, owing to rapid technological change. The new PPAs should include the possibility of providing ancillary services for variable renewables with storage.

14 Argentina, Brazil and Mexico have invested to develop components locally.

15 Calculated by ECLAC for the manufacture of solar and wind power technology.

16 Over 98% of Costa Rica's electricity is generated from renewables. In Ecuador, more than 80% of the electricity mix is generated by hydropower, which gives it great potential and flexibility when it comes to incorporating solar and wind energy. Uruguay now generates 97% of its electricity from renewables, with wind power accounting for 32%, while variable renewables make up 20% of Chile's electricity generation mix.

At the same time, the redesign needs to include capacity markets.[17] These increase the flexibility of the electricity grid and ensure the penetration of more renewables and new dynamics, such as storage, interconnections and immediate demand response (for example, during heatwaves that result in increased use of air conditioning, with the consequent explosive demand for electricity).

Lastly, technological change involves changes in tariff mechanisms. Tariffs can be made to vary according to the time of demand, allowing users to decide when to operate equipment or appliances that consume more electricity or to charge electric vehicle batteries.

8. Promoting renewable sources and discontinuing the use of fossil fuels

The governments of the region have used various mechanisms and instruments to encourage the construction of power plants, with financing from public or public–private funds. In Brazil, Chile, Colombia and Peru, for example, there have been major changes in regulation under long-term contracting systems with regulated tenders or auctions. These are generally based on a reliability charge, which can limit market risks by reducing the amount of energy traded or procured on the spot market (CIER, 2013). Many countries in the region have achieved record prices through renewable energy auctions. Nonetheless, instruments such as those detailed below, applied alone or, more often, in combination, can also be considered as national circumstances dictate:

- *National policies*. Set non-conventional renewable energy penetration targets; develop national or subnational strategies and particular laws or programmes depending on the source (wind, solar, geothermal, biomass and biofuels).[18]
- *Regulatory instruments*. Promote and adapt proven instruments such as auctions, net billing schemes[19] and community ownership models, known as pay-as-you-go models.
- *Fiscal incentives*. Establish national or subnational tax exemptions for renewable technologies and increased energy efficiency.
- *Network access*. Give renewables exemptions or discounts on transmission tolls, priority access, preferential dispatch and other benefits.
- *Financing*. Support renewables with currency hedging, specific funds, eligible funds, guarantees, pre-investment support and direct financing.
- *Technological instruments*. Implement storage in large-scale renewable systems, make use of big data and block chains in distributed generating systems, improve traditional electrical systems and promote the electrification of vehicles and transport systems.
- *Production of parts and components*. Promote the production of parts in the renewable energy industry value chain through regulations requiring a rising proportion of national content.
- *Other*. Promote the use of non-conventional renewable energy in homes, implement access programmes in rural and periurban areas, work to increase local content, take into consideration the food-water-energy link and establish special socioenvironmental regulations.

[17] In general, a capacity market is a mechanism whereby capacity (in megawatts or gigawatts) is acquired through short-term or long-term procurement contracts, usually awarded by tender or directly. This type of market provides the ability to react quickly to the possibility of future power outages resulting from an unexpected increase in demand or periods of little wind or low solar radiation. This helps to ensure that consumers continue to benefit from a reliable supply of electricity at an affordable price.

[18] Within the framework of the 25th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 25), 10 Latin American and Caribbean countries signed an agreement to bring installed capacity in the renewable energy mix up to an average of 70% of the total by 2030, which is equivalent to 312 GW of installed renewable energy capacity.

[19] This is a charging mechanism that compensates electricity consumers by netting out the power they consume against what they inject back into the network, with the net balance being based on the actual value of electricity on the market.

The push for renewable sources must be accompanied by measures to gradually eliminate fossil fuels from the supply mix. ECLAC proposes two lines of action to this end:

(i) Gradually incorporate the real social costs into the economic costs of production, so that subsidies for fossil fuels can be phased out. This in turn will allow an ever higher price to be set for CO_2, which will act as a stimulus for investment in renewables. This should go along with social and public transport policies to minimize undesirable distributional impacts.

(ii) Prepare the market to absorb the closure of coal-fired plants. For this, countries must proceed with legislative reforms to provide the basis for an emissions trading regime, with emission rights decreasing as coal-fired power plants are withdrawn from the network.

Lastly, governance of the energy transition involves strengthening public management capacity, and especially human capital, to design, manage and monitor policy instruments with a view to maximizing the social benefits from the use of new sources. The future of the energy transition will thus depend on the ability and willingness of the State to address problems, create the necessary momentum for change, encourage investment and secure the support and commitment of society.

B. Sustainable mobility and urban space

1. Mobility in Latin America and the Caribbean

Approximately 80% of the population of Latin America and the Caribbean lives in urban areas. This high degree of urbanization has exponentially increased mobility needs and exposed housing deficits and the need for urban planning.

Access to safe, efficient and sustainable modes of transport is essential for economic development and well-being. Although an average of 68% of total travel in the region is by public transport (Estupiñan and others, 2018, in Yañez-Pagans and others, 2018) and rapid transit bus systems have been established, metro systems expanded and other forms of mobility improved, there are expected to be more than 200 million private vehicles by 2050 (UNEP, 2017a).[20] Although the rate of motorization is lower than in developed countries at around 200 vehicles per 1,000 inhabitants, since 2000 it has grown at the fastest rate in the world (SLOCAT Partnership, 2019a and 2019b).

The increase in private transport, favoured by the bias of infrastructure investment towards it, has led to higher congestion, travel times, accidents, energy consumption and emissions of air pollutants, with substantial effects on mortality, morbidity, productivity and well-being. From a sample of 15 cities in the region, it is estimated that the health impacts of air pollution alone, largely attributable to transport, cost citizens 15% of their income (Hidalgo and Huizenga, 2013).

Transport is the world's second-largest source of GHG emissions, behind only the energy industry. The region contributes around 9% of global emissions attributed to the transport sector, excluding those from aviation and maritime transport, with a 46% increase between 2000 and 2017 (SLOCAT Partnership, 2019a and 2019b) to 578 million tons of CO_2. The region's carbon footprint is evenly divided between passenger and freight transport. Private vehicles represent 32% of the total and public transport barely 15%. Heavy and light trucks emit the remaining 53%, since road freight transport, the main mode of surface transport, has grown rapidly in the region (Vergara, Fenhann and Schletz, 2016). The expansion of the vehicle fleet explains why the transport sector consumed 38% of final energy in 2018, with almost all of this coming from fossil fuels (OLADE, 2019).

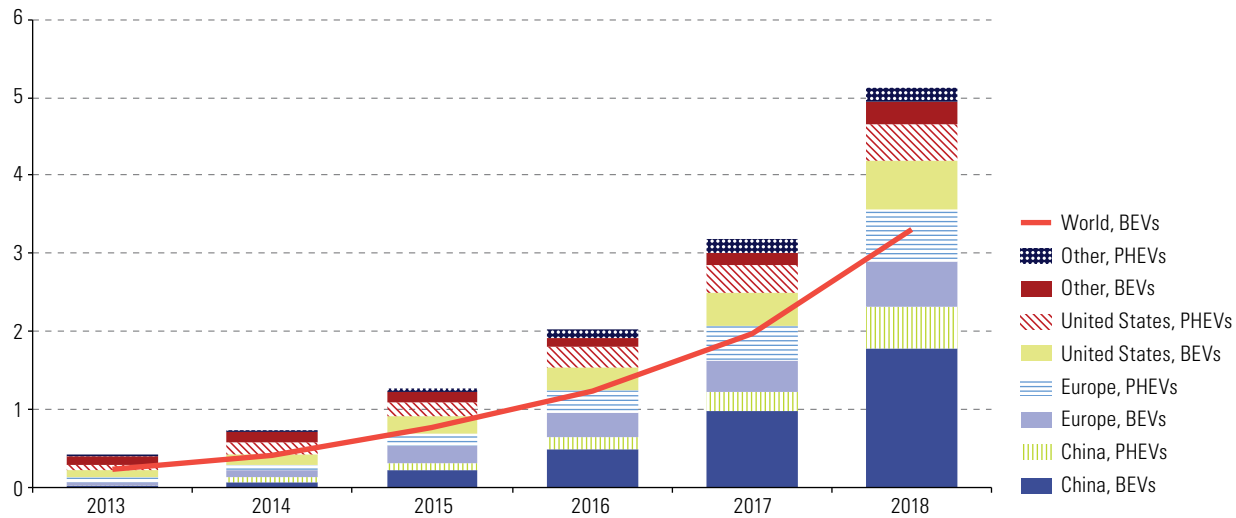
[20] The 22 metro systems operating in the region cover almost 1,100 km, are State-owned and mostly run underground. Many operate in an integrated manner, examples being those of Medellín in Colombia, São Paulo and Rio de Janeiro in Brazil, Santiago and Mexico City.

The GHG emissions of the region's transport sector relative to GDP are 2.2 times as high as in Europe and 1.3 times as high as in Asia, which means there is ample scope to increase carbon efficiency. If a better balance were achieved with electric railway transportation, the environmental performance of cargo transport would improve, while at the same time the competitiveness and flexibility of the sector would be enhanced. Decarbonizing the transport sector in the region would also create 4 million new jobs in heavy vehicle operation and maintenance activities and more than 1.5 million in the light vehicle industry (UNEP, 2019b).

2. The expansion of electromobility

The fleet of electric vehicles, both hybrid and pure, has increased steadily in recent years, with China leading the way (IEA, 2019) (see figure IV.5). The main incentives accounting for these figures have been reduced purchase taxes, market shares for zero-emission vehicles (Cattaneo, 2018), exemption from registration taxes and tolls (ACEA, 2019), free recharging at public points, carbon taxation, increases in the prices of internal combustion vehicles in proportion to their GHG emissions (Fearnley and others, 2015), financial support for recharging points (Consoni and others, 2018), subsidies for the installation of home chargers (ACEA, 2019), programmes for the installation of chargers in public buildings and government facilities (United States Department of Energy, 2019) and subsidies for the purchase of batteries according to capacity (He and others, 2018).

Figure IV.5
Electric car fleets in the main international markets, 2013–2018
(Millions of vehicles)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of International Energy Agency (IEA), *Global EV Outlook 2019: Scaling-up the Transition to Electric Mobility*, Paris, 2019.
Note: PHEV: plug-in hybrid electric vehicle; BEV: pure or battery electric vehicle.

The electric vehicle share of car sales is expected to increase greatly by 2050. In Brazil, for example, implementing policies that included a legal obligation to market electric vehicles and an increase in the price of internal combustion vehicles could lift the share of electric vehicles in the country's car sales to 20% (Borba, 2020).

Meanwhile, a cumulative total of 513,000 electric buses had been registered in the world as of 2019 (Cision, 2020), when they already represented 17% of the fleet (IEA, 2019). It is estimated that there will be 1.5 million units by 2030 and 2.3 million by 2040, when 80% of the municipal fleet will be electric.

About 95% of the electric buses registered in 2019 were manufactured and sold in China (see box IV.1). As of that time, China accounted for 99% of manufacturing and 98% of registrations (IEA, 2020). Domestic demand has been crucial, especially at the municipal level, since cities such as Shanghai and Shenzhen no

longer buy buses with internal combustion engines (BNEF, 2018; ITDP, 2018). Thus, electric and plug-in hybrid buses together accounted for 39.5% of the public transport fleet (ITDP, 2018). Meanwhile, 2,100 units were in use in Europe in 2017, or approximately 1.6% of the fleet (BNEF, 2018). In Latin America and the Caribbean, 1,229 electric buses, including trolleybuses, are operating in 10 countries (UFRJ, 2020). In 2019, 450 electric buses were registered in what is an incipient but expanding market. Santiago has been the leading adopter, introducing increasing numbers of new units (IEA, 2020).

Box IV.1
Why is China leading the electric bus race?

- *Financing*: by the end of 2016, a combination of national and regional subsidies had brought down the initial capital cost of an electric bus below that of its diesel equivalent, thus removing the main barrier to the adoption of this type of vehicle (high initial costs).
- *The effort to reduce urban pollution and oil imports*: China has the world's largest urban population, and local air pollution problems due to growing transport demand have rapidly become a major political issue. The country has also set out to reduce its dependence on imported oil.
- *Clean slate*: many Chinese cities are building entirely new public transport networks, whereas bus operators in Europe and the United States need to find ways to incorporate the new electric technology into a well-established infrastructure.
- *Industrial policy*: China is geared towards electric vehicles partly for reasons of industrial policy. The government aims to develop local brands that are competitive outside the domestic market. The country accounts for 99% of electric bus manufacturing.

Source: Bloomberg New Energy Finance (BNEF), *Electric Buses in Cities: Driving Towards Cleaner Air and Lower CO2,* New York, 2018.

According to the EVTrader site, there are 118 manufacturers of electric buses in the world: 53 in Europe, 32 in China, 13 in the United States and 10 in other countries. The main players in this market are BYD (China), Yutong (China), Proterra (United States), VDL Groep (Netherlands) and AB Volvo (Sweden). There are only three factories in Latin America and the Caribbean, all in Brazil.

New business models involving upfront subsidies, vehicle and battery leasing systems and shared ownership and operation are advancing across the world and driving the penetration of electric vehicles. BNEF (2018) observes that initial costs will be the same for electric and conventional vehicles by 2030 and that rising demand could bring this parity forward to 2025. Batteries, a major component in the cost, will represent 8% of the total price of an electric bus by then, compared to 26% in 2016. Indeed, lithium-ion battery prices fell by 87% between 2010 and 2019. In 2010, they cost more than US$ 1,100 per kWh, while the average real price in 2019 was US$ 156 per kWh. Bloomberg estimates that the average price will be around US$ 61 per kWh by 2030.

The continuing decline in battery costs has brought electric buses closer to cost parity with other bus technologies; in many cases they are already the cheapest option in terms of total cost of ownership (TCO). Battery costs, mileage and diesel prices have the greatest impact on TCO when electric and diesel buses are compared. For example, electric buses that travel between 40,000 and 50,000 km per year are competitive in regions with high fossil fuel taxation regimes and battery prices below US$ 260 per kWh (IEA, 2020).

Lithium-ion batteries are already close to peak development in terms of density (Soam, 2019), and the growing electricity generation needs for individual, collective and cargo vehicle engines have required new technologies for their construction. Solid state batteries are promising candidates, as they have new attributes that make them more efficient (Triggs, 2016 and 2019). In the future, the use of hydrogen as a fuel can provide new opportunities for sustainable mobility, if it is produced with clean energy.

3. An opportunity for the automotive industry in the region

The region is well placed to produce the material basis for electric mobility. Three countries are major car manufacturers: Argentina, Brazil and Mexico. The Brazilian automotive industry accounts for 5% of GDP and employs 500,000 people directly and 1.3 million indirectly, making the country the world's tenth-largest producer. In Mexico, the industry generated 3.7% of GDP and employed 824,000 people directly in 2017, placing the country seventh in the world for vehicle manufacturing and fifth for auto parts. In addition, three countries in the region, Argentina, Chile and the Plurinational State of Bolivia, have the world's largest reserves of lithium, and there are areas that are very well endowed with solar and wind energy that would allow hydrogen to be generated at very low costs. Chile and Peru also have large reserves of copper, a metal that is more in demand for the manufacture of electric vehicles than those with internal combustion engines.

The size of the conventional fleet gives an idea of the potential market for electric buses and their manufacture in Latin America and the Caribbean (table IV.1). Low rates of private vehicle ownership and rising populations and urbanization in an unequal region point to growth in demand for travel, and the higher the quality of service, the greater this will be.

Table IV.1
Latin America: conventional bus fleets in selected countries and cities, most recent year available

Country/city	Bus fleet
Brazil	Over 390,000 buses in organized urban transport systems as of 2020 (SINDIPECAS, 2020); 675,950 units (urban and interurban) in use as of 2019 (FENABRAVE, 2019).
Mexico	443,000 buses registered and in use, of which 56% are private and the rest public as of 2020 (INEGI, 2020).
Buenos Aires	18,000 urban units (Lexi Wiki, 2020).
Bogotá	16,029 units (CAF, 2019).
Other cities	Santiago: 6,937 buses (Metropolitan Mobility Network, 2020); Quito: 2,321 buses; Montevideo: 1,528 buses (CAF, 2019).

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of National Association of Brazilian Auto Parts Manufacturers (SINDIPECAS), "Relatório da Frota Circulante", São Paulo, 2020; National Federation of Motor Vehicle Distribution (FENABRAVE), *Balanço Semestral 2019*, São Paulo, 2019; National Institute of Statistics and Geography (INEGI), "Vehículos de motor registrados en circulación", Aguascalientes, 2020 [online database] https://www.inegi.org.mx/programas/vehiculosmotor/default.html#Datos_abiertos; Lexi Wiki, "Ciudades en América Latina con buses eléctricos chinos", 7 July 2020 [online] https://www.lexiwiki.com/2020/07/ciudades-en-america-latina-con-buses-electricos.html; Development Bank of Latin America (CAF), *La electromovilidad en el transporte público de América Latina*, Caracas, 2019; Metropolitan Mobility Network, "Con la incorporación de 115 nuevos buses eléctricos, más de la mitad de la flota del eje Alameda cuenta con estándar red", Santiago, 15 August 2020 [online] http://www.red.cl/noticias/con-la-incorporacion-de-115-nuevos-buses-electricos-mas-de-la-mitad-de-la-flota-del-eje-alameda-cuenta-con-estandar-red.

In this context, the region is beginning its transition to the production of electric passenger vehicles. The Chinese company BYD had sold 1,035 electric buses in Latin America by 2019, becoming the leader in the promotion and implementation of electrified public transport throughout the region and accounting for 71% of the market, with fleets in Argentina, Brazil, Colombia, Chile and Ecuador (BYD, 2019). Yutong had units operating in Mexico City (IEA, 2020). However, there are producers of electric vehicles, both buses and cars, in several countries of the region as well.

Brazil, for example, has three producers, Eletrabus, Agrale and Caio. In addition, BYD assembles chassis with bodies produced by local partners, Marco Polo and Volare, which have begun to produce batteries for electric buses in consortium with the former. Volare also launched a 100% electric minibus in 2017 in partnership with BYD. The Brazilian company Eletrabus, which was created in 1988 and produces mainly trolleybuses, has electric buses running in Greater São Paulo, Rosario in Argentina and Wellington in New Zealand. In December 2019, Volkswagen announced a large investment in its plant in the state of Rio de Janeiro to produce electric trucks. The share of electric cars in Brazil is still small, at 0.015% of all light vehicles in 2018, although it could grow substantially with the right incentives (Borba, 2020). The context for this is Brazil's success in the use of ethanol as a fuel for light cars, since its entire fleet, with or without flex-fuel engines, uses a 27.5% blend of

ethanol in petrol.[21] The widespread use of ethanol in Brazil began in the mid-1970s, when this solution was devised as a way of reducing the country's dependence on oil and adding value to agricultural production. The country became an international standard setter in endogenous production development and biofuel use.

Mexico also has local companies involved in the manufacture of electric buses. For example, DINA Camiones manufactures a hybrid trolleybus designed in collaboration with the Metropolitan Autonomous University (UAM) that operates in urban transport in Mexico City and Guadalajara. It is estimated that electric bus manufacturing in Mexico can generate 185% more value added than diesel bus manufacturing, especially where parts are concerned (INECC, 2017). Given the significant presence of electronic product manufacturers (910 economic units and 458,563 direct jobs, according to CANIETI/SE (2017)), Mexico has the technical capacity to manufacture new electric propulsion systems (see table IV.2). If an aggressive programme of unit replacement is implemented, the electric fleet could form 42.6% of the total (approximately 39,500 units) in the metropolitan areas of Valle de Mexico, Guadalajara and Monterrey by 2030. This potential demand for units should be an incentive for the development of a local manufacturing industry. There would be about 5,655 fast charging stations in the three metropolitan areas, with a large positive impact on employment (Carrillo, De los Santos and Briones, 2020). Meanwhile, Zacua and Giant Motors are leading the transition towards the production of 100% electric cars, and the Spanish firm CAF is building different types of electric rail vehicles and buses for public transport in Mexico.

Table IV.2
Mexico: installed production base for electric bus components

Component	Economic units	Staff employed	Concentration
Electric motors	74	27 665	Chihuahua, Nuevo León, Tamaulipas
Rechargeable batteries	22	5 123	Nuevo León
Electrical cables and connectors	93	18 142	Mexico City, Baja California, Nuevo León, Chihuahua
Power inverters	80	10 530	Mexico City, Nuevo León, Baja California

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of National Institute of Statistics and Geography (INEGI), Censos Económicos 2014 [online] https://www.inegi.org.mx/programas/ce/2014/.

Argentina also has an automotive industry with the potential to produce or assemble electric vehicles. In 2019, Sero Electric completed the commercial and industrial launch of the first domestically mass-produced electric vehicles approved for registration and use in urban areas (Elonce, 2020). That same year, the Plurinational State of Bolivia launched the first generation of electric cars manufactured in the country, which opens up prospects for the local production of rechargeable lithium batteries. The two models, the Quantum E2 and Quantum E3, can carry up to three people and were tested in high-altitude Andean regions (between 2,400 and 4,000 m). Like their Argentine counterparts, they are very economical vehicles (*El Comercio*, 2019).

4. Conversion of conventional buses to electric propulsion

It is also important to consider the conversion of diesel buses to electric power. The experiences of Chile and Mexico show that this can be an economically and environmentally viable option compared to the manufacture of new vehicles. Conversion is emerging as a way to incorporate electromobility into the Latin American market with great benefits: lower investment costs, decarbonization of vehicles already in operation whose structural characteristics have been proven in the region's street and road conditions, compatibility of spare parts in the local ecosystem, promotion of the circular economy through waste reduction and the generation of scrap, creation of local employment in the conversion process, and lower emissions during manufacture owing to the reuse of components.

[21] A flex-fuel or dual fuel vehicle has a conventional four-stroke or diesel internal combustion engine that can alternate between two fuels stored in different tanks.

According to e-troFit, a German company based in Mexico, it is about 50% cheaper to retrofit a bus than to buy a new electric bus (Carrillo, De los Santos and Briones, 2020). In Chile, five local jobs would be created for every bus converted per month, and the sum of operating, maintenance and leasing costs would be lower for a converted bus than for a new electric bus or a diesel bus (Reborn Electric, 2020).

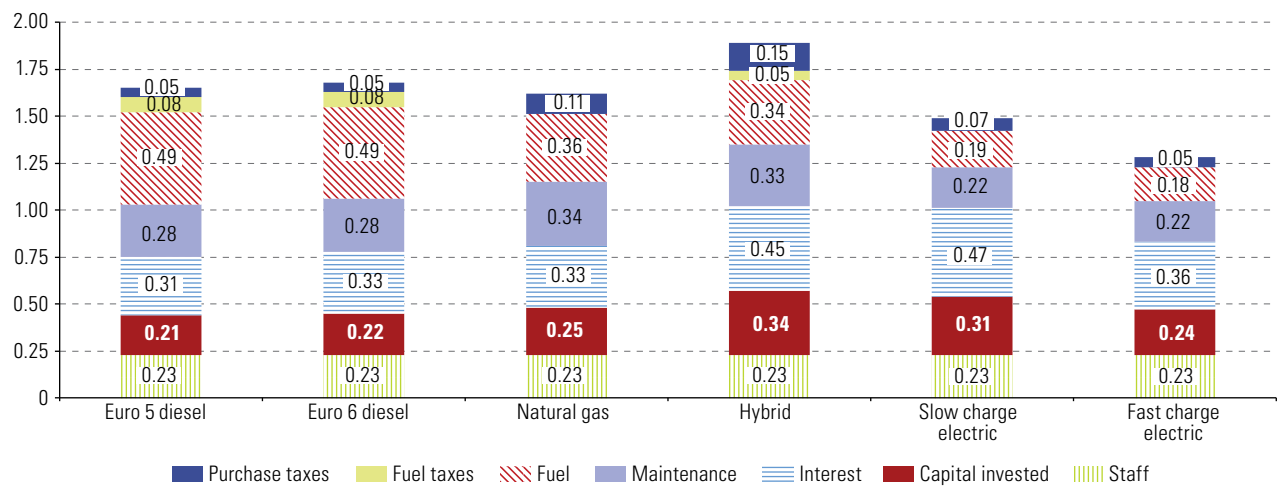
5. The advantages of public electromobility

Public electromobility includes electric buses, metro systems, trolleybuses, trams, urban light trains, cable cars, public lifts, escalators, scooters and, where available, electric public bicycles. The idea of a big push to locate production in the region applies to all these forms of transport, although this document focuses on just a few.

The electrification and digitization of transport and the supply of clean energy create a virtuous circle, and integrating them could generate value of more than US$ 2.4 trillion worldwide by 2025 through increased efficiency in the system as a whole and the creation of new services (WEF, 2017). In addition, reducing CO_2 emissions associated with electric vehicles helps to curb local pollution and climate change (WEF, 2018).

The advantages of electromobility are clear when the total costs of ownership are studied. This analysis considers the capital costs of acquiring the unit, the distance travelled each year, vehicle lifespan and the costs of maintenance and fuel or energy. There are many differences in total cost of ownership (TCO) analyses depending on the operational conditions in each city, fuel/energy prices, contracts and other variables. Various analyses show TCO to be lower for electric buses than for their conventional diesel counterparts, with a difference of approximately 20%. In California (BNEF, 2018), it has been calculated that fast charge 250 kWh electric buses covering 80,000 km a year cost 22% less to run than natural gas buses and 12% less than diesel buses. In the case of Mexico City (World Bank, 2019), fast charge electric buses with a 10-year lifespan cost 20% less to run than diesel buses with Euro 5 technology (see figure IV.6).

Figure IV.6
Mexico City: total cost of bus ownership over a 10-year lifespan
(Dollars per kilometre)



Source: World Bank, *Green Your Bus Ride: Clean Buses in Latin America. Summary Report*, Washington, D.C., 2019.

The same is true in the case of Santiago, in Chile. Although leasing rates for an electric bus are 60% higher, monthly operating costs (energy) and maintenance costs (chassis, engine and bodywork) are 70% lower (DTPM, 2018). These figures yield a positive net result in favour of electric buses, with a monthly saving of approximately 20% over diesel buses. BYD, the company supplying electric buses in Santiago, quotes operating costs of US$ 0.1 per km for electric buses versus US$ 0.4 per km for diesel buses, giving a 70% reduction in operating costs (Kane, 2019).

6. A new business model

The development of an ad hoc business model for implementing and expanding public electromobility has been crucial in overcoming the initial financial and technological barriers arising in each situation or city. Santiago is the regional leader in this transition.[22] The business model for the incorporation of electric buses into the Metbus fleet was innovative, as it involved the direct and active participation of the energy company Enel Chile, which purchased the electric buses from BYD. Metbus is operating them under a 10-year leasing contract, after which it will acquire ownership.[23] In addition to the monthly charge for the buses, Metbus pays Enel Chile for the supply of energy at 40% of the price charged to household users. Metbus engaged Enel Chile to build the charging infrastructure, financed from its own resources. The batteries are guaranteed for 10 years.

7. The region has experience with electromobility and bus rapid transit systems

Trams and trolleybuses, with a catenary-based system, were the predominant mode of public transport for much of the twentieth century. Their infrastructure still exists in several cities of the region, and much of it could be restored if they were to be brought back into service. Thus, not only do modern trolleybuses have a greater range, which makes them more flexible, but the infrastructure for their rehabilitation and maintenance is already in place. In Mexico City, for example, there were at one point almost 500 km of catenaries for trolleybuses, 200 km of which are still in use, and the plan is to rehabilitate the rest by 2024, in addition to carrying out major maintenance work on the metro and light rail systems. In Chile, the import of used trolleybuses has been allowed since 2014, and this has facilitated the expansion of the fleet in the city of Valparaiso.

Many cities in the region have metro systems. The oldest, that of Buenos Aires, dates from 1913. Panama, the first Central American country to have a metro, began to extend its third line in 2020. In Mexico, an extension to metro line 12 and a viaduct for an elevated trolleybus in the eastern sector of Mexico City are under construction, as are a new light rail line in Guadalajara and an electric intercity train between the metropolitan areas of the Valley of Mexico and the Toluca Valley. For their part, Medellín (Colombia) and La Paz were pioneers in the introduction of cable cars and escalators as modes of public transport, and these have saved a great deal of time and improved connectivity between central areas and poorer districts, as well as having a major impact on inclusion. In Mexico City, the plan is to add three new cable car lines to the city's first, the Mexicable.

Another advantage of Latin America and the Caribbean when it comes to implementing a robust system of public electromobility are its long-established and extensive bus rapid transit (BRT) systems, which began in 1972 with the pioneering experience of the city of Curitiba in southern Brazil. This hierarchizes traditional road use, rationalizing urban road space by creating express lanes and so immediately relieving traffic congestion and emissions. The system features high-capacity multi-door buses, dedicated raised stations where passengers pay before boarding, and centralized control involving the use of permanent passenger monitoring and information technologies.

The consolidation of these BRT systems would allow electric buses to be implemented on a massive scale in the corridors as a spearhead for subsequent expansion to the rest of public transport, with the advantage of having an established recharging and maintenance infrastructure in place. The countries of the region have added more than 1,200 km to their rapid transit passenger transport networks in the last decade, with BRT accounting for 78% of this total (table IV.3). By late 2018 they were operating in 55 cities and carrying about 21 million people daily, equivalent to 62% of all passengers using this type of transport in the world (WRI, 2019).

[22] Information was obtained from the firms involved, from DTPM (2018) and from the National Register of Public Passenger Transport and School Transport Services, administered by the Undersecretariat for Transport.

[23] The buses are 12 m long and have a capacity of up to 81 passengers and a range of 250 km.

Table IV.3
Latin America and the Caribbean: bus rapid transit systems in operation

Country	Passengers per day	Number of cities	Length *(kilometres)*
Argentina	1 717 000	3	76
Brazil	10 681 654	21	765
Chile	476 800	2	105
Colombia	3 071 541	7	225
Ecuador	1 055 000	2	117
El Salvador	27 000	1	6
Guatemala	210 000	1	24
Mexico	2 652 204	11	394
Panama	...	1	5
Peru	704 803	1	26
Trinidad and Tobago	...	1	25
Uruguay	25 000	1	6
Venezuela (Bolivarian Republic of)	240 778	3	42
Total	20 861 780	55	1 816

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Resources Institute (WRI), Global BRT Data, 2019 [online database] https://brtdata.org/location/latin_america.

8. Cobenefits for health and the environment are also substantial

The time and fuel wasted by urban congestion generates costs estimated at between 2% and 5% of GDP in each country (Lefèvre and others, 2016). According to the United Nations Environment Programme (UNEP), a full transition to electromobility based on clean energy would yield US$ 30 billion in savings on public health costs in the region through reduced air pollution by 2050 (UNEP, 2019a). In Costa Rica, for example, it is estimated that accidents, time wasted in traffic and the effects of local air pollution on health cost the country 3.8% of GDP (PEN, 2018) and that decarbonizing the transport sector by improving public transport and increasing electromobility would bring net benefits of some US$ 20 billion by 2050. In Brazil, air pollution costs about 22.9 billion reais annually (ANTP, 2020), and it is estimated that 4,000 people die each year from problems caused by air pollution in the city of São Paulo alone, generating costs equivalent to US$ 1.5 billion (Vaz, Barros and Castro, 2015). In Colombia, the implementation of the TransMilenio BRT system contributed to a 43% reduction in sulphur dioxide (SO_2) emissions, an 18% reduction in nitrogen oxides (NOx) and a 12% reduction in particulate matter, resulting in significant environmental benefits and a reduction in respiratory diseases (ECLAC, 2015; Carrigan and others, 2013). BRT systems and other alternatives such as the cable car in La Paz, the Metrocable in Medellín and the Mexicable in Ecatepec (Mexico state), have helped to reduce traffic accidents and travel times and given people living further out greater access to better jobs (Yañez-Pagans and others, 2018; Bocarejo and others, 2014). For example, Mexico City's Metrobús Line 1 alone saved the equivalent of 6,000 working days (Carrigan and others, 2013). These examples show that health cobenefits reinforce the positive social value of expanding clean public transport.

9. Mobility and housing: the spatial structure of cities matters

Travel requirements depend on the spatial structure of a city. More spread-out cities require their inhabitants to make longer journeys that involve greater costs in time and fuel use. There is a clear inverse correlation between density and per capita emissions in the region, as was analysed in chapter I, and a direct correlation between density and the functionality of public transport. Virtuous interaction between the two systems, habitability and mobility, provides major opportunities for inclusive development with a smaller environmental footprint.

The increasing penetration of private vehicle ownership, a trend that may be reinforced by health considerations in the post-pandemic phase (see box IV.2), is being stimulated by growth in suburban areas that is not accompanied by an equivalent expansion of urban transport services. Urban sprawl manifested in the fragmentation of property developments poses problems of access to the urban fabric for the populations that settle there. In many cases, metropolitan areas are characterized by large shopping centres located far from residential areas, while outlying districts have serious deficiencies in educational and health infrastructure (Di Ciommo, 2020). This is all the more serious when it is considered that households in outlying urban areas are often poorer than those in the centre, with an average spending gap of 45% in Brazil, 42% in Mexico and 27% in Colombia (Adler and Vera, 2019).

Box IV.2
Latin America and the Caribbean: the COVID-19 pandemic and public transport

The current health crisis has introduced an additional challenge into the dynamics of public transport in all its forms in the region. Its characteristics and inefficiencies, such as overcrowding at certain times of day and unpredictability or lack of timetables, make the necessary social distancing extraordinarily difficult to achieve. Inadequate fleets aggravate the problem. The ending of lockdown measures and the need to operate under restrictive sanitary conditions should be seen as an opportunity for the immediate expansion of provisional and permanent infrastructure capable of accommodating the population in safe and protected spaces, to the detriment of private vehicles. The urban space must incorporate routes, barriers or expansions that expedite public and active mobility, the costs of which are very low in relation to their advantages in terms of fluidity, efficiency and accessibility.

Operating with greater social distancing inside units has placed urban public transport systems in a difficult financial position. It has been necessary to review the role of fares and seriously consider the possibility of providing the service at subsidized prices or even free of charge on the basis of financing formulas other than ticket sales.

New mobility trends also offer alternatives. The number of bicycles in sharing schemes continues to grow, as does the number of private vehicles, while scooters and similar alternatives are being introduced. As the next section of this chapter shows, digital technologies can contribute to the development of a world where service is prioritized over ownership, freeing up urban space and making public transport systems more fluid.

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

For large sections of the population, the burden of transport costs on family budgets also conspires against access to the opportunities, of all kinds, that cities offer. In Lima, for example, 55% of poor households spend more than US$ 28 per month on transport (the poverty line for a family of four in 2019 was approximately US$ 400). At the same time, people carrying out economic activities, often informal, in the district where they reside are more likely to live in units made of substandard materials (55%), while in the case of households whose housing is not substandard, a higher proportion of members work in areas other than that of residence (54%).

In general, the model of sprawling cities with a proliferation of scattered settlements far from their centres has a negative impact on urban development. The perennial belief that the housing deficit can only be met with new units or in new locations makes it harder for cities to contribute to national emissions reduction targets. Hence the importance of implementing strategies that aim to rehabilitate, reuse, reconstruct and expand existing properties for residential purposes.

Buildings, the largest users of urban space, require energy for their construction and operation. The energy incorporated into buildings in developed countries represents the equivalent of between 9 and 15 years of the emissions produced by their operation (UNEP 2019b; Australian Government, 2020), and the figures could be even higher in the region. Thus, if we consider that the housing deficit in several countries of the region ranges around 40%, it is easy to imagine the scale of the emissions associated with construction activity in urban environments. This underscores the need to promote the use of green building materials with lower carbon requirements over their life cycles. This diversification would not just have environmental effects, but

would also help to reduce imports and thus close the external gap. In addition, there are opportunities to boost local economies throughout the life cycle of building materials, for example through decisions on construction methods and material supply chains.

The need to align housing construction with national climate change mitigation targets is also severely challenged by the existence of substantial amounts of abandoned housing. In Mexico, for example, there are an estimated 4.5 to 5 million abandoned homes, while in a sample of countries in the region (Chile, Colombia, Costa Rica, Ecuador and Peru), the proportion of unoccupied homes ranges from 5.8% to 10.8%. This reflects the complexity of the factors behind housing decisions and, above all, reveals the inadequacies of the housing market and State action. The existence of abandoned housing complexes shows that low-cost housing in the outskirts and suburbs of cities is constructed without observing minimum standards of urban planning to integrate new developments into the coverage networks of residential services and, above all, public transport. The result is that there are built-up areas where access to economic and educational opportunities, healthcare facilities and public spaces is difficult and expensive, and where there are serious problems of insecurity and violence. This leads to the paradox that there are houses without occupants and families without adequate housing.

Analysis of the overall cost of this phenomenon to society must also consider the inappropriate use of an irreproducible asset, namely land. It must also take into account the significant environmental footprint of these unoccupied residential buildings and the inequity inherent in the generation of an asset that is so vital for households but that simply becomes one more item of production in the economy, without considering its implications for overall human development.

10. Policies to make mobility and urban building sustainable

If new and more sustainable forms of building and mobility are to be established, their connections with the rest of the economy must be considered, including the spillover effects along the entire production chain of the goods and services that constitute it. This means developing new sectors and production chains and reducing external dependence in respect of materials and products. Their social function as public services and the positive externalities they entail, or the negative ones if unsustainable models are chosen, must also be considered. In short, they must play a part in reducing external, social and environmental constraints. This is not possible without public policies.

Getting this industry off the ground means creating a regional urban market that ensures predictable demand for regional production. One option would be contracts between producers and cities as purchasers of electric buses, which would make it possible to schedule production and obtain financing. Tax incentives for this type of production at the outset would encourage the construction of new plants or the adaptation of existing ones. Again, export taxes or royalties inversely scaled according to the value added to inputs essential for electromobility, such as lithium and copper, would be an incentive to set up processing, component and equipment manufacturing and final production lines in the region. Boosting local industrial development is a way of maintaining employment in a changing sector while reducing the imported component. Regional agreements and system standardization would make it possible to achieve the necessary scale by integrating different countries into the production chain, thus increasing regional content in the assembly and manufacture of system parts and components. Coordination between the private sector, public stakeholders and development banks is essential.

Appropriate scale is critical to achieving an industrial response. As long as cities' demand and investment are atomized and unplanned, the only suppliers capable of meeting this demand will continue to be the global players. These essentially come from China and the developed countries, and they already dominate the global provision of buses, rail systems, bicycles and scooters, while supplying public and shared-use transport systems. Identifying and coordinating needs for new transport units, the scheduling of fleet replacements and expansion of the coverage of different modes of electric transport such as metros, trolleybuses and light rail, both nationally and regionally, would give an idea of the scale of the industrial effort involved and possible

regional arrangements to achieve it, and would send a signal to the industry. Regulatory fragmentation between systems and the different performance, capacity and configuration specifications compatible with the different urban systems are hampering the regional effort. To facilitate this effort, it is important to standardize the technical requirements applicable to public electromobility.

Consideration of the social dimension shows that investment needs to be redirected towards the majority of the population. In the case of mobility, this means that investment should centre on public transport and that the labour market benefits deriving from jobs created in the sector should be considered. Nor should the health benefits be forgotten. They include the reduction of noise and vibrations, slower depreciation of the urban environment, time savings and better access to clean mobility services.

For a mobility policy to be successful, systems must have a level of quality, predictability, reliability and safety that makes them an attractive option for all social groups. In addition, each policy must include gender considerations and seek to be competitive with private mobility. Access to the system is indispensable. Efforts to improve quality by increasing fares to a level unaffordable for a population characterized by inequality undermines its character as a public service. Alternatives that have been proposed include fare subsidies, purchase of the service by local government and the setting of a zero fare for users, or cost recovery through other financial mechanisms, e.g. raising fiscal revenues from the commercial use of spaces in the infrastructure that supports the system or from capital gains in areas adjoining the infrastructure.

The positive environmental externalities of mobility services with a smaller environmental footprint need to be incorporated into project evaluations, using a lower discount rate and shadow prices for carbon and other pollutants. This would be a way of recognizing their higher social returns and longer lifespans. It will also be important to decide what types of technology are acceptable in both public and private mobility systems. To this end, a regulatory floor that rules out fossil fuel-based options and progressively raises energy efficiency and emissions standards should be established.

As regards urban building that is synergetic with mobility systems, besides paying attention to land-use and urban planning mechanisms, it is important to promote best building practices and send signals to guide innovation, development and dissemination of new technologies in the sector. Circular economy considerations regarding the materials employed and energy efficiency, both in the construction process and in subsequent use, also contribute to the reduction of the imported component and to the employment of local inputs. To this end, governments can strengthen the requirements in building codes relating to the efficient use of resources (water, energy and type of materials or construction processes) in all kinds of buildings. For example, in 2018 only six countries in the region were developing voluntary or mandatory energy efficiency codes for buildings, although most of the countries have certification programmes (Global ABC/IEA/UNEP, 2020). To drive innovation in building processes and materials, operating and environmental footprint standards must be specified on the basis of improved building performance, as has been done in New Zealand's building code (WEF/Boston Consulting Group, 2016). Accordingly, it is important to introduce sustainability standards into public procurement rules for the construction of social housing and public buildings and to consider the total cost of ownership or performance over the life cycle of a building (European Commission, 2020).

For climate change to be dealt with systemically, measures must be taken to achieve net zero energy use in buildings. Decarbonization strategies for building also need to be incorporated as part of nationally appropriate mitigation actions, which so far they have been in only a very few countries (UNEP/Global ABC, 2018). Considering the synergistic relationship between buildings and sustainable mobility means recognizing that new construction will create demand for mobility services. In turn, any new project must be adapted to the new forms of these, e.g. by including electrical recharging systems for private electromobility in the absence of decisive action to improve public transport.

The demand for housing in Latin America and the Caribbean will create investment opportunities worth approximately US$ 4.16 billion in potentially green buildings (IFC, 2020). The collaboration of investors, developers, owners and governments is needed to make new buildings efficient and low-carbon. Fostering a systematic process whereby banks identify the environmental attributes of their loans as a tool for scaling up sustainable financing, i.e. labelling assets by their environmental quality, would facilitate access to green

bond markets (Sweatman and Robins, 2017). Since the real estate sector has a strong presence on banks' balance sheets, the efficiency of buildings and their complementarity with electromobility make it a suitable sector for this type of instrument.

At the same time, increasing urbanization and its complexities, combined with those introduced by the pandemic, are opening up opportunities for investments in nature-based solutions to replace traditional infrastructure solutions. One example is the development of green infrastructure, such as networks or corridors of natural and semi-natural areas planned and designed to address climate threats and allow for social distancing in public places. Furthermore, using nature-based solutions can help reduce inequalities in access to particular goods and services such as parks and other public spaces.

Moving towards sustainability in urban construction and mobility brings great environmental benefits and creates opportunities for national production development. The social benefits and those brought by improved quality of life in cities complete its contribution to the three dimensions of sustainable development.

C. The digital revolution for sustainability[24]

The digital revolution has changed and will continue to change consumption, production and business models. Besides increasing the productivity and well-being of users, this can be combined with objectives of growth, employment, inclusion and environmental sustainability.

The development and adoption of digital solutions are influenced by structural factors. In countries with production structures that are excessively heterogeneous and undiversified in product terms, with highly informal and unstable labour markets and with socioeconomic constraints on access and connectivity, much of society is unable to appropriate the value generated by digital technologies (Cimoli and Correa, 2010; ECLAC, 2016). In particular, connectivity, understood as adequately fast broadband and ownership of access devices, strongly affects the exercise of the rights to health, education and work, while it can increase socioeconomic inequalities.

Digital development that does not respect human rights in the digital environment (digital rights) and is not guided by principles of inclusion and sustainability can reinforce patterns of social exclusion and unsustainable methods of exploitation and production, while exacerbating their negative environmental impacts. The net effect will then depend on the linkage between business strategies and policy actions aimed at steering digitization towards sustainable development.

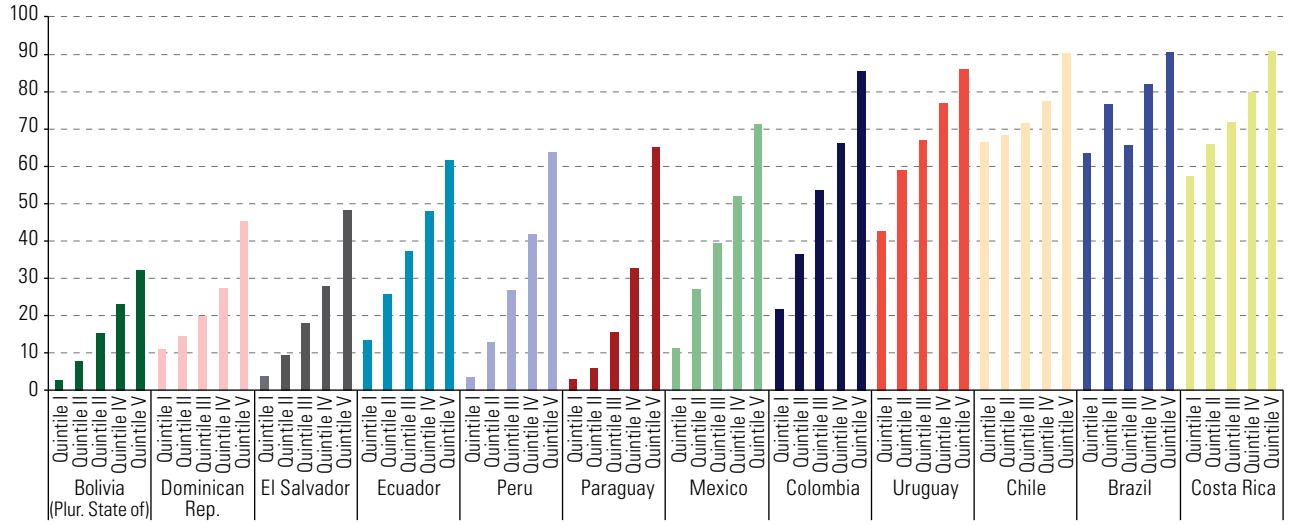
1. The progress and limitations of digitization in the region

As of 2019, 66.7% of the inhabitants of Latin America and the Caribbean used the Internet. This finding, which is remarkable in terms of how fast and far the use of a technology has spread in the region, was made possible because the incorporation of technological progress has been combined with highly competitive strategies by private or public companies (depending on the country) and with the implementation of policies to support and regulate the sector. Despite this great progress, one in three inhabitants of the region has limited or no access to digital technologies because of their economic and social status, with the main determinants being income, age and location of the home.

Access to connectivity is extremely dependent on income distribution. While 81% of households in the richest quintile were connected in 2018, the figure for households in quintiles I and II (almost 23 million households) was 38% and 53%, respectively (see figure IV.7). While more than 60% of households in quintile I were connected in Brazil and Chile, only 3% were in Paraguay, Peru and the Plurinational State of Bolivia. This asymmetry affects households, limiting or hampering their access to telework, tele-education and tele-health services, as well as other goods and services provided by public platforms and institutions, the result of which is a widening of existing gaps.

[24] The information and analysis in this section is largely based on ECLAC (2020b).

Figure IV.7
Latin America: connected households by income quintile, 2018 and 2017[a]
(Percentages)



Source: Regional Broadband Observatory, on the basis of Household Survey Data Bank (BADEHOG).
Note: The data for Brazil, Chile, Costa Rica, Ecuador, El Salvador, Paraguay and Uruguay include mobile Internet.
[a] The data for Chile and Ecuador are from 2017.

Despite the large reduction in the prices charged for services over the last decade, the cost of mobile broadband access for the population in the first income quintile exceeds 10% of income in many countries of the region and 5% in almost all of them, according to data from the ECLAC Regional Broadband Observatory (ORBA).[25] In the most critical cases, these costs represent more than five times the reference threshold of 2% of income recommended by the United Nations Broadband Commission for Sustainable Development for an Internet service to qualify as affordable.

In terms of age, young people (particularly those under 12) and older adults (over 65) are the groups with the least connectivity: 42% of those aged under 25 and 54% of those aged over 66 are not connected. The differences in connectivity between the urban and rural world are also substantial. While 67% of urban households are connected to the Internet, only 23% of rural ones are. In El Salvador, Paraguay, Peru and the Plurinational State of Bolivia, more than 90% of rural households are not connected; even in better-off countries such as Chile, Costa Rica and Uruguay, only about half of rural households are connected.

From the technological point of view, low connection speeds consolidate situations of exclusion, as they prevent the use of teleworking and tele-education solutions, which have been especially necessary since the advent of the COVID-19 pandemic. In June 2020, 44% of the region's countries had connection speeds of less than 25 Mbps, i.e. they did not meet the download speed requirements for two or more data-intensive online activities to be carried out simultaneously.[26]

2. Different abilities to access telework, tele-education and telemedicine

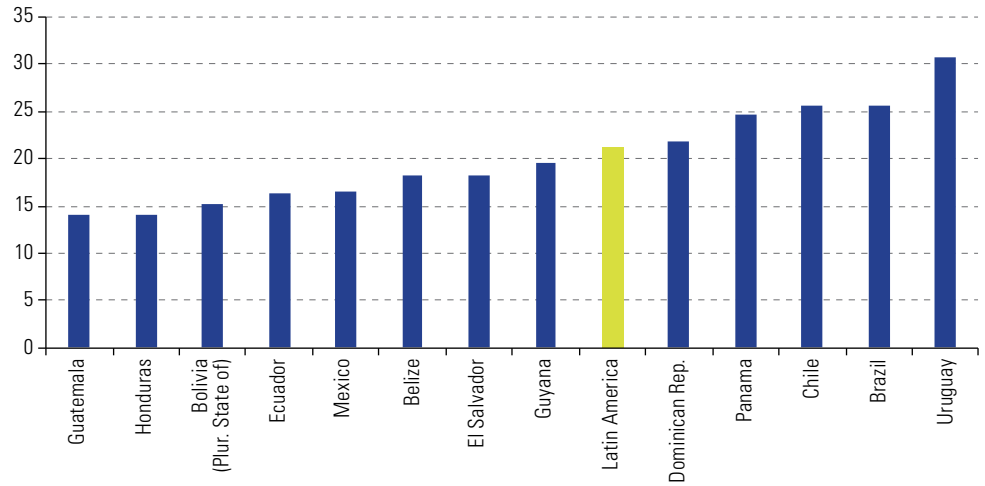
The pandemic has accelerated a process of change that had been under way for more than a decade. An online presence has become essential for work, education, health, some professional services, and commerce. Digital platforms catering for everything from virtual meetings to home delivery have become prominent as never before, and their use is increasing exponentially.

[25] The calculation considers the cost of mobile broadband, which covers 68% of the region's households, as compared to 14% for fixed broadband.
[26] Download speeds of around 18.5 Mbps allow two basic activities such as email and a single high-demand activity such as video or videoconferencing to be carried out simultaneously, forcing users to choose between tele-education and teleworking. With a download speed of less than 5.5 Mbps, users can carry out only basic activities, which rules out teleworking or tele-education.

(a) Telework

The proportion of work that can be done remotely varies from one country to another and with production structures, the level of informality in labour markets and the quality of the digital infrastructure. International experience indicates that the percentage of jobs able to migrate to telework is positively linked to the level of GDP per capita and lower degrees of informality. Thus, while almost 40% of workers in Europe and the United States can work from home, only 21.3% of employed people in Latin America can access this type of work (see figure IV.8).

Figure IV.8
Latin America and the Caribbean: likelihood of teleworking
(Percentages)



Source: Regional Broadband Observatory, on the basis of Household Survey Data Bank (BADEHOG); J. Dingel and B. Neiman, "How many jobs can be done at home?", *White Paper*, Chicago, Becker Friedman Institute, 2020.

Note: The estimates for Chile, the Dominican Republic, El Salvador, Ecuador and Mexico are based on national four-digit occupational classifications. The estimates for the remaining countries are based on International Labour Organization (ILO) two-digit occupational classifications. Data are for 2018 or the latest year available.

The characteristics of the region's production structure limit the proportion of occupations that can migrate to telework, owing to the high concentration of workers in activities that require social interaction and a physical presence. ECLAC estimates that, at the sectoral level, the likelihood of teleworking is greater than 80% in professional, scientific and technical services, education, finance and insurance. However, these sectors account for less than a fifth of all those employed in the countries of the region. In contrast, those employed in wholesale and retail trade and agriculture have a 15% and 1% likelihood of teleworking, respectively.[27] Moreover, informal jobs accounted for more than 50% of employment in 2018, and most of them were concentrated in activities that require physical interaction and cannot be performed remotely.

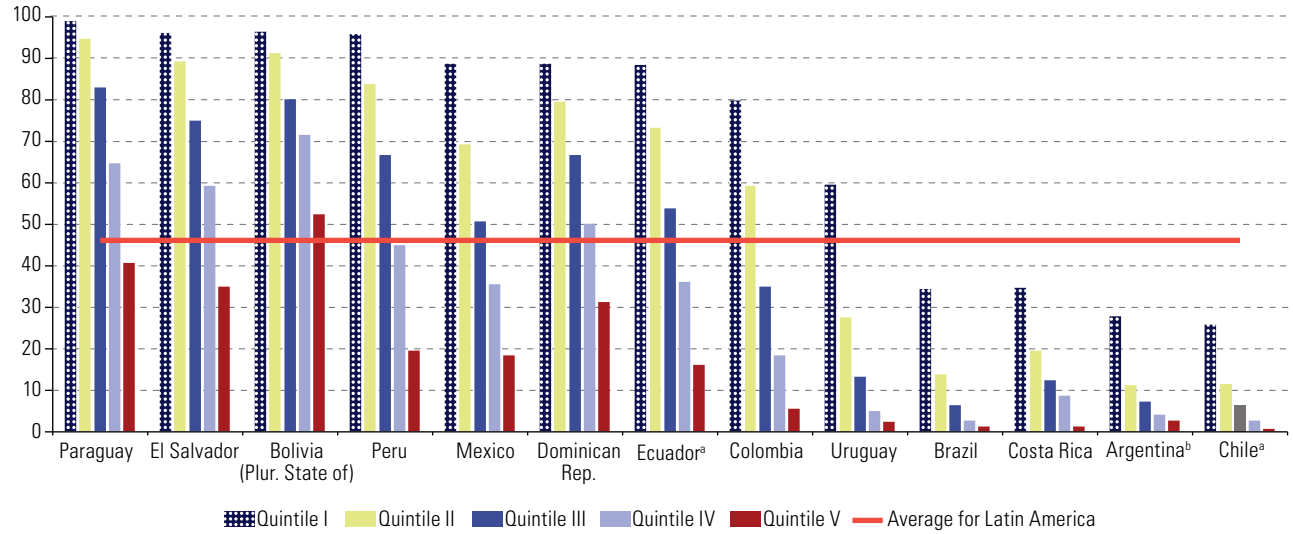
Most of the occupations that can be carried out remotely require workers with higher levels of training and, on average, pay higher wages than other activities. Consequently, more than 80% of employed persons in the first three wage quintiles cannot telework, while more than 50% of employed persons in the top two quintiles can. This situation is aggravated when a high-quality Internet service is not available. In countries of the region with low connectivity, the proportion of employed people who can telework is 11 percentage points lower than the proportion that would be technically feasible if they had access to quality broadband. Conversely, in countries of the region with better connectivity, the proportion is less than 3 percentage points lower. For this reason, quarantines and the suspension of economic activity have extremely negative impacts on those who cannot telework, increasing vulnerabilities and inequalities.

[27] Weighted averages of Chile, the Dominican Republic, El Salvador, Ecuador, Mexico and Uruguay, calculated on the basis of the Household Survey Data Bank (BADEHOG) and Dingel and Neiman (2020).

(b) Online education

The use of online education solutions is only possible for those with an Internet connection and access devices. More than 32 million children aged between 5 and 12 (46% of the total) live in households that are not connected (see figure IV.9). In El Salvador, Paraguay, Peru and the Plurinational State of Bolivia, more than 90% of the children from the poorest households live in unconnected homes, while in countries with better connectivity indicators, about 30% of these children do not have an Internet connection at home.

Figure IV.9
Latin America (13 countries): children in households without Internet access, by income quintile
(Percentages)



Source: Regional Broadband Observatory, on the basis of Household Survey Data Bank (BADEHOG).
Note: In the survey on which the information is based, "households with Internet access" means that the Internet is generally available for use by all members of the household at any time; the connection and devices may or may not be owned by the family, but should be considered as household assets; and the household Internet connection must be working at the time of the survey. The calculation is made on the basis of the total number of children aged between 5 and 12 years old in each income quintile of each country.
[a] Data are for 2017.
[b] Includes only urban areas.

There are, on average, four times as many children living in the poorest households as in the highest-income households. This means that the poorest households need more connection devices to be able to access several online education sessions simultaneously. Once again, differences between economic strata affect the exercise of the right to education and exacerbate inequalities.

(c) Telemedicine

Telemedicine is changing health-care delivery models. Its benefits are manifold: it improves access to these services, enhances the efficiency and quality of their provision, reduces costs and increases disease prevention capacity. It also helps to relieve congestion in health centres and hospitals, curb infections and flatten infection and epidemic curves. Symptoms and recovery from illness can be monitored through calls or video chats, keeping low-risk patients with mild symptoms at home and reducing the likelihood of infection.

In 2016, 56% of the region's countries had a national e-health policy or strategy. However, only 38% had specific regulations for the sharing of digital data between health services, and this highlights how long it is taking to put a key component of the enabling regulatory framework in place.

In addition to increasing demand for tele-health services, the COVID-19 pandemic has highlighted some structural weaknesses in the medical and telemedical systems. For example, costs and uncertainty about reimbursement are barriers to the use of telemedicine, as patients and health-care providers often lack

information about payment and insurance coverage. Other factors are related to the age and educational level of patients: those who are less digitally literate (e.g. older adults) are the most vulnerable and the least able to benefit from tele-health solutions.

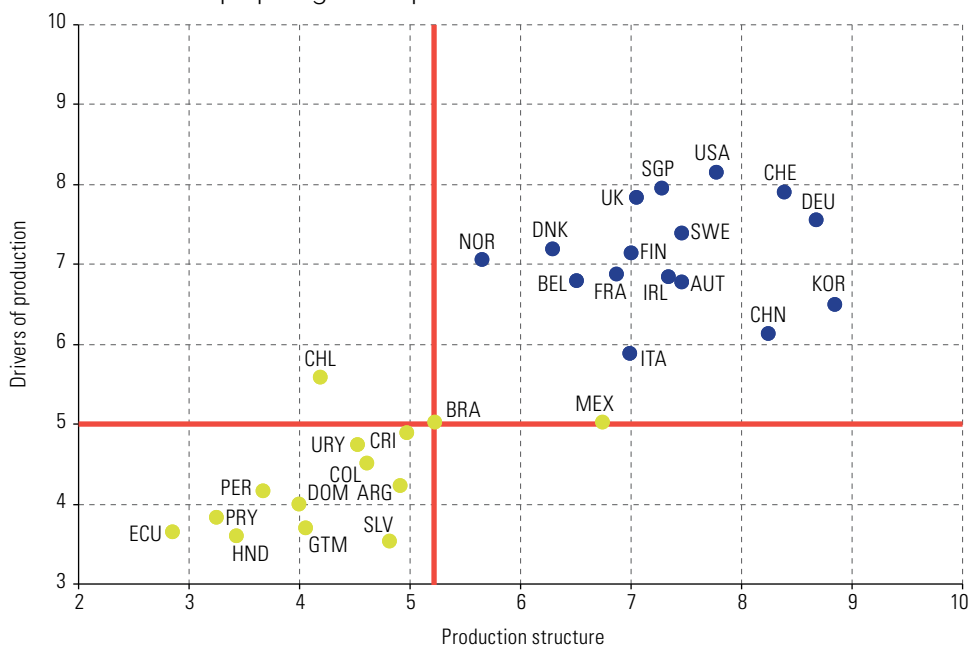
In this context, governments in the region have developed mobile applications to minimize physical contact between patients and health-care providers and to disseminate essential information on ways to prevent infection and news about the pandemic. Many of these applications provide information on the location of health-care facilities and allow for self-diagnosis. In some cases, after an initial self-diagnosis, the application refers the user directly to a health-care facility. In a handful of countries, these applications can be used to schedule priority medical appointments (virtual triage), trace contacts, communicate with quarantined persons or issue health passports or movement permits.

3. The digitization of production and commerce

The digitization of production processes is not advanced in the region. Although 90% of companies are connected and 80% of them use electronic banking, the use of digital technologies in supply chain management, processing, manufacturing, operations and distribution channels lags far behind that in more developed countries. For example, while 70% of companies in the Organization for Economic Cooperation and Development (OECD) countries use the Internet in their supply chain, the figure in the region is only 37%.

As the digital transformation proceeds, the ability of countries to mitigate the risks and challenges of the pandemic, respond to new shocks and take advantage of economic opportunities beyond digital commerce will depend on how prepared they are for the industry of the future. The structure of production (complexity and scale in particular) and the factors that drive it (technological and innovation capabilities, skills and human capital, trade and investment, the institutional framework and sustainable resources) determine countries' positioning with regard to advanced manufacturing or industry 4.0 (WEF, 2018). Figure IV.10 includes three groups of countries: (i) those that are well positioned to take advantage of these technologies, i.e. the developed countries and some in South-East Asia; (ii) countries in an intermediate position, which have a production structure that should allow them to exploit the potential of digital technologies but lack some of the factors to do so, such as innovation capacity and human capital; and (iii) most countries in the region, which have little access to new technologies and are at high risk from the effects of technological progress.

Figure IV.10
Selected countries: preparing for the production of the future



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Economic Forum (WEF), *Electric Vehicles for Smarter Cities: The Future of Energy and Mobility,* Geneva, 2018.

The new production and supply structure will be based on greater flexibility and responsiveness, and proximity to suppliers will become more important. The new scenario will see a reconfiguration of (i) investment patterns, including the development of fifth-generation (5G) mobile networks; (ii) supply chains (regionalization); (iii) production plants (automation and adoption of advanced technologies); and (iv) manufacturing, diagnostic and remote maintenance processes, all of which will involve greater use of big data and artificial intelligence.[28] To respond, companies will have to develop new products and services, become more flexible, optimize their performance, invest in research and development (R&D) and create, resize or modernize their capabilities.

Confronted with these demands, most countries in the region have few highly trained human resources, limited incorporation of digital technologies into training processes and low levels of investment in innovation. For example, whereas the gross enrolment rate for tertiary education in the region is 50%, in the OECD countries it is 74%, while the ratio of students to computers is 42 and 8, respectively, the number of patents awarded per million inhabitants is 1 and 211, and spending on research and development is 0.67% and 2.15% of GDP. This disadvantageous situation contrasts with the great dynamism of electronic commerce, which is described below.

4. Electronic commerce

As the pandemic continued into the second quarter of 2020, many companies recognized the importance of having a more active online presence to reach consumers. In April and March 2020, the number of business websites increased by some 800% in Colombia and Mexico and by around 360% in Brazil and Chile relative to the previous year, according to data from the ECLAC project "Big data for measuring the digital economy in Latin America and the Caribbean".

The largest increases were for transactional business sites (active presence) and electronic commerce platforms. In Brazil and Mexico, the number of new e-commerce sites was up by more than 450% in April 2020 over the same month in 2019. The number of sites with an active presence in Colombia and Mexico increased by nearly 500% in the same period. In June 2020, the online presence of retail companies was up by 431% on June 2019, and there were increases of 331% for restaurants and food delivery services and 311% for business services.

The increase in delivery capacity was crucial in reducing the great numbers of people going to supermarkets and shops, and in keeping businesses going. Delivery service activity increased by 157% between the first and second quarters of 2020, according to the traffic figures recorded on the websites of this category. Online delivery platforms have registered increased demand for their services; in March, almost 100% of orders were in the food and pharmacy category. For small businesses, however, commissions of the order of 20% or more can be a barrier to using these platforms.

5. Digitization for environmental sustainability

Digitization is positive for sustainability because of its ability to dematerialize the economy by enabling the supply of digital goods and services, which represent an ever-increasing share of countries' exports and economies.[29] The increasing importance of digitally deliverable services is reducing the need for travel, with the consequent reduction in carbon emissions. In addition, the incorporation of artificial intelligence into decision-making is making it possible to optimize resource management, leading to a smaller environmental footprint in areas such as the exploitation of natural resources, manufacturing, logistics and transport and consumption.

[28] 5G technology offers great advantages over 4G (LTE): up to 200 times faster download speeds and 100 times faster upload speeds, and a nine tenths reduction in latency.

[29] In Costa Rica, digitally deliverable services represented 41% of total service exports in 2017. Some 95% of the services that could be digitally delivered were provided in this way. Most of these exports were made by large foreign companies providing administrative and back office services to companies in the United States. Micro and small enterprises accounted for 7.5% of total exports of digitally delivered services (UNCTAD, 2018).

Product-as-a-service (PaaS) models allow users to purchase the result of using a product rather than the product as such. This approach breaks down capital expenses into small operating expenses, which reduces the cost of a product over its life cycle. Another important change in consumption and service provision models is the "gig economy", which allows better use to be made of capital goods by multiplying the opportunities for their use, with the consequent savings in materials. However, this may be accompanied by social costs such as the casualization of labour. Likewise, digitization reduces the levels of intermediation in value chains, thus lowering transaction costs, with the consequent savings in energy and inputs.

On the other hand, greater digital development is generating negative environmental effects associated with energy consumption and highly polluting hardware production processes, as analysed in the section on the circular economy in this chapter. The digital sector is responsible for 1.4% of global emissions, but has the potential to halve this percentage by 2030 thanks to the impact of 5G networks, artificial intelligence, blockchains, cloud computing and the Internet of Things (IoT) (Falk and others, 2019). Moreover, it could directly reduce fossil fuel emissions by 15% by 2030 and indirectly support a further 35% reduction by influencing commercial and consumer decision-making and the transformation of production systems (Ericsson, 2015).

The net result of these opposing effects will depend on incentive and regulatory policies that increase the positive impacts and counteract the harmful ones.

6. Data protection and privacy

The pandemic has brought the debate about data protection to the fore, since the response to the health crisis requires full and coordinated deployment of digital technologies that generate large amounts of data from the actions of the authorities, health and research centres and the population. In some countries of the region, moreover, the declaration of a state of emergency has allowed personal data to be extracted by the authorities without user consent.

Some countries are updating the relevant regulatory and institutional frameworks. The main changes concern the implementation of mechanisms for evaluating data protection systems and the creation of data protection authorities. The exponential growth in the volume of data has also highlighted the importance of measures in the areas of cybersecurity and the prevention of cybercrime. Regulations in the region focus on data protection to prevent theft and tampering, hitches in the functioning of computer systems and attempts to delete, suppress or block access to information without the consent of its owners.

7. Regulation and competition enforcement

The growing role played by digital technologies and platforms has increased the need for regulatory frameworks to prevent abuses of market power resulting from concentration and to encourage competition.

The indispensability of digital services during the pandemic increased the market value of digital businesses, particularly platforms. At the same time, their business models pose various problems for tax systems. These include the fact that firms do not need a physical presence in the country where they provide services because their activities transcend geographical borders, together with the existence of intangible assets that are difficult to value, the complexity of transactions, and the difficulty of categorizing the type of economic activity and associated revenue.

Given the obstacles to taxing digital businesses directly, most countries have chosen to apply indirect taxes, such as VAT, to their services. Worldwide, 77 countries have introduced this type of tax, 12 of them in Latin America and the Caribbean. As for direct taxes on digital services, levied on the revenues of non-resident companies that provide digital advertising, services or content to a local user base, 22 countries (4 in the region) have adopted unilateral tax measures pending agreement on comprehensive international solutions (KPMG, 2020).

At the same time, the large-scale use of management algorithms for teleworking, information technologies, the use of big data for contact tracing applications to contain infections, artificial intelligence, telemedicine and e-commerce have highlighted the need for standards to complement existing antitrust regulatory frameworks. This requires a legal framework that, in addition to including privacy and data protection issues, deals with interoperability, access and data gathering for development purposes, and restrictions on intellectual property rights. This would ensure competition and prevent restrictions on access to platforms by unofficial tracking applications.

The business models and growing market power of these companies have increased concern in some countries and civil society organizations. Even before the pandemic, platforms such as Twitter had announced restrictions on political content deemed harmful. While this may not be the rule, there is a need for standards that seek a balance between prohibiting harmful content and restricting freedom of expression. The platforms' argument is based on their responsibility to disseminate relevant and truthful official information on the progress of the pandemic and the measures taken by governments to combat it. While this argument has merit, there is concern that these tools may become established as a new practice of market domination and control by these companies.

8. Three lines of action

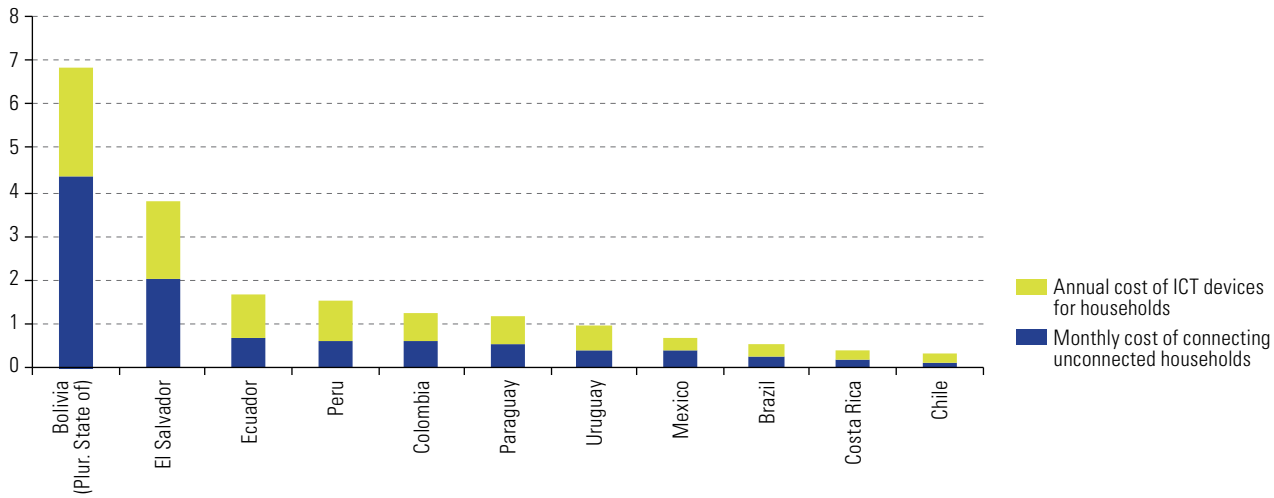
Taking into account the progress and limitations of digitization in the region, ECLAC suggests advancing in the following policy areas with a view to consolidating digitization as an instrument for sustainable development.

(a) Universal access for an inclusive digital society

The essential requirement for effective participation in the digital age is high-speed broadband access. This means extending fixed broadband coverage and improving the speed of mobile broadband connections. The costs involved in connecting households and the necessary devices, coupled with the difficulties of financing digital infrastructure (e.g. fibre optic cables), are barriers to digital inclusion. For this reason, ensuring that access and devices are affordable is crucial.

Using the prices of mobile and fixed broadband Internet plans and electronic devices, ECLAC has estimated the annual cost of a basic digital basket that includes monthly connectivity plans, a laptop, a smartphone and a tablet. The region's countries would have to invest an average of about 1% of GDP per year to ensure access for unconnected households, although with large differences between them (see figure IV.11).

Figure IV.11
Latin America (11 countries): investment needed to close the digital access gap
(Percentages of yearly GDP)



Source: Regional Broadband Observatory, on the basis of Household Survey Data Bank (BADEHOG), World Bank and official data from Internet providers.

Demand subsidies could be used to help lower-income households afford telecommunications services and the basket of access devices. What is essential, though, is to coordinate public-private actions tailored to each country that meet socioeconomic, geographical, age and gender criteria.

A regulatory sandbox can be implemented in this area, with operators being allowed to directly manage some of the resources to be provided by universal access funds or other funds set up to expand telecommunications services on a mass scale, using them to cover the costs of providing services to lower-income households. Authorization could be subject to conditions set by the regulator that incentivized service providers to compete to offer the best conditions in order to obtain this authorization. This could be supplemented by measures to make regulations more flexible in certain areas, such as network neutrality. In this case, the use of education, health and government services could be encouraged by zero-rating access fees.

As regards access to devices, there could be temporary reductions in import duties and sales taxes such as VAT on devices specified by the regulator, as well as encouragement for public–private partnerships with suppliers and manufacturers to produce them at low cost in the region and improve conditions of supply.

(b) Building an advanced digital infrastructure

The countries of the region need to deploy infrastructure that provides quality broadband access and allows digital solutions to be used to meet the structural challenges of production, inclusion and environmental sustainability. Accordingly, the following measures are urgently needed to hasten the deployment of 5G and the Internet of things:

- *Design of the network expansion model*. Given the scale of the investments required, it should be ensured that the characteristics of the deployment are consistent with the uses and applications to be implemented. Since the most advanced digital activities are concentrated in a few large urban centres, measures are needed to ensure service quality in intermediate cities capable of becoming innovation hubs, particularly in the digital area (Atkinson, Muro and Whiton, 2019).
- *Design of a financing model*. Deployment can be facilitated by models based on agreements between public bodies and private actors and on shared physical infrastructure solutions. In all cases, though, the right of universal access, the public good nature of access networks and the protection of personal data privacy must be safeguarded.
- *Updated regulations that optimize network use*. Given the variety of expected uses, with different needs in terms of speed, latency and reliability, an efficient solution for increasing the performance of networks would be to segment them. This is a form of virtualization that allows mobile operators to create multiple virtual networks on the same physical infrastructure.
- *Spectrum harmonization, liberalization and allocation.* Clear and orderly management of the electromagnetic spectrum, enabling clear rules to be set for access to and use of frequencies over the long term, is vital to maximize utilization and increase investment in the network.
- *Development of fibre optic backbones* that have the capacity to carry large volumes of traffic at high speeds and with low latency. Proper connectivity also requires Internet exchange points (IXPs) and content distribution networks (CDNs) to optimize traffic. A fibre backhaul must be available to support projected capacity demand, particularly in 5G networks.[30]
- *Regulations for the installation and operation of high-performance data centres* that cover issues of security, service continuity and energy efficiency in line with international parameters.

[30] A backhaul is the portion of a hierarchical network comprising the intermediate links between the backbone and the subnetworks at its edges.

(c) Strengthening regional digital cooperation

The architecture of regional digital cooperation lacks an institutional framework for discussing and designing common policies, rules and standards. In this context, the Digital Agenda for Latin America and the Caribbean (eLAC2020) is a space for determining regional principles and priorities in which 33 countries of the region participate, together with representatives of the private sector, civil society and the science and technology community. Considering the agreements established in the Agenda, ECLAC is supporting the design of strategies relating to the deployment and ownership of digitization. These include moving towards a regional digital market that would increase trade and strengthen the digital economy through incentives, regulatory consistency, digital infrastructure integration (including 5G networks), reduction of barriers to e-commerce, promotion of digital innovations and ventures (particularly in MSMEs), design of tax regimes for the digital economy, universal broadband Internet access, data protection and digital security, and competition policies.

9. A welfare State with digital development and inclusion

In the post-COVID-19 world, social welfare will not be possible without digital transformation. Accordingly, the new model of digital governance must achieve the following:

- *Promote equality* through inclusive digital transformation processes, facilitate multi-channel interaction with the State and pay attention to the population without adequate access to digital technologies or the skills needed to use them. Attention should also be paid to the socioeconomic barriers that restrict their use. Innovation and digitization must serve to narrow the social gap, not widen it.
- *Encourage the digitization of businesses,* particularly MSMEs, in a way that contributes to progressive structural change through technological innovation and diffusion in the production structure, new business models, integration into global value chains, the creation of digital capabilities and skills, and financing mechanisms. Given that the use of digital technologies has been associated with content consumption in the region, there needs to be progress towards more intensive use of them in the production sector. In other words, there must be a shift from the consumer Internet to the industrial Internet.
- *Protect data privacy and security*. This means preventing unauthorized collection and improper or unauthorized use of personal data, providing high standards of information security and avoiding any violation of the privacy and dignity of individuals, strengthening access to public information, and pursuing anti-corruption efforts. A balance needs to be struck, for while privacy cannot be an impediment to dealing with the health emergency, neither can the emergency mean the end of privacy.
- *Protect economic, social and labour rights,* prevent work from being casualized as a result of digital technology use and ensure that social protection systems and their benefits are delivered using digital technologies in an efficient, accessible and user-friendly way. Electronically determined eligibility processes must be transparent and include mechanisms for legitimate clarifications and rectifications.

D. The health-care manufacturing industry

Health-related industries (the pharmaceutical and medical device and equipment industries and related research and development activities) are of strategic importance because they provide products and services geared to improving living conditions and human health, generate high-quality jobs with productive linkages and drive technical progress with their strong emphasis on research and development and their considerable knowledge externalities. They accordingly have the potential to play a central role in a big push for sustainability.

The corporate strategies of international companies in this industry have been changing in the context of the COVID-19 pandemic. In particular, they are seeking to reduce risk in international supply chains, even if it means higher production costs. In a scenario of economic recovery, companies are considering using dual

location strategies to bring part of their production closer to their final markets through nearsourcing options. The creation of new production capabilities would give international companies greater flexibility, opening up market and investment opportunities for the countries of the region.

1. The pharmaceutical industry

Pharmaceutical markets worldwide are highly concentrated and dominated by oligopolies with enormous market power. The industry is characterized by high barriers to entry because of the economies of scale that operate in research and technological development and the protection provided by patent regimes.

The situation of this industry in the region is reflected in its large trade deficits and small shares of production, employment and value added. While the growing supply of low-cost generic drugs from local industries has led to major improvements in health indicators in the region, strong growth in imports of innovative biological products for diseases with rising morbidity rates has resulted in persistent increases in trade deficits. At the same time, the industry's contribution to production and employment is lower than in developed countries and Asian countries with income levels similar to those of Latin America and the Caribbean. Furthermore, although the increasing quality demands of sectoral regulators have resulted in process improvements, most companies in the region have struggled to position themselves in higher value added segments such as the production of biopharmaceuticals.[31]

Since the late 1990s, and as a result of the accession of the region's countries to the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), local producers in the region have specialized in the formulation and production of generic products, whose quantity and variety have grown over the past 20 years as patents on drugs in high demand have expired. These producers have concentrated on improving manufacturing quality standards, managing the registration processes for their products and, to a lesser extent, expanding their exports to regional markets.

This process has been accompanied by a dramatic decline in the use of locally produced active ingredients. These ingredients have increasingly been supplied from imports originating mainly in China and India, which are able to supply these inputs at competitive prices thanks to economies of scale and improved process quality. As a result, domestic firms grew until the mid-2010s, but momentum was then lost because of the rapid increase in imports from India and the Republic of Korea.

The supply of innovative medicines has remained in the hands of international companies, which tend to concentrate their production in global centres.[32] These companies do not carry out significant research and development activities in the region, except for clinical trials. Although the supply of biopharmaceuticals, including biosimilars whose patents have expired, mainly relies on imports, the local industries in Argentina, Brazil and Mexico have made progress in producing first-generation biosimilars.

Domestic firms and foreign ones producing locally supply more than 50% of the market. Multinational companies, which sell patented products at high prices, have a majority market share in many of the countries. This configuration is a decisive factor in the pharmaceutical industry's shares of GDP and of imports and exports. The value added of the pharmaceutical industry in Latin America in 2014 was equivalent to 5.4% of global production, a figure similar to that of the mid-2000s, according to data from the International Federation of Pharmaceutical Manufacturers and Associations (IFPMA, 2017). That same year, the industry's share of regional GDP was 0.37%, less than half its share in the OECD countries (0.83%). The countries in the region where its share was highest were Argentina (0.7% in 2015), Brazil (0.5% in 2017), Mexico (0.5% in 2015) and Chile (0.3% in 2017).

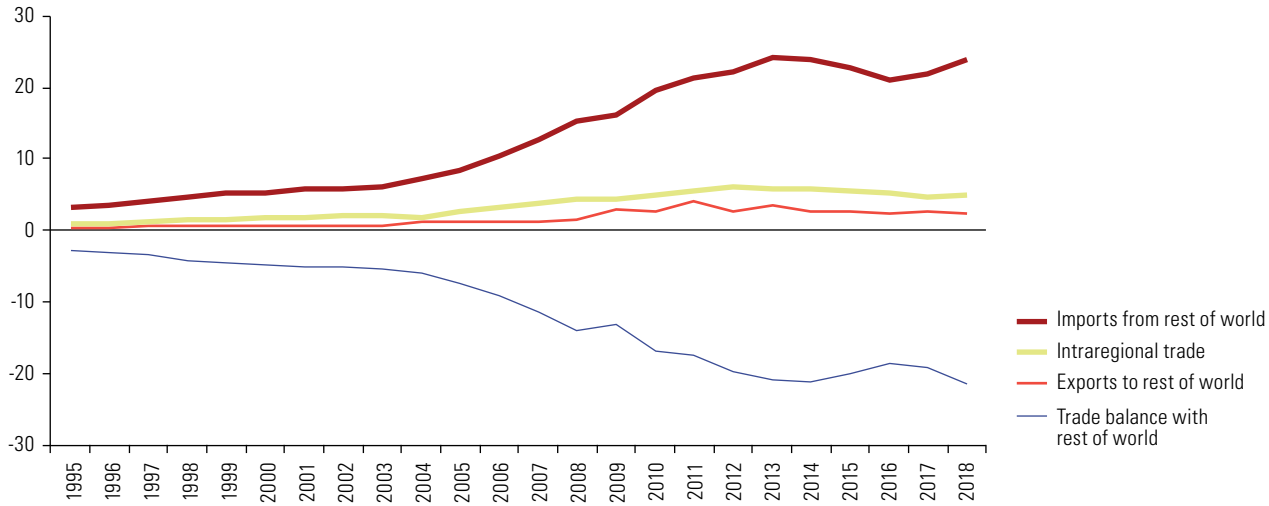
31 However, there are important instances of biopharmaceuticals being produced in the region. In Costa Rica, for example, the Clodomiro Picado Institute (ICP) developed a treatment using purified antibodies from the plasma of horses immunized with SARS-CoV-2 virus proteins. Its effectiveness was certified by the Type III Biosafety Laboratory of the National Center for Biodefense and Infectious Diseases at George Mason University.

32 Foreign direct investment (FDI) flows announced in the Latin American pharmaceutical industry totalled US$ 6.675 billion between 2004 and 2019. More than half of this went to Brazil and Mexico, followed by Argentina, Colombia, Ecuador and Chile. The region received only 4.8% of global pharmaceutical FDI in those years, and projects centred on manufacturing and sales, followed by research and development. Companies from Canada, France, Germany and the United States carried out most of these projects.

The external dependence of the region's countries as regards the supply of medicines with current patents and of active ingredients as inputs for local manufacturing is reflected in pharmaceutical imports from outside the region of US$ 23.795 billion in 2018 (see figure IV.12). Exports outside the region grew until 2012 but have since tended to stabilize at around US$ 2.5 billion, about one tenth of the amount of imports. In 2018, these exports totalled US$ 2.312 billion (32.5% of total exports). Of this total, about 83% came from Mexico, Brazil and, to a lesser extent, the Dominican Republic. The main destination for exports from the Dominican Republic and Mexico was the United States, while Brazil exported primarily to Europe.

The pharmaceutical sector has a substantial trade deficit with the rest of the world as a result, and this has grown consistently over the last 20 years, reaching US$ 21.483 billion in 2018.[33]

Figure IV.12
Latin America and the Caribbean: pharmaceutical industry trade balance and intraregional trade, 1995–2018
(Billions of dollars)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of United Nations Conference on Trade and Development (UNCTAD), UNCTADstat [online database] https://unctadstat.unctad.org/EN/.

Intraregional trade, meanwhile, surpassed US$ 6 billion in 2012 before dropping to US$ 4.808 billion in 2018. The pattern of location of the subsidiaries set up by large multinational companies to supply the regional market generates trade flows between countries that are considerably smaller than imports from extraregional sources. The largest countries in the region are net suppliers of pharmaceuticals to the rest of the region, as evidenced by the regional trade surpluses of Argentina, Brazil, Colombia and Mexico. However, Cuba and Panama, as well as El Salvador, Guyana and Uruguay to a lesser extent, also have intraregional surpluses.

2. The medical device and equipment industry

The situation of this industry is connected to the way it fits into global value chains. Most countries in the region are net importers of products from high-income countries and barely export. That aside, they supply a small part of their domestic demand with technologically unsophisticated products. Costa Rica, the Dominican Republic and Mexico are production centres used by multinational companies to supply mainly the United States market. Almost 99% of medical device and equipment exports from the region (US$ 12.42 billion in 2018) originated in these three countries. This has generated exports that slightly exceed the region's total imports. Medical device and equipment imports, which totalled US$ 9.525 billion in 2018, come mainly from the United States

[33] All countries in the region except the Dominican Republic have a trade deficit with countries outside the region. However, considering the global market, i.e. both the regional and the extraregional market, Cuba and Panama have a positive trade balance. In the case of Panama, this can be explained by the fact that it is a logistics centre that funnels imports from outside the region to Latin American and Caribbean markets.

and then from Europe and Asia. For both variables, intraregional trade is marginal. Like the pharmaceutical industry, the medical device and equipment industry shows large trade deficits in all the countries of the region except Costa Rica, the Dominican Republic and Mexico.

3. Latin America and the Caribbean in the global trade in medical products essential for combating COVID-19[34]

The COVID-19 crisis has highlighted the dependence of the region on imports of essential medical products from outside the region to combat the pandemic. This makes it vulnerable to unilateral supply disruptions, such as those imposed by several major suppliers in the first half of 2020.

In 2018, the 20 countries of the Latin America and the Caribbean for which information is available exported about US$ 17.5 billion worth of products essential for combating COVID-19.[35] Their imports were worth about US$ 30.3 billion.[36] Of the six categories making up this group of products, the region only recorded surpluses in medical consumables and other medical devices (see table IV.4).

Table IV.4
Latin America and the Caribbean (20 countries): trade in medical products essential for combating COVID-19, 2018
(Millions of dollars and percentages)

Category	Exports	Share	Imports	Share	Balance
Diagnostic kits and apparatus	658	3.8	10 754	20.2	-10 096
Personal protective equipment	924	5.3	2 049	8.3	-1 125
Thermometers	134	0.8	162	0.6	-28
Disinfectants and sterilization products	5 307	30.4	10 910	45.4	-5 603
Other medical devices	5 526	31.7	3 988	16.0	1 539
Medical consumables	4 897	28.1	2 420	9.5	2 477
Total	17 445	100.0	30 282	100.0	-12 836

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of United Nations, United Nations International Trade Statistics Database (UN Comtrade) [online] https://comtrade.un.org/.

Exports from Latin America and the Caribbean are highly concentrated by origin: Brazil, Costa Rica, the Dominican Republic and Mexico accounted for more than 90% of the total in 2018, this being explained by their participation in international networks producing medical devices and supplies. In Costa Rica, the Dominican Republic and Mexico, this is associated with the presence of multinational companies that produce mainly for the United States market. Regional imports are more diversified. The trade balance for medical products is in deficit in almost all the region's countries. Only Costa Rica and Mexico recorded significant surpluses in 2018, while the largest deficits were in South America (see figure IV.13).

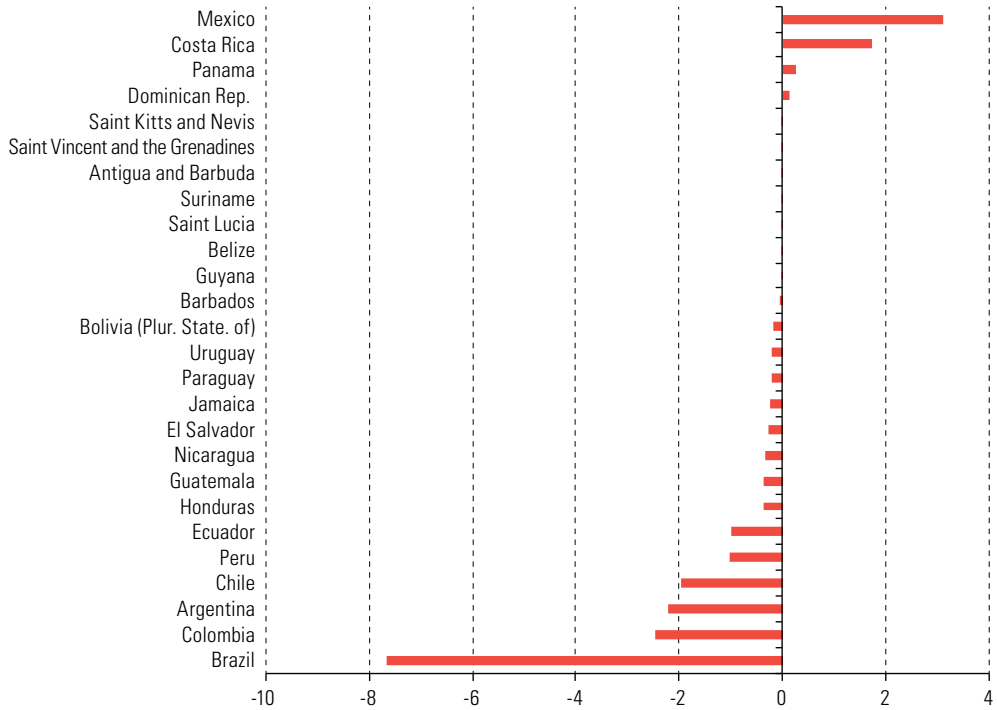
The United States is the region's main supplier of these types of products, accounting for almost a third of total imports in 2018. It is followed by the European Union with just over a quarter, China with 8% (mainly personal protective equipment) and Switzerland with 6% (mainly highly sophisticated medicines and medical devices). Less than 4% of regional purchases are from the region itself. In this context, Costa Rica, the Dominican Republic and Mexico could benefit from any restructuring of global value chains in the health sector as a consequence of the pandemic. This could include, in particular, new investments and the expansion of existing ones in the medical supplies sector, owing to the interest expressed by the Government of the United States in reducing its dependence on China in this area (UNCTAD, 2020).

34 This section is largely based on ECLAC (2020e).

35 Antigua and Barbuda, Argentina, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guyana, Mexico, Nicaragua, Paraguay, Peru, the Plurinational State of Bolivia, Saint Vincent and the Grenadines, Suriname and Uruguay.

36 The coverage of this list, prepared by the World Customs Organization (WCO) in conjunction with the World Health Organization (WHO), has been expanded during the pandemic. Its third edition, from June 2020, is available from WCO/WHO (2020).

Figure IV.13
Latin America and the Caribbean (26 countries): trade balance in medical products essential for combating COVID-19, 2018[a]
(Billions of dollars)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of United Nations, United Nations International Trade Statistics Database (UN Comtrade) [online] https://comtrade.un.org/.
[a] The data for Guatemala, Honduras, Jamaica, Saint Kitts and Nevis and Saint Lucia are from 2017, while the information for Panama is from 2016.

4. Innovation in the Latin American health-care industry

The percentage of GDP spent on research and development in Latin American health-care industries is an order of magnitude lower than in the OECD countries. Although aggregate information is not available for the region, this indicator for the discipline of "medical sciences" in 2017 was 0.082% in Uruguay, 0.047% in Argentina and 0.041% in Chile and Costa Rica, based on ECLAC calculations using data from the Ibero-American Network of Science and Technology Indicators (RICYT). By contrast, the figure ranges from 0.35% to 0.5% of GDP in the OECD countries.[37] Similarly, the region accounted for only 0.77% of global patents in the pharmaceutical field and 0.38% in that of medical technologies in 2018.

Companies in the region do not produce advanced innovations, unlike developed countries and, increasingly, countries such as China and the Republic of Korea. These innovations involve the introduction of medicines or new devices that generate strong profits secured by patent protection. In the local pharmaceutical industry, this situation means that research and development activities are limited to drug formulation, galenic research on pharmaceutical forms and small-scale clinical trials to obtain authorization for their drugs on the local market. In this context, the bulk of research and development in the region's countries takes place in universities and public laboratories.

[37] Government budgets for health-related research and development in the OECD countries amounted to 0.1% of their GDP in 2014. To this must be added between 0.05% to 0.2% for university research and 0.2% for research conducted by companies, giving an overall estimate of between 0.35% and 0.5% of GDP invested in health-related research and development (OECD, 2018b).

The region's larger countries have hubs of high-quality basic research, with good productivity indicators in terms of publications and an incipient trend towards the creation of start-ups that aim to bring research results to the market. However, the absence of a base of companies capable of introducing these innovations into the market thwarts any possibility of obtaining results like those seen in highly developed countries.

Most pharmaceutical companies concentrate their research and development activities on formulating generic medicines and registering them with each country's regulatory systems, a process that includes clinical studies into bioequivalence and pharmacological studies. In some countries, mainly Argentina and Brazil, acquisitions of biotechnology start-ups by investors have enabled biosimilar products to be manufactured.

The level of patenting is low because the region's research hubs are detached from companies. This is connected to a lack of incentives for universities and technological institutes to register patents and to the strategies of pharmaceutical companies specializing in the production of generic medicines whose patents have expired. Against this background, however, there have been public initiatives, like those described below, to stimulate the introduction of innovative products into the market:

- Hubs with research capabilities that are not exclusively university-based and that, thanks to a base of public sector funding, have been able to undertake research projects with implementation horizons and levels of resources that have brought them close to the production stages. Some examples are the Butantan Institute and the Oswaldo Cruz Foundation (Fiocruz) in Brazil, the Leloir Institute and the "Dr. Carlos G. Malbrán" National Administration of Health Laboratories and Institutes in Argentina, and the Pasteur Institute in Uruguay, together with private entities such as the Science & Life Foundation in Chile. These have played a key role in the introduction of products such as vaccines, the incubation of start-ups and capacity-building.
- The creation of technology-based companies has had a significant impact on the development of biotechnology applications for human health, especially when it comes to the manufacture of innovative medical devices. In Argentina, Brazil, Chile and Uruguay, companies of this type have been set up with the aim of introducing innovative products or services into the market. However, many of them are struggling to move to an industrial production stage or internationalize. Venture capital firms, which have received public policy support to finance these stages in the development of start-ups, have not as yet established specialized health-care industry funds capable of dealing with the complexities of that industry and investing over the time horizons that projects in it typically take to mature.
- The formation of research and development consortia with the participation of research centres and companies in Argentina, Brazil, Chile and Mexico. Funding has been provided for long-term projects aimed at developing products at the frontier of regional capabilities, usually in biopharmaceuticals. These initiatives have resulted in the introduction of new products, although not always patentable ones, such as biosimilars.
- In the context of the pandemic, different government institutions, business associations and academic centres have launched calls for innovation to promote initiatives ranging from the production of masks to the manufacture of emergency respirators (see table IV.5).

Table IV.5
Latin America: collective initiatives in support of the health-care system and population health

Product	Participants	Countries
Mechanical respirator	Automotive industry, universities, partnerships with firms in the medical equipment sector	Argentina, Brazil, Chile, Colombia, Costa Rica, Guatemala, Uruguay
COVID-19 diagnostic test	Research institutes, technology centres, universities, biotechnology firms	Argentina, Brazil, Colombia, Uruguay
Masks and other personal protective equipment	Textile and apparel manufacturers	Argentina
Hospital structures and infrastructure	Construction, metallurgy and household goods firms	Colombia

Source: Economic Commission for Latin America and the Caribbean (ECLAC), "Sectors and businesses facing COVID-19: emergency and reactivation", *Special Report COVID-19*, No. 4, Santiago, 2020.

5. Policy proposals

While the pandemic exposed weaknesses in health systems and supply chains for key inputs, it also showed the ability of some firms to adapt to make up for deficiencies in production systems. Different individual and collective initiatives, sometimes coordinated by business associations, public institutions and academic centres, have made it possible to adapt production and provide equipment, supplies and essential services to the health system to deal with the health crisis (see table IV.6). The most successful initiatives have mainly been in economies that built up capabilities during their industrialization processes. The long-term accumulation of capabilities by workers and management was crucial to the response capacity of firms and sectors (ECLAC, 2020c).

Table IV.6
Latin America and the Caribbean: production sector adaptation initiatives in support of the health-care system and population health

Product	Industry	Country	Example
Hand sanitizer	Manufacture of alcoholic beverages, sugar cane milling and alcohol production, cosmetics manufacture, paint manufacture, cleaning product manufacture, refrigeration industry, university laboratories, armed forces of Argentina and Brazil	Argentina, Brazil, Chile, Colombia, El Salvador, Guatemala, Mexico	Domestic and international brewing groups using the alcohol obtained as a by-product of alcohol-free beer production. Cosmetics groups: L'Oréal in Argentina, Natura in Brazil.
Masks	Textile, paper and cardboard manufacture	Argentina, Brazil, Chile, Colombia, Dominican Republic, Guatemala, Haiti	In Chile, Caffarena and Monarch, which manufacture socks, stockings and vests, produce masks containing copper.
Protective equipment for health-care professionals (masks, visors, etc.)	Automotive industry, household appliance industry, plastics industry, 3D printing in technology centres and universities, machinery and equipment manufacturers	Argentina, Brazil, Chile, Colombia, Costa Rica, Uruguay	In Argentina, Ford, Volkswagen, Mercedes-Benz and Fiat Chrysler Automobiles produced face protectors. In Chile, Comberplast, a plastics firm, is using recycled plastic to produce masks and face protectors.
Logistics, distribution and transport	Airlines, bus companies, tobacco firms, automotive industry, brewing industry	Argentina, Brazil, Chile, Colombia, Mexico, Panama	In Colombia, the Bavaria brewery made its fleet of trucks and its logistical expertise available to the government to transport food and other essentials.
Hospital structures and infrastructure	Construction, metallurgical industry, hotel industry, mining, automotive industry	Argentina, Brazil, Chile, Colombia, Dominican Republic, Mexico, Uruguay	In Argentina, Fiat produced beds, while in the steel sector Ternium Argentina shipped more than 270 tons of steel at the end of March for the construction of modular hospitals. In the Dominican Republic, the Association of Hotels and Tourism made 1,500 rooms available as isolation facilities for people infected with COVID-19.

Source: Economic Commission for Latin America and the Caribbean (ECLAC), "Sectors and businesses facing COVID-19: emergency and reactivation", *Special Report COVID-19,* No. 4, Santiago, 2020.

Considering the lessons of these successful experiences, the region's capabilities in the areas of production and science and technology, and the changes in the strategies of international companies, which are beginning to evaluate strategies for locating production facilities close to final consumer markets, the following guidelines are suggested for an innovation agenda in the health-care industry: (i) substantially increase the public contribution to research and development, (ii) increase the size and time horizon of projects to be implemented, (iii) strengthen public, university or private centres of excellence, (iv) promote connections between actors in the health industry innovation system, (v) improve product and process patenting, registration and approval processes and (vi) monitor procurement processes in the health industry innovation process.

Health-care industries have large economies of scale, which means that small and medium-sized countries in the region need to have easy access to the region's markets. The following is recommended with a view to strengthening regional collaboration: (i) develop mission-oriented innovation programmes implemented by regional multinational consortia, (ii) foster the integration of training and exchanges of students and researchers, (iii) extend and formalize mutual recognition of drug registration, (iv) complement installed capacity in the countries with a regional clinical trials platform designed to consolidate common and recognized regulatory standards, (v) regulate procurement strategies by creating a base of suppliers that offer guarantees of compliance with standards of high-quality, safe and timely supply at reasonable prices and (vi) strengthen regional mechanisms for joint procurement of medicines and medical devices in health emergencies.

In line with these proposals, on 2 July 2020 the Executive Committee of the Conference on Science, Innovation and Information and Communications Technologies (a subsidiary body of ECLAC) approved a regional cooperation proposal presented by ECLAC and the Ministry of Science, Technology and Telecommunications of Costa Rica which includes measures to develop the health-care industry at the national and regional levels. The idea is for it to work on the development of mission-oriented industrial and technological policies, the promotion of strategic partnerships for regional integration, the creation and strengthening of a regional market through recognition of regulatory bodies and coordination of public procurement, and the creation and expansion of capabilities at the regional level.

In late May 2020, Costa Rica and WHO launched a sharing platform to make COVID-19 vaccines, tests, treatments and technologies accessible to all.[38] This platform builds on the experience of the Medicines Patent Pool, which seeks to expand access to treatments for HIV and the hepatitis C virus. WHO recognizes the important role of patents in driving innovation, but at this time the tools to prevent, detect and treat COVID-19 are global public goods that are meant to be accessible to everyone.

Of particular importance in tackling the pandemic is progress with an intraregional cooperation initiative led by Argentina and Mexico, aimed at ensuring production of and access to a potential vaccine.[39] On 12 August 2020, the Anglo-Swedish transnational AstraZeneca and the Carlos Slim Foundation signed an agreement to contribute to the production in those two countries and the distribution in Latin America of the potential vaccine called AZD1222. This project of the University of Oxford and AstraZeneca is considered one of the most advanced in the world and is in phase 3 of development. The final stage of the vaccine trials, in which 50,000 people in Brazil, South Africa, the United Kingdom and the United States will participate, is due to be completed in late 2020. Once all stages have concluded, the Argentine biotechnology company mAbxience of the InsudPharma group is to produce the vaccine reagent while the Mexican laboratory Liomont completes the stabilization, manufacturing and packaging process for distribution in the region (Carlos Slim Foundation, 2020).[40] Manufacturing is expected to start in early 2021 so that the vaccine will be ready during the first quarter of that year. If this were achieved, it would mean an advance of between 9 and 12 months on the timeframe envisaged for access to the vaccine in the region.

E. The bioeconomy: sustainable development based on biological resources and natural ecosystems

When it comes to benefiting from the potential of the bioeconomy, the greatest strength of Latin America and the Caribbean lies in its abundance of undervalued biological resources and natural ecosystems.[41] These include all forms of biomass, whether natural (e.g. natural pastures and forests), cultivated (e.g. crops, livestock, forest plantations, aquaculture), harvested (e.g. fisheries) or waste, as well as natural ecosystems and the services they provide, and biodiversity and its genetic resources. The main technologies and production processes serving to enhance the use and value of these resources are biotechnologies, digital technologies, sustainable agricultural intensification, sustainable precision agriculture and biorefining.

38 A precedent for this action was resolution 74/274 of the General Assembly of the United Nations, adopted on 20 April 2020. Proposed by Mexico, this resolution requests the Secretary-General to identify and recommend options, including approaches to rapidly scaling manufacturing and strengthening supply chains that promote and ensure fair, transparent, equitable, efficient and timely access to and distribution of preventive tools, laboratory testing, reagents and supporting materials, essential medical supplies, new diagnostics, drugs and future COVID-19 vaccines, with a view to making them available to all those in need, in particular in developing countries.

39 This regional cooperation effort was recognized by the virtual ministerial meeting of the Community of Latin American and Caribbean States (CELAC) "Access to the AstraZeneca COVID-19 vaccine", held on 17 August 2020. The 19 countries in attendance confirmed their involvement in the initiative, while stressing that it had proved possible for the public sector to join forces with private actors to provide a vaccine accessible to all with speed and urgency, on a non-profit basis.

40 See Liomont [online] https://liomont.com.mx/.

41 The bioeconomy pursues new ways of organizing value chains associated with biological resources, which involves generating circular economy flows from the use of biomass and organic waste (circular bioeconomy). It seeks to reduce dependence on fossil resources and promotes the intensive production and use of knowledge about biological resources, processes and principles for the sustainable supply of goods and services (agricultural bioenergy and bioinputs, food, fibres, biopharmaceuticals and biocosmetics, bioplastics and other biomaterials for industry). It aims to minimize the production of waste, design new products and services and create sources of equitable economic and social growth. It offers a route to sustainable structural change by providing options for agricultural and rural development, the generation of value chains and the creation of quality green jobs and new opportunities for agriculture as an activity that produces not only food and ingredients but also biomass for multiple uses.

With an expanding global market for bio-based goods and services, the bioeconomy can diversify the production structure and increase value added in a sustainable way (Aramendis, Rodríguez and Krieger, 2018). Following the bioeconomy route means identifying institutional factors, regulations and barriers to market access that limit investment and the harnessing of its potential. A considerable effort of research and development and innovation is also needed.

The potential of the bioeconomy has become evident in the COVID-19 pandemic. Many of the "winning" sectors are related to the bioeconomy, such as agriculture, agroindustry and food production in general. Other clear winners are sectors involved in applying biotechnology, particularly in the field of health, because of their role in developing vaccines and designing methods for characterizing SARS-CoV-2 and for diagnosing and treating the disease.

Considering the technological sophistication of production processes and the nature of the products obtained, Rodríguez, Mondaini and Hitschfeld (2017) identify three levels in the development of the bioeconomy: (i) the bioeconomy of primary sectors (agriculture, fisheries and aquaculture, and forestry), (ii) the bioeconomy of primary resource processing (the food, wood, natural leather and textiles, and bioenergy industries) and (iii) the high added value bioeconomy (e.g. biochemicals, bioplastics, biopharmaceuticals and biocosmetics, enzymes for industrial use).

The bioeconomy can lay the groundwork for a transition to agroecology,[42] the development of value chains and more diversified systems of crops native to the region, and livestock production that is low in GHG emissions. New production methods combining digital technologies and those derived from progress in the biological sciences are areas with potential for the development of the bioeconomy in the region.

1. The bioeconomy and the agroecological transition

The transition to a sustainable bioeconomy in agriculture has three stages: (i) the sustainable intensification of primary production, or agroecological transition, based on the improvement of agricultural sectors and the sustainable management and use of ecosystems and their biodiversity services; (ii) the creation of value added through industrial processing based on research and development programmes applied to primary production and biodiversity, agroindustry and waste management; and (iii) the development of new high value added products, following the production model of biorefineries (full utilization of biomass) and advances in production methods based on the combination of modern biotechnologies and digital technologies.

Given the region's specific characteristics, implementing an agroecological transition means, first and foremost, preserving the great natural systems that play an important role in maintaining environmental balances in the region and the world.

Agroecology is generally associated with family farming and small-scale production; however, its principles can be extended to the scales of commercial agriculture. In Argentina, for example, extensive agroecological production has been carried out in mixed crop and livestock units of between 50 and 600 ha (Patrouilleau and others, 2017). In these models, there is rotation between crops and pastures associated with legumes that fix atmospheric nitrogen to restore fertility. The purpose of this rotation is to break the cycles of weeds, pests and diseases, leading to lower costs and better yields of wheat, soybeans and other grains (Cerda and Sarandón, 2011).

[42] Agroecology combines agronomy with ecology and seeks to "create diversified agro-ecosystems, mimicking natural systems as closely as possible to enhance sustainable production" (FAO, 2018, p. vii). The agroecological transition sets out from conventional agricultural models and aims to restore the functioning of agroecological principles. This change is carried out from a perspective of conservation and regeneration, combining traditional practices and techniques with innovations that contribute to the design of more efficient production models capable of creating safe and reliable products which have a value in the market and protect the health of farmers and the environment. For this reason, agroecology relies on collective intelligence and is implemented through mechanisms involving a high level of social participation.

2. Crops domesticated by indigenous peoples

A great variety of crops were domesticated by the indigenous peoples of Mesoamerica and the Andean-Amazon area, the centres where agriculture originated in the region. In addition to potatoes and maize, two of the nine staple foods humanity depends on, a wide array of other products originating in the region are also consumed in the rest of the world, such as: the common sunflower; different varieties of grain legumes; the common bean, broad bean and peanut; cucurbits such as the courgette; solanaceae such as chillies, peppers and tomatoes; roots and tubers such as manioc and the sweet potato; and plants with attenuant properties, such as cacao, tobacco and vanilla. These are crops with wild relatives that still exist in their centres of origin and may be essential to cope with exceptional situations in other parts of the world (Williams, 2014).

Exports of agricultural products originating in the region account for 10% of world agricultural trade (categories 1–24 of the Harmonized Commodity Description and Coding System (HS)) and grew at a cumulative average annual rate of 8.3% between 2000 and 2016, which was higher than the 7.5% growth rate for agricultural trade overall and the 5.7% growth rate for non-agricultural trade (HS categories 25–99). Several categories show cumulative annual growth rates of more than 10%, examples being pineapple juice concentrate, avocados, sweet potatoes, vanilla, cassava flour and cocoa paste.

There is great potential for the development of currently underutilized crops, which continue to be grown in their places of origin for local culinary purposes and can contribute to food security and livelihoods, especially for indigenous communities. Many of them are almost unknown outside their places of origin. They are domesticated crops that are generally adapted to poor soils and resistant to pests and diseases, as well as drought (Williams, 2014). An example of the development of new chains with high value added is the tequila industry, based on blue agave.

Many little-known domesticated crops have an important role to play in dealing with climate change, owing to their mechanisms of photosynthesis and their adaptation to conditions of water scarcity.[43] In addition, many of these species (e.g. quinoa) are high in protein and micronutrients and nutritionally superior to traditional cereals.

3. Agricultural production with low greenhouse gas emissions

A prime example of the potential for application of the bioeconomy is the development of livestock production that is low in GHG emissions. The region provides 25% of global beef exports, 26% of chicken exports, 6% of milk exports and 5% of pork exports. In this context, some 70% of grazing areas are undergoing degradation (70% of deforestation is due to the expansion of pastures); in addition, the sector has a large water footprint and GHG emissions of 1.63 gigatons of carbon dioxide equivalent (Gt of CO_2 eq) per year (Steinfeld and Mottet, 2018). Livestock production can help reduce GHG emissions and halt and reverse changes in land use. It can also increase the productivity of land and add more value. There are three paths towards the development of livestock production that is low in GHG emissions:

(i) Improvements in animal feeding, genetics, health and breeding to increase productivity and reduce emission intensity.

[43] Where photosynthesis is concerned, plants are classified as C3, C4 or CAM according to their metabolism. Most terrestrial plants (90% of higher plants), including rice, wheat, barley, oats, legumes and potatoes, have a C3 photosynthesis mechanism. The C4 group comprises only 3% of all terrestrial species and is more water-efficient than C3 plants; it includes species that originated in dry or semi-arid tropical environments, such as maize and sorghum, sugar cane, millets and amaranths. The third group, which comprises about 8% of the higher plants, has crassulacean acid metabolism (CAM) mechanisms; it includes plants such as agaves, bromeliads (such as pineapple) and cactuses. They are the most water-efficient crops and can be produced in near-desert conditions (Williams, 2014).

(ii) Restoration of degraded and fragmented landscapes and intensification of production in crop-livestock-forestry systems to increase carbon sequestration in soil and vegetation (about 30% of the global potential for carbon sequestration through improved grazing management is in the region).

(iii) The design of circular bioeconomy processes based on the exploitation of waste and residues (e.g. manure and crop residues) in energy production and nutrient recovery (FAO/AGROSAVIA, 2018).

Besides stimulating rural development, these practices also reduce pressure for the physical expansion of the sector and free up land that can be used for other productive purposes or for environmental restoration. Practices that sequester carbon in pastureland tend to increase resilience to climate variability and hence long-term adaptation, as well as yielding additional benefits in the form of food security, biodiversity and water conservation.

Of the methods already evaluated economically and environmentally, the most promising are crop-livestock-forestry systems, which combine fodder, grasses and legumes with shrubs and trees for animal feed and complementary uses (FAO/ICPAT, 2019).[44] These systems enable production to be diversified and intensified on the basis of natural processes, using land more sustainably than in conventional farming. Ecological interactions increase productivity, efficiency, the provision of environmental services and, ultimately, the economic performance of properties.

The production of better-quality fodder reduces the need for supplementation from external sources and increases the number of livestock per hectare up to fourfold. Other benefits are: increased carbon uptake by soil and plants; increased nitrogen fixation and improved nutrient availability, owing to improved soil conditions; increased water infiltration capacity and regulation of the hydrological cycle; and increased biodiversity of birds, insects and microorganisms, which improves pollination, pest control and soil quality. Results from 10 case studies that looked at the adoption of crop-livestock-forestry integration practices in Argentina, Colombia and Mexico over a decade show that fodder production grew by between 12% and 733% depending on the initial conditions and the proportion of the area converted. Milk and meat production increased considerably in all cases and CO_2 emissions declined. In one case where biodiversity was monitored, there was found to be a threefold increase in the bird population, a doubling of the bee population and a 60% increase in the ant population compared to the base year (FAO/ICPAT, 2019).

The financial results reveal that these systems are profitable, especially in the medium and long term. In all cases, revenues were higher than costs at the end of the 10-year period; in some cases, however, negative values were obtained in the first period of investment. Consequently, initial financing should be a matter for public policy, so that the barrier to adoption represented by start-up costs can be overcome. Overall, the implementation of integrated forest-livestock systems yields gains for productivity, profitability and the environment. These gains are simultaneous and come through gradually as the productivity of the environment increases.

For these systems to be able to be put into practice, cultural barriers must be overcome and technical support and initial funding provided. Studies have been carried out in Brazil on the carbon footprint of some cattle production systems (Cardoso and others, 2016; Barretto and others, 2016) and on carbon sequestration in some livestock production systems (Oliveira and others, 2018). These studies also found better results for crop-livestock-forest systems than for conventional ones (extensive, semi-intensive and with degraded pastures). In a country where agricultural activity causes 31% of emissions, with more than half of this coming from enteric fermentation in cattle (MCTIC, 2017), it is essential for production practices to evolve.

[44] Different names are used to identify variants in the method, the most common being crop-livestock-forest systems, forest-livestock integration and agriculture-livestock integration.

A pioneering initiative to reduce the environmental impact and increase the efficiency of agricultural activity in Brazil is the Low Carbon Agriculture Plan (ABC Plan), which operates in the form of a credit line to finance changes in production methods and processes. The ABC Plan is a policy of agricultural intensification which operates on a large scale, particularly in terms of its size and potential to induce changes in the production system, and which has allowed animal stocking rates to be increased from 0.7 units per hectare in degraded areas to 1.5 in reclaimed areas and 2.5 in areas with integration (ABC Observatory, 2017).

Taking the results of evaluations of the ABC Plan as a guide, the Brazilian Agricultural Research Corporation (EMBRAPA) designed the Carbon Neutral Meat seal, which certifies beef by the volumes of emissions neutralized or sequestered during production. The seal is granted on the basis of predetermined and registered parameters applied by auditing forest-livestock or crop-livestock-forest integration systems and evaluating enteric emissions and sequestration by vegetation and soil. Meat bearing this seal is worth more than meats in the gourmet segment (special meats for export) and adds value to the sector's output.

Another important innovation in the meat production sector is the increase in animal recycling throughout the production chain. This type of recycling generated 53,943 direct jobs in Brazil in 2014, with 344 recycling plants processing more than 12 billion kilos of by-products worth more than US$ 2 billion (ABRA, 2016).

4. Convergence between biotechnologies and digital technologies

The application of digital tools in agriculture is creating opportunities to improve production processes and drive the agroecological transition and the reduction of GHG emissions. It is part of a paradigm shift aimed at strengthening synergies between productivity and sustainability and between profitability and resilience, and at bringing production closer to distribution and producers closer to consumers.

Digital agriculture has at least five effects: (i) it reduces the quantity of inputs used; (ii) it favours innovation and productivity; (iii) it facilitates cooperation between farmers; (iv) it allows producers to connect directly with consumers; (v) it increases transparency in the functioning of markets. Digital technologies are useful tools for accelerating the agroecological transition and progress towards a sustainable bioeconomy.

There has already been considerable take-up of digital technologies in the region. In Argentina, for example, the 2018 extensive crop harvest was carried out with 11,240 yield monitors, covering almost 100% of the area farmed (Méndez and others, 2018). On the logistics side, the large transnational companies specializing in grains (Archer Daniels Midland (ADM), Bunge, Cargill, Louis-Dreyfus Company (LDC) and China National Cereals, Oils and Foodstuffs Corporation (COFCO)) have created a partnership to standardize data and digitize global agricultural shipment transactions, using technologies such as block chains and artificial intelligence. These tools have great potential in the soybean chain and in other large chains in which the South American countries are important players. This will increase the transparency and efficiency of the chain throughout the world (BW, 2018).

Another key factor for innovation in agriculture is the rapid development of technologies in the field of the biological and life sciences. The following are some of the aspects of agriculture where these technologies can be applied: the development of improved crops and foods; the promotion of non-food uses for crops (such as biodegradable materials, vegetable oils and biofuels); the exploitation of agricultural, forestry, fishery and agroindustrial waste and residues (new products that can be used as inputs in other sectors); the development of biopesticides, biofertilizers and other bioinputs; and environmental management through bioremediation, i.e. the recovery of degraded or contaminated soils and treatment of wastewater. Table IV.7 presents examples of some emerging technologies with the potential to accelerate these transformations.

Table IV.7
Technological advances with a large potential impact on agriculture and the bioeconomy

Technology	Description	Examples of applications and impact
Smart farming	Intensive use of agrometeorological data on soil, humidity and sunlight and on plant and animal behaviour, and process automation to optimize yields.	Use of sensors to automatically detect variations in soil conditions and in the behaviour of crops and animals. Customized production of specific products for particular customers. Increase in the diversity of products and production methods. New generation of precision agriculture. Increasingly accurate remote identification of crop needs at any given time and place. Automation of agricultural activities, such as soil preparation and harvesting.
Synthetic biology	Design of living organisms to meet the needs and desires of humanity.	Reduction of space and energy requirements. Production of sophisticated ingredients or components and substances, even without the need for soil. Design of crops adapted to climate change. Customized production of food for self-consumption.
Food design	Laboratory development of foods with specific components added or extracted to improve their taste or structure and promote health.	3D printing to enable households to design and print their own food. Monitoring of food composition. Production of nutrient units (cubes, gel or powder). Emulation of flavours.
Vertical agriculture	Agriculture in high buildings (vertical farms).	Increase in the food supply in densely populated cities and limitation of the footprint of conventional agriculture. Production closer to consumers and reduced transport costs.
Bioinformatics	Application of information technology (IT) tools to enhance biological knowledge.	DNA barcoding. Modelling of disease outbreak patterns or individual genomes. Development of new biological products. Analysis of plant properties. Increased agrometeorological forecasting capacity. Monitoring of animal health.
Gene technology	Technological applications using biological systems, living organisms and their derivatives (e.g. DNA sequencing, cloning, cisgenesis, transgenesis, gene inactivation and epigenetics).	Production of customized populations of individual animals and plants for specific applications (e.g. cows that produce milk high in unsaturated fatty acids or potatoes containing a specific type of starch). Development of plants that are resistant to specific diseases (less need for herbicides) or can be grown in areas currently considered unsuitable. Improvements in the suitability of plants and biomass residues for new generations of biofuels.
Protein transition	Less consumption of animal protein and more consumption of plants and new alternatives, such as seaweed and insects.	Meat production by tissue culture. Development of meat lookalikes from mushroom, soybean or dairy proteins. Mixing of meat with alternative proteins.
Aquaculture	Cultivation of aquatic organisms such as fish, molluscs, crustaceans and algae.	Marine, brackish water and freshwater aquaculture and cultivation of seaweed. Replacement of commercial fishing. Urban aquaculture.
Food conservation technologies	Design of packaging and of processing techniques that allow food to be kept fresh for longer and protected from contamination.	High-pressure pasteurization, pulsed electric fields and the cold plasma method. Application of relevant genes as alternatives to conventional thermal pasteurization or sterilization. Development of smart packaging using nanomaterials and sensors.

Source: P. Van der Duin and S. den Hartog, "Disruptive futures: prospects for breakthrough technologies", *Agriculture & Food Systems to 2050: Global Trends, Challenges and Opportunities,* World Scientific Series in Grand Public Policy Challenges of the 21st Century, vol. 2, R. Serraj and P. Pingali (eds.), Singapore, World Scientific, 2019.

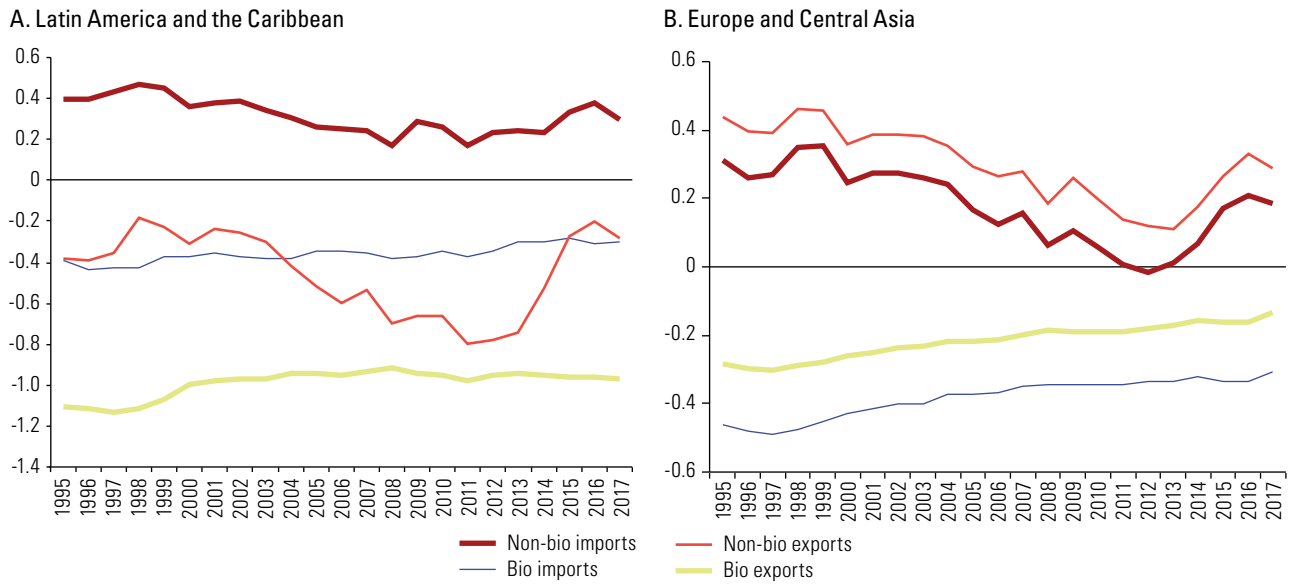
5. The bioeconomy and the complexity of the export basket

The fundamental challenge of the bioeconomy in the region is to increase the value added and complexity of production based on biological resources. Agricultural and other bio-based exports are of low complexity, and commodities continue to account for a large share. This contrasts with the situation in Europe, where complexity is high and growing, reflecting the continent's position in the value chains of the bioeconomy. Thus, the region is a net importer of complexity,[45] i.e. it exports non-complex products and imports complex

[45] A sector's complexity is calculated as a weighted average of the complexity per product (HS 1992 at the four-digit level). Complexity per product is the average of that complexity in the three years prior to the analysis (2014–2016), so changes do not reflect the movement of the index over time. The concept of complexity is explained in Hausmann and others (2014). The concept of bioproducts is taken from the classification of Rodríguez, Mondaini and Hitschfeld (2017) and includes the agricultural sector and downstream products of biological origin.

products in both the agricultural chain and all other sectors (see figure IV.14, where the agricultural chain is represented by green lines and the remaining sectors by grey lines). By contrast, Europe imports less complex products and exports complex products. Examples to follow include particularly Germany and the Republic of Korea at the global level and Chile and Uruguay in the region.

Figure IV.14
Latin America and the Caribbean, and Europe and Central Asia: complexity of foreign trade, by sector, 1995–2016
(Weighted averages of the product complexity index)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).
Note: The product complexity index (PCI) is a measure of how knowledge-intensive a product is. Weighted averages have been calculated on the basis of the fixed PCI, averaging out the period 2014–2016 (OEC, n/d).

The cases of cacao and soybeans are illustrative. Worldwide, chocolate has a value by weight 59% higher than that of cocoa beans. In the region, there are exporters of cocoa beans, such as Ecuador and Peru, and exporters of chocolate, such as Brazil and Mexico (which are also producers) and Argentina. Capturing value added (downstream) is an important but difficult task for most countries in the region. In Ecuador and Peru, there is a slight trend towards exporting the more processed product, but there is still ample scope to develop these chains.

Soybeans are a modern commodity forming part of a long and complex food chain, with value added concentrated downstream. Soybean oil was worth almost twice as much per ton as the bean itself in 2016 (FAO, 2020). Argentina, the world's largest exporter of soybean oil with an average of 44% of the global trade in the latest five years available, has applied the strategy of exporting higher value added processed products, while Brazil has followed the strategy of the United States, exporting mostly unprocessed soybeans. However, the soybean chain does not end with milling. Soybean meal is an important input in the production of pork and fish (especially in China, but also in Brazil, a large exporter of pork). Soybeans can also be used to produce biofuels (biodiesel), while soybean lecithin and glycerin are important inputs in a variety of industries, such as the cosmetics, food ingredient and pharmaceutical industries, and have a range of uses, some of them little known. Although soybeans are a commodity in the classic sense, there is a plethora of options for capturing more value in the chain. As in the case of cacao, progress involves combining industrial policies to develop production chains through innovation and the incorporation of more sophisticated technologies.

6. Policies to develop the bioeconomy, sustainable agriculture and biodiversity management

Many of the institutions and policies oriented towards the agricultural sector in the region have been weakened by fiscal constraints. This runs counter to the need to deal with ever-increasing pressures from growing food demand and depletion of the natural resources that sustain agricultural production, the demand for production to become more sustainable, and the impacts of climate change. At the same time, emerging production paradigms, such as the bioeconomy and agroecology, provide a way of responding to these pressures and are being boosted by changes in consumer preferences and concerns, the growing body of knowledge in the biological sciences and the development of related technologies (e.g. modern biotechnologies), and the mass application of digital technologies (Sotomayor, Rodríguez and Rodrigues, 2011).

This situation makes it necessary to reorder priorities and implement new policies and alternative ways of managing natural, human and financial resources in the agricultural sector and related areas. To this end, ECLAC proposes to strengthen the following linkages: between the bioeconomy (as a technological and productive paradigm for the development of agriculture and other activities that use biological resources) and the sustainable use and management of biodiversity; between agroecology (as a production system for sustainable agriculture) and nature-based solutions within the framework of the bioeconomy; and between new technologies and traditional knowledge.

Where the development of the bioeconomy is concerned, exploiting its potential requires knowledge of the biological resources available, related scientific and technological capabilities, market potential and consumer acceptance of new products. The development of an inclusive, sustainable and competitive bioeconomy involves dealing with obstacles such as the lack of appropriate regulatory frameworks, insufficient coordination of technical capabilities, restrictions on market entry by small enterprises and the lack of funds to foster the creation of innovative businesses (Rodríguez, Rodrigues and Sotomayor, 2019). To resolve these limitations, actions are needed in the areas of policy and regulation, research and development, innovation and support for entrepreneurship, exploitation of biological resources in a way that adds value, and market access and development. A notable case in the region is the Costa Rica National Bioeconomy Strategy 2020–2030, summarized in box IV.3.

Box IV.3
The Costa Rica National Bioeconomy Strategy 2020–2030

The Costa Rica National Bioeconomy Strategy 2020–2030 seeks to lay the foundations for the country to become a knowledge-based economy, with sustainable, high value added production in all regions, fair and equitable use of biodiversity, circular use of biomass and biotechnological progress. The goal is to make the bioeconomy a pillar of economic transformation by promoting innovation, the creation of value, the diversification and sophistication of the economy, the application of circular bioeconomy principles and the decarbonization of production and consumption. It aspires to make the country a model of sustainable development in which biological resources are used to foster social inclusion and equity, balanced territorial development, conservation, knowledge and sustainable use of biodiversity, and national competitiveness, by seeking to bring together the country's biological resource wealth with its capabilities in the field of biological sciences.

The Strategy has five pillars: (i) the bioeconomy for rural development (promoting sustainable and inclusive rural economic development by diversifying and adding value to the production of goods and services in agricultural, fisheries and forestry activities and supporting the creation of value networks and better environmental management of production processes); (ii) biodiversity and development (fostering ecosystem services and the sustainable use of land and marine biodiversity resources as a new engine for sustainable, inclusive development with high added value and low GHG emissions); (iii) biorefining of residual biomass (encouraging new production activities based on the full use and optimization of residual biomass from agricultural, agroindustrial, forestry and fisheries processes); (iv) the advanced bioeconomy (supporting the creation of new activities based on the development of new products, applications and biotechnological and bionanotechnological platforms by promoting synergies and alignments between the country's scientific capabilities in the biological sciences and the sustainable use of biodiversity resources); and (v) the urban bioeconomy and green cities (promoting the application of biological principles in urban development policies and initiatives in areas related to solid waste management, the creation of recreational spaces and the construction of buildings). In addition to these strategic pillars, there are also cross-cutting ones such as communication with society, education and capacity-building, research and development, incentives, financing and attraction of foreign investment, and market access.

Source: Government of Costa Rica and others, *Estrategia Nacional de Bioeconomía Costa Rica 2020–2030*, San José, 2020.

The regulatory environment is essential to the development of the bioeconomy. In particular, there is a need to: develop regulatory frameworks, particularly in areas where the progress of knowledge and the application of new technologies is more rapid (e.g. biotechnology applications); reduce the complexity (while preserving the rigour) of national regulatory processes, in relation for example to access to genetic resources for research and development and the protection of traditional seeds and plants; strengthen producers' ability to comply with regulations in destination markets relating to bioeconomy products (new food products, biopharmaceuticals and biocosmetics); harmonize regulations between conventional products and similar bioproducts (biopharmaceuticals, bioremediation, biomaterials); and harmonize criteria for classifying new products related to the bioeconomy, such as functional foods and superfoods, biopharmaceuticals, agricultural bioinputs and industrial enzymes.

The scale of the challenges requires a shift towards more sustainable and inclusive production models that strike a better balance between profitability and resilience. In these models, nature-based solutions can be used to solve production problems and foster inclusion, examples being mixed crops and crop rotation, biological pest control and the construction of hedges or the incorporation of organic matter into the soil to improve water retention.[46] These models should build on knowledge about the principles and functions of ecosystems to design infrastructure that addresses environmental problems, an example being water management practices that prevent desertification or reduce flooding. Natural infrastructure, such as wetlands, riparian buffers and the reconnection of rivers to flood plains, should also be integrated with artificial infrastructure, such as roads and reservoirs, as a hybrid option to improve economic and environmental performance.

To accelerate the adoption of nature-based solutions, it is necessary to improve the stock of knowledge about the processes involved, and indeed to make it more scientifically rigorous.[47] It is also crucial to incorporate the traditional knowledge of local communities on ecosystem functioning and nature-society interaction and to ensure that those in possession of knowledge and territories are fully and effectively involved in assessments, decision-making, implementation and management. One variant of nature-based solutions is payment for ecosystem services by large users (e.g. cities that consume water) to groups that provide them (e.g. farming communities in river basins). Since there are positive externalities involved, an institutional framework is required so that users internalize the costs of generating the service and providers are adequately compensated. Communities can also provide engineering services such as slope and soil stabilization, dredging and coastal protection; in these cases, the existence of markets for engineering services facilitates payment for the ecosystem service. In this area, as shown in chapter III, reforestation plays a significant role by supporting decarbonization as well as having positive effects on campesino communities and farms and the provision of ecosystem services such as water availability and soil formation.

A line of action connected to those just analysed is decarbonization by prior offsetting for specific types of production or products which entail high GHG emissions by their nature or because of the difficulty of modifying production processes. These include oil and its derivatives, steel, cement, air travel, cars and other forms of transport. Emissions would be neutralized by capturing the equivalent amount of carbon in natural systems, with the offsets to be sold on national or international markets. This requires the creation of a regulated certification and traceability system that can give consumers and all actors in the production chain confidence in the characteristics of the GHG emission offsets.

In pursuit of progress with the new production models, research and development policies must be reoriented with a view to enhancing knowledge of biological processes and principles and of ecosystem functions relevant to the effort to make agriculture more sustainable (by means of biotechnology applications, for example). A new orientation should also be given to policies that incentivize the design of digital applications for generating information in support of the operation of other advanced technologies, such as task and process mechanization. There is likewise a need for policies to strengthen producers' capabilities so that they can adopt and manage these technologies and provide the connectivity infrastructure which digital technologies require.

[46] Nature-based solutions are actions to protect, sustainably manage and restore natural or modified ecosystems that effectively and adaptively address social challenges and at the same time provide benefits for human well-being, the environment in general and biodiversity in particular (Cohen-Shacham and others, 2016).

[47] See Galopín and others (2020) for a wide-ranging discussion on this point.

An understanding of biodiversity (i.e. comprehension of the richness of the natural heritage and its ecosystem services and cycles, as a strategic resource) is an enabling condition for the bioeconomy to act as an engine of development. This means investing in the creation of biodiversity information infrastructure that can be used to coordinate the actions of the State, academia, the private sector and society so that early assessments can be made of the effectiveness of policies, standards and programmes throughout their cycle. There is also a need to systematize traditional knowledge, especially that of indigenous and campesino communities, and to provide infrastructure that improves spatial connectivity and ecosystem management. These policies must operate in a coordinated manner and open up spaces for action on the basis of governance mechanisms involving a variety of actors and making full use of the work of standard-setting institutions such as the Alexander von Humboldt Biological Resources Research Institute in Colombia, the National Biodiversity Institute (INBio) in Costa Rica and the National Commission for the Knowledge and Use of Biodiversity (CONABIO) in Mexico.

The bioeconomy and agroecology can contribute to social inclusion. The poorest sectors involved in family farming have traditionally been neglected in public budgets. Policies to promote the bioeconomy and the agroecological transition should therefore pay attention to these groups in order to alleviate their poverty and find solutions to environmental problems. To this end, it is essential to rethink the criteria for targeting public interventions and to seek an appropriate balance between public goods (information, health, access to external markets, defence of the domestic market, food safety and biodiversity) and the (appropriable) private goods that are essential for accelerating investment and technological innovation.

New approaches to management, governance and citizen participation must be pursued. There must be progress towards a new generation of policies that, in addition to using advanced technologies to reduce costs, expand coverage and increase potential impact, recognize the value of local resources and encourage partnership and knowledge sharing between peers. Platforms for sharing information and good practices between governments and other regional actors are important. The Platform for Climate Action in Agriculture (PLACA) is an example of an initiative that uses digital resources and promotes horizontal knowledge transfer to improve policy efficiency.

The involvement of civil society actors is essential to improve the quality and legitimacy of policies. At a time of scarce resources and demands for greater transparency, it is essential to approach public policy as something to be developed and managed in partnership with producers, local organizations, NGOs, businesses, municipalities and other stakeholders. There are many examples in the region of governance mechanisms oriented towards sustainable production that are participated in by a variety of actors, often including indigenous communities. There is also a need for increased South-South cooperation to share and systematize experiences that can serve to reproduce these isolated instances on a larger scale. All these factors must be considered if policies are to have an impact and yield additional wealth for territorial and sectoral actors to share.

F. Developing the circular economy

The aim of the circular economy is to preserve the value of materials and products for as long as possible in order to minimize waste and complete their life cycle, in contrast to the dominant paradigm of the linear economy of production-consumption-disposal. To this end, the objective is to restore and maintain the utility of products, components and materials and thereby preserve their value by changing the production model, designing suitable processes and products (ecodesign), creating business models, promoting resource flows and creating value (Ellen MacArthur Foundation, 2017). Minimizing the input of new materials and energy reduces the environmental pressure associated with the life cycle of products, from resource extraction through production and use to the end of their useful lives (EEA, 2017). The European Union (EU) is leading the way in this area and has implemented a programme to become a resource-efficient, low-carbon economy (European Commission, 2019a). This will have repercussions in countries with which the EU cooperates closely. Within this framework, there is an opportunity for Latin America and the Caribbean to design and strengthen a circular growth strategy of its own.

In the circular economy, waste is seen not as something to be got rid of but as a resource, which is important considering that a 90% reduction in material use in industrialized countries is necessary to achieve sustainable economic development worldwide by 2050 (Lehmann, 2018). Proper management of waste involves prioritizing prevention, reuse, recycling, and energy recovery over final disposal (Lansink, 2018).

1. Solid domestic waste

Global waste production will increase from over 2 billion tons in 2016 (about 0.74 kg per capita per day) to 3.4 illion tons by 2050 (Kaza and others, 2018). More waste is generated per capita in more urbanized and higher-income countries, although volumes are growing at higher rates in lower-income countries. The composition of household waste varies with the income level of countries and cities.

The region generates 0.97 kg of waste per capita per day, with a higher figure in the Caribbean because of the effects of tourism.[48] Organic waste accounts for more than 50% of this total, with a figure of almost 70% in some countries. Waste collection coverage in the region is high compared to the global average. About 85% of waste is collected in urban areas, mostly door to door; however, figures vary considerably between countries, from over 95% in cities in Uruguay and Colombia to only 12% in Port-au-Prince. In rural communities, waste collection coverage is about 30% (Kaza and others, 2018).

In 2014, less than 75% of urban waste was deposited in sanitary landfills and more than 20% went to open dumps (UNEP, 2018d). The infrastructure for managing, reusing and disposing of waste is not developing fast enough to keep pace with the amount produced under the current consumption pattern.

Furthermore, only 4% of solid urban waste is recycled in the region, in contrast to countries where the figure is as high as 20%. National recycling markets in Colombia, Ecuador, Panama and Peru focus on paper, cardboard, ferrous metal scrap, some plastics (polyethylene terephthalate (PET) and high-density polyethylene) and glass. In Brazil, on the other hand, there are tax incentives that promote reverse logistics, e.g. the sales tax on merchandise and services is lower for various recycled inputs (Gramkow and Anger-Kraavi, 2018). Formalizing waste pickers, applying Extended Producer Responsibility (EPR) criteria and improving collection, treatment and disposal systems can reduce environmental impacts and create job opportunities that should yield social and environmental benefits (UNEP, 2018d). This is important because there is a high level of informality in the sector.

2. Organic waste

The management of organic waste creates opportunities to recover proteins that can be used as animal and human food, enzymes that can be employed in industry, and materials that can be converted into biomaterials and returned to the soil, or into energy (Philp and Winickoff, 2018). If 100% of the nitrogen, phosphorus and potassium in the world's animal and human food waste streams were recovered, nearly 2.7 times the amount of nutrients contained in all chemical fertilizers used would be saved. Every second, an amount equivalent to six refuse truckloads of edible food is lost or wasted in the world, i.e. 30% of the food produced annually for human consumption. In the region, 15% of available food is lost or wasted each year (FAO, 2014; UNEP, 2018d; Ellen MacArthur Foundation, 2019).

In 2011, food wastage led to the unnecessary emission of 3.6 Gt of CO_2 eq of GHGs, a figure which does not include the 0.8 Gt of CO_2 eq of deforestation and managed organic soils associated with the food wastage (FAO, 2015a). Therefore, the total carbon footprint of food wastage, including land use change, is about 4.4 Gt of CO_2 eq per year. This means that, if food wastage were a country, it would be the third largest emitting country in the world (FAO, 2015a; C40 Cities/Arup/ University of Leeds, 2019).

[48] Data from Kaza and others (2018). UNEP (2018d) indicates that the average for the region was 1 kg per person per day. That report also notes that it is difficult to present a complete overview of the situation of all waste streams in the region, since there is little information on hazardous wastes, hospital waste, construction and demolition waste or food waste, among other types.

3. Plastic waste

Between 1950 and 2017, world plastic production increased from 2 million to 348 million tons per year.[49] By 2050 it will be 1.124 billion tons per year, accounting for 20% of total world oil consumption (WEF, 2016; Geyer, Jambeck and Law, 2017; Plastics Europe, 2019). In Latin America and the Caribbean, plastic makes up 13% of all waste.

Plastic is treated as a disposable material: over 75% of all plastic produced ends up as waste (WEF, 2018). Without the right policies, this waste could triple by 2060 (Lebreton and Andrady, 2019).[50]

There is growing concern about the health effects of microplastics: it is estimated that the average person ingests about 5 grams of plastic per week, equivalent to the weight of a credit card (Senathirajah and Palanisami, 2019).[51] Globally, it is estimated that between 4.8 million and 12.7 million tons of plastic waste were washed into the ocean from coastal areas in 2010 (Jambeck and others, 2015), a figure that is expected to double by 2030 and quadruple by 2050 (WEF, 2016). The Caribbean Sea is the second most polluted with plastics in the world; there is thus an urgent need for actions to reduce the consumption of disposable plastics and eradicate the use of microplastics in the subregion (UNEP, 2018a). Sources of marine refuse generally correlate with inefficiency in solid waste management and wastewater treatment (Schmidt, Krauth and Wagner, 2017).

The countries of the region have approved regulations for the manufacture, import, sale, use and disposal of plastics. Some countries have taxes on single-use plastics. Although microplastics are not banned in the region, in Brazil a bill (No. 6528/16) has been introduced to prohibit their use in personal care items. Through laws dealing with waste or extended producer responsibility (EPR), the region is making progress on standards and the creation of the associated markets. For example, responsibility systems for single-use plastics are in place in Barbados, Belize, the Bolivarian Republic of Venezuela, Brazil, Paraguay, the Plurinational State of Bolivia, Saint Kitts and Nevis, Saint Vincent and the Grenadines and Uruguay. In Chile, as part of EPR, targets were set in 2019 for the collection and recovery of plastic containers and packaging by 2030 (Ministry of the Environment, 2019).

Most countries regulate or prohibit plastic bags, with exemptions only for certain activities and products. Restrictions, prohibitions and, in some cases, taxes apply to importation, manufacture, retail distribution or use. In Colombia, for example, a tax is being levied on the consumption of plastic bags while a bill to prohibit them moves forward. In Antigua and Barbuda, the Bahamas, Paraguay, the Plurinational State of Bolivia and Uruguay, EPR laws have been or are in the process of being passed as part of plastic bag regulations (UNEP, 2018a, 2018b and 2018c).

Buenos Aires, Rio de Janeiro (Brazil), São Paulo (Brazil) and Mexico City also have local regulations that range from complete prohibition to a ban on distributing plastic bags free of charge. Costa Rica aims to become the first country in the world to be free of single-use plastics by 2021. In Peru, public sector entities have a specific mandate to recycle plastic bags: they must purchase and use biodegradable plastic bags, and at least 80% of the materials in them must be recycled (UNEP, 2018a, 2018b and 2018c).[52] However, even if global recycling rates were to increase from the current 14% to over 55%, which would be higher than in the best-performing countries at present, annual virgin raw material requirements would double by 2050. There is thus a need for the plastics industry to consider action on redesign and convergence of materials, formats and after-use systems via a global plastics protocol, the development of secondary markets and innovation in technology and materials to capture a significant share of value and materials. From the point of view of the bioeconomy, the strategy would be to move from using polymers derived from fossil resources to employing biopolymers to produce bioplastics, particularly ones that biodegrade rapidly.

49 This figure is for production from raw materials and includes thermoplastics, polyurethanes, thermosets, elastomers, adhesives, coatings and sealants, and polypropylene fibres. It does not include polyethylene terephthalate (PET), polyamides or polyacrylonitrile fibres.

50 Packaging accounted for at least 36% of the total volume of single-use plastics in 2015 (WEF, 2016).

51 A list of common foods and beverages containing microplastics includes drinking water (tap and bottled water), beer, seafood and salt.

52 This is an example of how sustainable public procurement policies can encourage the production and marketing of more socially and environmentally appropriate goods and services.

The fourteenth meeting of the Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal adopted an amendment to the annexes to the Convention to add entries on plastic waste. These will enter into force in 2021 and will increase the transparency of the global trade in these wastes, thus preventing developing countries from continuing to receive plastic waste in an uncontrolled fashion (UNEP, 2019c).

4. Sanitary waste during the pandemic

Sanitary waste is mainly generated in hospitals, laboratories and research centres, mortuary services, blood banks and nursing homes, among other places. Of the total waste generated, an average of 80% is common waste and 20% is hazardous material that may be infectious, toxic or radioactive (WHO, 2018). Because of the pandemic, the use of personal protective equipment has increased considerably among health workers and the general public. WHO/UNICEF (2020) has provided a guide to the management of sanitary waste associated with the pandemic, and UNEP (2020) has stressed that waste management is an essential public service. In line with this, national and municipal governments have developed the necessary protocols. Unsafe sorting and separation procedures for medical waste could increase infection rates and pose a high risk to informal sector workers, as the virus can live for up to seven days in the outer layer of a surgical mask (approximately 0.1% of the original inoculum) (Chin and others, 2020). There is thus an urgent need to raise awareness of how this type of waste, particularly masks and gloves, should be disposed of responsibly.

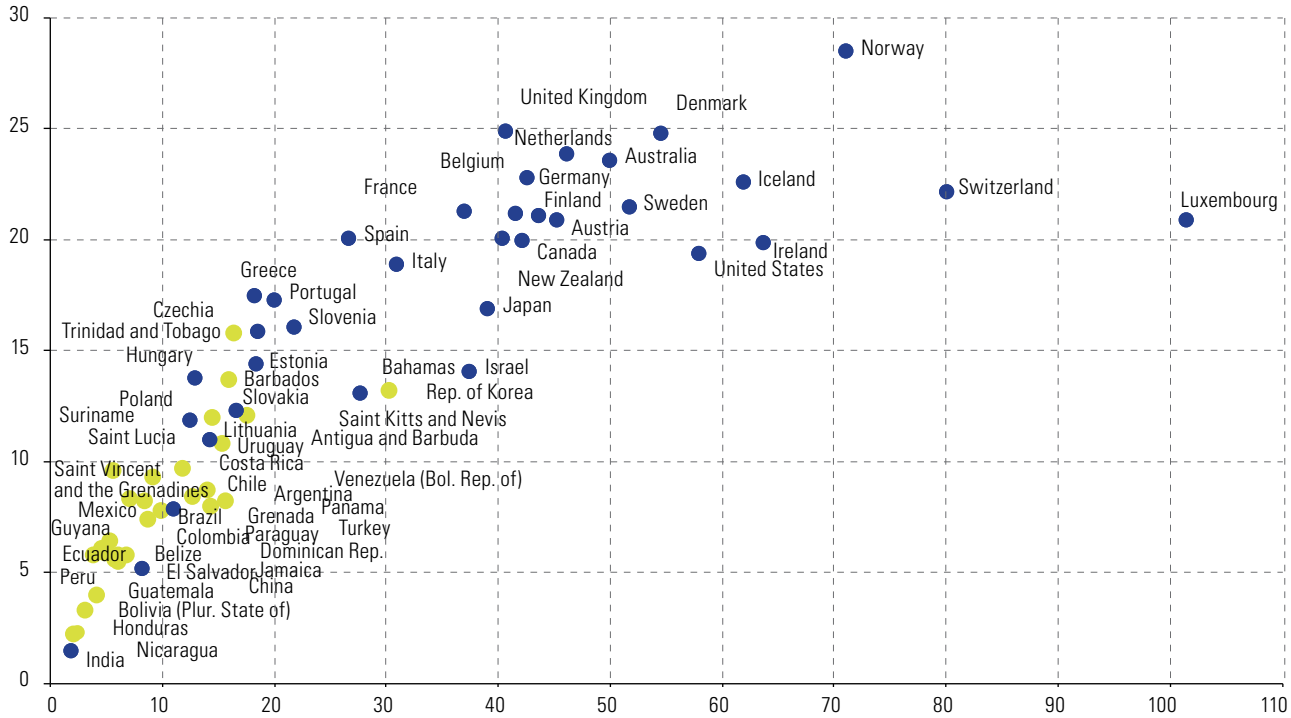
The significant increase in sanitary waste due to COVID-19 also makes disposal difficult, especially in places where there is little infrastructure. In Wuhan (China), up to 256.5 tons of medical waste were generated daily in April 2020, five times more than before the pandemic, and some of this waste had to be transferred to nearby cities for disposal (Liqiang, 2020; Yukun, 2020; Shi and Zheng, 2020). In Spain, hospital waste quadrupled (Waste Agency of Catalonia, 2020; Teimas, 2020) and difficult decisions had to be made about the type of disposal to be used (Arévalo, 2020; EFE Agency, 2020). In the United States, an amount of waste equivalent to what used to be produced in a year was produced in two months (Cutler, 2020). In Asian countries it is estimated that the amount of medical waste generated by an infected person averages 3.4 kg per day (ADB, 2020).

In some hospitals, single-use personal protective equipment is sterilized by autoclaving or chemical treatment and reused, which could help reduce the amount of such waste. However, health-care waste contains plastic elements that are not recyclable. With the increased demand for gloves and masks, and considering the health emergency, there is pressure in several European countries and the United States to delay the implementation of regulations banning single-use plastic (Scaraboto, Joubert and Gonzalez-Arcos, 2020; McVeigh, 2020). Although there are no official figures as yet for the amount of health-care waste generated in Latin America and the Caribbean, the pandemic should be seen as a warning about the importance of hospital and health-care infrastructure and the management of waste, including traceability.

5. Waste electrical and electronic equipment

Each social group and country's contribution to the generation of waste electrical and electronic equipment (WEEE) depends on its income level (see figure IV.15). Although 66% of the world's population was required to comply with some national law on the handling of electronic waste as of 2017, only 20% of WEEE was collected and dealt with properly. What happened to the remaining 80% is unclear: it is assumed that it was deposited in landfills and dumps, or sold and recycled in conditions that fell short of the standards set.

Figure IV.15
Latin America and the Caribbean, Organization for Economic Cooperation and Development (OECD), China and India: generation of waste electrical and electronic equipment and per capita GDP, 2016
(Kilograms per capita per year and thousands of dollars at current prices)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of C. Baldé and others, *The Global E-waste Monitor 2017: Quantities, Flows, and Resources*, Tokyo, United Nations University (UNU), 2017; World Bank, World Development Indicators [online database] https://databank.worldbank.org/source/world-development-indicators; United Nations University Institute of Advanced Studies (UNU-IAS), *eWaste in Latin America: Statistical Analysis and Policy Recommendations*, Tokyo, 2015.
Note: Waste generation is displayed on the vertical scale and GDP on the horizontal scale. The figure for Haiti is taken from UNU-IAS (2015).

Monitoring waste movements internationally is very challenging, since in most countries there are few statistics on imports and exports of used equipment and electronic waste, and those that do exist are of low quality (Baldé and others, 2017). However, WEEE contains many metal components, such as copper, gold and silver, which can be used several times over as raw materials in production processes, thereby reducing the amount extracted through traditional mining. The value that can be extracted from WEEE in terms of resources saved and jobs created depends on the type of waste and the processing technologies available. For every 1,000 tons of WEEE recycled per year, 40 jobs are created in collection, transport, storage, pre-processing, processing, measurement and oversight, among other areas (Gray, Jones and Percy, 2004).

At least 12 countries in the region have some kind of legislation on WEEE. Brazil, Chile and Colombia have EPR laws, and these include reduction targets. The rest of the countries are evaluating decrees or bills.

6. Lead batteries

Inappropriate handling of lead battery waste has an impact on the environment and the population, with effects on the neurocognitive development of children and cardiovascular disease in adults (WHO, 2017). The costs attributable to the effects of lead exposure on neurological development in children are estimated at up to 1.2% of global GDP and up to 2% of the GDP of Latin America and the Caribbean in 2011 (Attina and Trasande, 2013).

Legislation on battery handling is heterogeneous in the region. As of September 2019 there were laws regulating batteries in four countries, while in another eight there were decrees, regulations or bills under evaluation. Several countries have incorporated these types of regulations into EPR laws. In 2016, three of the largest vehicle battery importers in Chile signed a clean production agreement, anticipating the targets set under the EPR law, and committed themselves to implementing a collective management system to increase the collection and traceability of this waste.

7. Production linkages in the waste sector

In the context of the circular economy, not only does waste become a resource, but the production sector that manages it can have a pull effect on other sectors of the economy. When input–output matrices are used to compare and analyse the potential of production structures in the waste and recycling sector in Chile, Germany, Japan and the United States, it can be seen that a higher proportion of domestic inputs is used in the production process of that sector than in that of the average sector in each country.[53] In other words, there is a greater degree of direct linkage with domestic industries (see table IV.8). The development of this sector should therefore have a stimulating effect through the direct purchase of inputs.

Table IV.8
United States, Germany, Japan and Chile: intermediate consumption of the waste management and recycling sector as a proportion of the gross value of production
(Percentages)

Intermediate consumption	Waste management and remediation services (United States, 2012)	Wastewater management, waste disposal and recovery of materials (Germany, 2014)	Reuse and recycling (Japan, 2011)	Waste management and recycling (Chile, 2013)
Domestic (average of all sectors)	45 (39)	46 (41)	65 (49)	44 (43)
Imported (average of all sectors)	5 (8)	7 (12)	0.4 (9)	4 (12)

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Bureau of Economic Analysis; National Statistics Center, Portal Site of Official Statistics of Japan (e-Stat) [online] https://www.e-stat.go.jp/en; Federal Statistical Office of Germany; and Central Bank of Chile.

A breakdown of the value added structure between wages, return on capital and production taxes shows that, in general, the share of wages in waste management and recycling is higher than the national average in the countries analysed. An increase in the level of activity in this sector could therefore have direct positive effects on income distribution.

The direct backward and forward linkages of the waste and recycling sector are also above average in all countries, since this sector's purchases and sales are very closely linked to the rest of the national economy.

The indirect effects on other related sectors vary between the countries studied (see table IV.9). In Germany, this sector is key to stimulating production because its purchases and sales have direct and indirect effects greater than the national average. In Chile, on the other hand, the sector can be seen as isolated, since its sales and purchases have few indirect effects. This contrast is an example of the impact the sector could have in the region if it were not isolated and if all the connections associated with the circular economy were established.

[53] To study waste management, the sector taken in the United States is Waste Management and Remediation Services (code 562000 of the North American Industry Classification System (NAICS)) from the 2012 input–output matrix published by the Bureau of Economic Analysis. For Germany, the 2014 matrix published by the Federal Statistical Office is used. This includes the emissions structure sector (pollutants, waste, wastewater) and the waste collection sector (German national accounts codes 85111 and 32111, respectively). In the case of Japan, the reuse and recycling sector (national code 3921) included in the 2011 matrix published by the Japanese statistical office (E-Stat) is studied. Lastly, the matrix published by the Central Bank of Chile in 2013 covers waste management and recycling, the sectors concerned being 3710 (Recycling of metal waste and scrap) and 3720 (Recycling of non-metal waste and scrap) of the International Standard Industrial Classification of All Economic Activities (ISIC). Each country has a national classification that is not necessarily fully comparable with other countries', but which consistently and robustly represents the structure in accordance with the system of national accounts.

Table IV.9
United States, Germany, Japan and Chile: direct and indirect linkages in the waste management and recycling sector

	Waste management and remediation services (United States, 2012)	Wastewater management, waste disposal and recovery of materials (Germany, 2014)	Reuse and recycling (Japan, 2011)	Waste management and recycling (Chile, 2013)
Output multiplier[a] (average of all sectors)	1.84 (2.17)	**1.75** (1.71)	**1.97** (1.94)	1.71 (1.73)
Demand multiplier[b] (average of all sectors)	**2.86** (2.17)	**1.94** (1.71)	1.58 (1.94)	1.37 (1.73)

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Bureau of Economic Analysis; National Statistics Center, Portal Site of Official Statistics of Japan (e-Stat) [online] https://www.e-stat.go.jp/en; Federal Statistical Office of Germany; and Central Bank of Chile.

[a] Indicates the multiple by which the output of the economy increases if the output of a sector increases by one unit (including the direct and indirect effects of purchases associated with the increased output of the sector).

[b] Indicates the multiple by which the output of the economy increases if the sales of a sector in the country increase by one unit (including the direct and indirect effects of sales entering the production chain of the whole economy).

Indeed, if the waste and recycling sector in Latin America and the Caribbean were developed into a key sector and had a municipal waste recycling rate equivalent to that of Germany, it could contribute to the green economic revival: almost 450,000 stable jobs would be created and the region's GDP would increase by 0.35%.[54]

8. Extended producer responsibility laws

One mechanism for strengthening the circular economy are extended producer responsibility (EPR) laws, which extend producer responsibility to the stage following consumption of a product. This means manufacturers and importers taking responsibility for collecting their products at the end of their useful lives and sorting them prior to final processing, ideally recycling. The polluter pays principle is consistent with EPR in that the cost of processing products at the end of their useful lives is transferred from taxpayers and municipalities to producers and ultimately to consumers. Setting an environmental price for a large amount of waste is impractical; therefore, EPR policies give producers an incentive to redesign their products and packaging in order to facilitate management of these at the end of their useful lives (OECD, 2016).

In the countries of the region, EPR has been incorporated as a principle into general waste laws or specific regulations. This is the case in Argentina, Chile, Colombia, Costa Rica, Ecuador, Honduras, Peru and the Plurinational State of Bolivia. In Uruguay, the principle has been implemented for different types of waste by specific regulations, but not explicitly included in any of them. Another example is the Plurinational State of Bolivia, where article 38 of Law No. 755 of 28 October 2015 states that "producers and distributors are responsible for the complete management of their products, up to the post-consumption phase, when they become waste" (Plurinational Legislative Assembly, 2015). In Costa Rica, Law No. 8839 of 2010 states that "producers or importers are responsible for the product throughout its life cycle, including the post-industrial and post-consumption phases" (ECLAC, 2020d).

Responsibility can also be shared by bringing in other actors, such as consumers, waste managers and the State. This would mean involving them in the cost and responsibility of management, given that they can or must to alter aspects of design or production. This logic does not apply to waste requiring special handling, which normally falls under EPR as well.

[54] This calculation was made using the input–output matrices of Germany and selected countries of the region that had an equivalent sectoral classification, apart from the differentials in recycling rates between them.

9. Policies to promote the circular economy

For the circular economy to develop in the region, public policies, regulations, management systems, public finances, investments, funding systems and capacities need to change in all the countries. All stages must be addressed: production, consumption and final disposal of waste.

Since information is scarce, incomplete or outdated and does not provide an overview of waste streams and their potential use, it is first necessary to create a system of monitoring indicators covering the supply of raw materials, repair and reuse, waste generation and management, trade in secondary raw materials in the region and with other countries, the use of recycled materials in products, and civic engagement.

At the same time, the region's waste disposal infrastructure is inadequate, and there are numerous illegal and abandoned dumps, as well as landfills that are used beyond their capacity. Measures have been taken to monitor waste production and develop sophisticated management systems, including focusing on prevention, ending uncontrolled and open dumpsites, monitoring hazardous waste and focusing on recovery and recycling of materials (UNEP, 2015).

Most initiatives in the region are associated with traditional waste management and should take a more comprehensive approach to better address the aspects and sectors involved in the circular economy (see table IV.10). However, there are two initiatives with a broader outlook, namely the Compact for the Circular Economy (Ecuador) and the National Strategy for the Circular Economy (Colombia), which aim to increase the use of resources and the efficiency of production processes.

Table IV.10
Some policies that promote the development of the circular economy

Sustainable production and ecodesign	Consumption	Waste
Create standards for the use of inputs throughout the production cycle (efficiency, compatibility, recyclability and other aspects) that prohibit toxic substances and those that are difficult to reuse.	Make consumers aware of the impact their consumption and waste patterns have on the environment.	Strengthen waste collection and sorting systems.
Strengthen extended producer responsibility.	Introduce ecolabelling systems.	Promote investment in waste management systems.
Foster innovation.	Update consumer laws and encourage the shared use of appliances and products.	Formalize the waste collection sector.
Align fiscal policy with sustainable production and consumption objectives. Social aspects must be taken into account in the price signals given and in the application of the principle that the polluter or user pays.		
Incorporate the circular economy into mainstream academic training and design specializations (ecodesign, environmental and process engineering, social innovation and others).		
Promote regional and subregional partnerships and arrangements, such as common standards and labelling, to increase the scale and impact of actions and improve port and customs controls.		

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Industrial policies are essential for boosting investment in national and regional infrastructure and in industrial inputs that serve the circular economy, such as recycling plants for heavy metals from batteries, hazardous waste confinements whose high cost means that they only make sense if they cover large territories, the manufacture of coatings for controlled landfills, methane capture technologies, and even options such as waste distillation, the use of organic films to handle organic waste, and other cutting-edge technologies applied to the processing of waste materials. Creating or adapting these technologies requires national laboratories capable of creating the components of the relevant production chains, with a regulatory policy that facilitates their implementation and development. At the same time, fiscal incentives and instruments must be designed to provide certainty and allow these new processes to be profitable. Industrial policy must be accompanied by training actions aimed at the country's professionals, local government officials, and grassroots waste pickers and recyclers.

To increase collection, recycling, reuse and remanufacturing rates, it is necessary to promote markets for these types of inputs and ensure that materials are not mixed and contaminated. Part of this work involves achieving traceability and improving information on how municipal, construction and electronic waste, and especially hazardous industrial waste, is produced and managed (EEA, 2016; OECD/ECLAC, 2017).

Circularity means designing and manufacturing products that have longer lives and can be upgraded, repaired, reused, reconditioned or remanufactured. It also means pursuing policies for ecodesign aimed at using minimal resources, harnessing secondary resources and recycling high-quality materials, while combating programmed obsolescence and standardizing design elements, e.g. by producing universal chargers for electrical appliances.

Industrial and inter-firm cooperation policies should be used to help ensure that waste or by-products from one sector become resources for another (pull sectors) and that there is transparency right along the value chain. Awareness of the potential for extracting resources and energy from waste facilitates the development and application of technological options. And to make these new businesses viable, it is necessary to create a regulatory framework that can orient the sector and provide the appropriate incentives, both positive and negative. There are measures which help to promote citizen participation, such as using transparent and comprehensible ecolabelling systems to encourage responsible consumption patterns, facilitating shared consumption by giving preference to services rather than ownership of the products from which they are obtained, or rewarding individual collection at collection centres. Incorporating grassroots waste pickers and recyclers and formalizing the informal economy contributes to decent work. It is essential for the State to take direct action to integrate the requirements of a circular economy and efficient use of raw materials into public procurement.

G. Sustainable recovery in the tourism sector

1. A sector vital to exports, GDP and employment

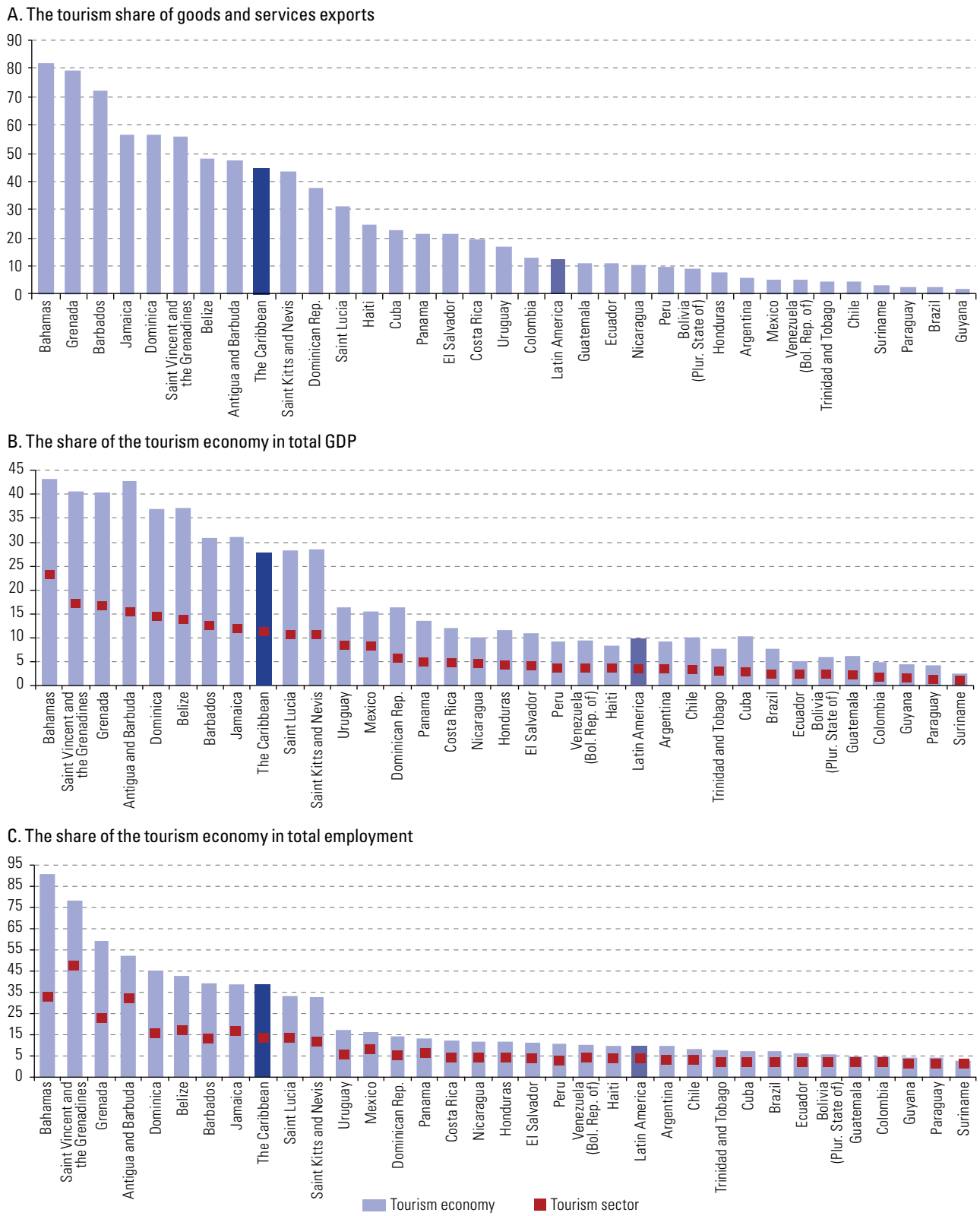
Tourism is an important source of foreign exchange throughout the region. In 2019, it accounted for 42% and 10% of total exports of goods and services in the Caribbean and Latin America, respectively. In some Caribbean countries, its share exceeded 50% (see figure IV.16A). The tourism sector also accounts for a substantial share of GDP: 11% and 4% in the Caribbean and Latin America, respectively, in 2019. Once again, the share was much larger in some Caribbean countries (see figure IV.16B).

Since many non-tourism activities depend on the sector, its real contribution to GDP is much higher. According to the World Travel and Tourism Council (WTTC) tourism satellite accounts, the "tourism economy" in the Caribbean is approximately 2.5 times the size of the tourism sector. This suggests that tourism has many backward linkages to other sectors, such as agriculture, food, beverages, construction, transport and other services. The tourism economy represented 26% of GDP in the Caribbean and 10% of GDP in Latin America in 2019.

Tourism is very labour-intensive. It accounts for 17% of direct employment in the Caribbean and 4% in Latin America; in some countries, such as Antigua and Barbuda, the Bahamas, Saint Lucia and Saint Kitts and Nevis, the share was over 20% in 2019. If indirect employment is taken into account, the weight of the tourism economy was more than double the sector's share of direct employment, particularly in the Caribbean: it accounted for 35% of employment in the Caribbean and 10% of employment in Latin America (see figure IV.16C).

At the same time, tourism drives cities and contributes to local, coastal, rural and remote communities that have specific advantages. It creates employment opportunities for specialists and professionals, and especially for women, migrants, students and older workers. However, in most cases it delivers low-skilled jobs.

Figure IV.16
Latin America and the Caribbean: the tourism share of total exports, GDP and employment, 2019
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Travel and Tourism Council (WTTC), World Bank, World Development Indicators [online database] http://data.worldbank.org/data-catalog/world-development-indicators.

Note: The tourism economy includes both tourism itself and all the sectors that depend on it. The figures for Latin America and the Caribbean are unweighted country averages. The Caribbean includes all member countries of the Caribbean Community (CARICOM) (except Montserrat), Cuba and the Dominican Republic.

The countries of the region are very heterogeneous as regards the relative importance of domestic and inbound tourism. In the Caribbean, most economies are almost entirely dependent on foreign visitors. In contrast, domestic visitors account for almost three quarters of the total in Mexico, while in some South American countries (Brazil, Argentina, Chile and Peru, in descending order) this share is over 50%.

Tourism presents opportunities for women because it provides flexible working hours and part-time employment, although gender gaps and job instability persist. Accommodation and food services account for 9% of female and 4% of male employment in Latin America and 11% and 5%, respectively, in the Caribbean. Although women are the majority of tourism workers in the region, they are also likely to work in low-level or poorly paid jobs (UNWTO/UN-Women, 2019). However, 51% of tourism businesses are run by women in Latin America, while in Nicaragua and Panama the proportion rises to 70% (World Bank, 2017).

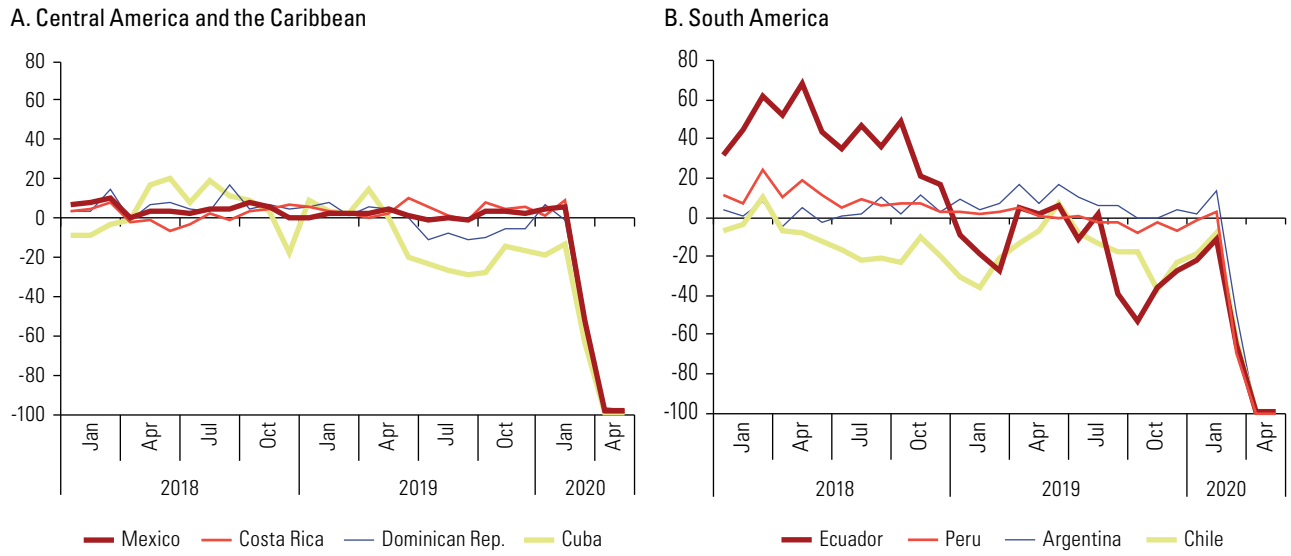
The tourism sector operates in highly segmented markets. On the one hand, large companies and international chains play a very important role in the sector and often function as enclave economies that have few links with local economies, especially when they offer "all-inclusive" services. At the other extreme are the majority of companies, which are MSMEs. As an example, the latter represented 98.7% of tourism-related enterprises in Costa Rica in 2016 and 99.8% in Mexico in 2018 (tourism satellite accounts of Costa Rica 2016 and Mexico 2018) (BCCR, 2018; INEGI, 2019).

2. The impact of the collapse in tourism on exports, GDP and employment

This sector is one of the largest contributors to exports, the economy and employment, not only in the Caribbean but also in many cities and local communities in Latin America. Given the great uncertainty about the duration of the pandemic and the associated contingency and easing measures that will follow, it is difficult to estimate the impact it will have on tourism in the short, medium and long term.

The crisis caused by COVID-19 has led to a large drop in tourism activity worldwide. Globally, international tourist arrivals could be down by between 60% and 80% in 2020 (UNWTO, 2020). Between 2016 and early 2020, tourist arrivals grew by around 10% annually in Latin America and the Caribbean. However, tourist arrivals fell when the pandemic arrived and the borders of a growing number of countries were closed, with a drop of over 50% in March and nearly 100% in April (see figure IV.17).

Figure IV.17
Latin America and the Caribbean (8 countries): year-on-year changes in monthly arrivals of foreign tourists, January 2018 to May 2020
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official figures.

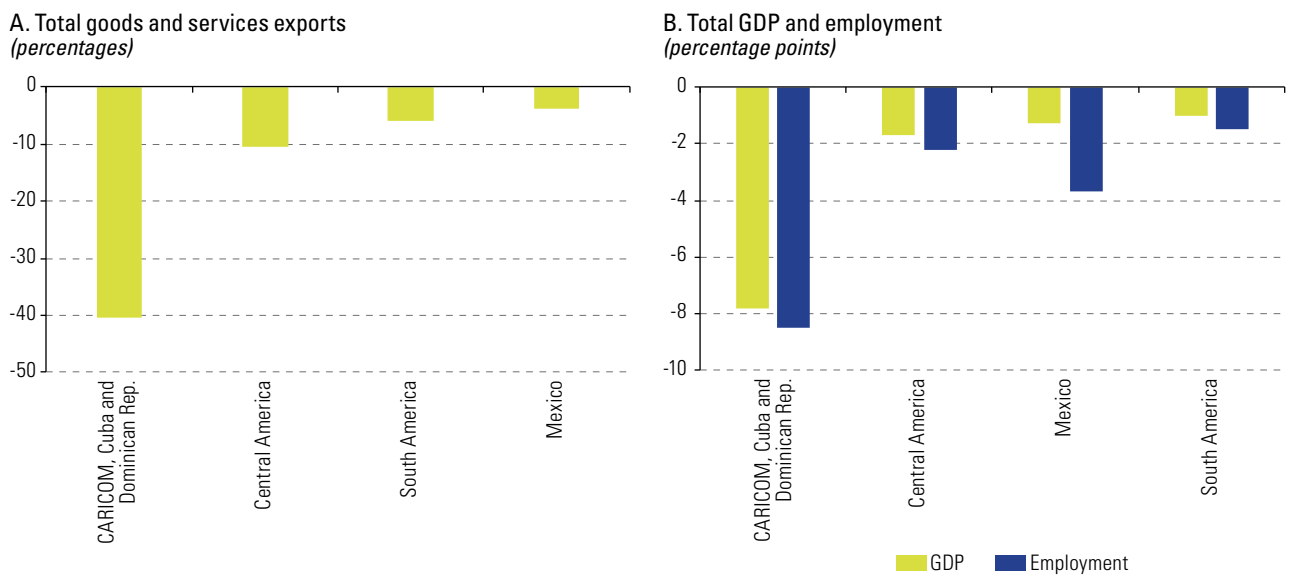
The Caribbean is the subregion that specializes most in tourism: of the 20 small economies that depend most on tourism in the world, 13 are located there. Caribbean tourism, which came to a standstill in April, is almost entirely dependent on visitors from the United States, Canada and Europe, areas that have been badly affected by the pandemic. The cruise industry has been particularly hard hit: as the pandemic spread around the world, the number of passengers dropped to almost zero by mid-March (Panetta, 2020). However, cruises booked over the Internet for 2021 are up 40% compared to 2019 (Panetta, 2020).

Estimates of the impact that the drop in tourism activity will have on overall GDP are surrounded by uncertainty and depend on several factors: how the pandemic progresses, how quickly policies are changed, how resident and visiting tourists behave, and what impact the sustained low level of activity and higher operating costs have on business survival. In addition, recovery will also depend on factors such as the revival of domestic travel before international tourism, since restrictions on the former will be lifted sooner.

ECLAC (2020a) estimated monthly international tourist arrivals from May to December 2020. The estimate assumes that international tourist arrivals will remain at a standstill until September of this year, and that there will then be a recovery over the course of nine months, until a plateau representing 60% of the baseline is reached. With regard to domestic tourism, declines of 50% and 60% were assumed in South America and the rest of the region, respectively. This drop in volume was applied to tourism GDP and exports, and the elasticity of employment to GDP was used to estimate possible job losses in the sector.

On the basis of these assumptions, it was concluded that in 2020 the decline and temporary cessation of tourism would have a strong impact on total exports, GDP and employment in the Caribbean and more moderate effects in the rest of the region. The drop in total goods and services exports could be almost 40% in the Caribbean, 11% in Central America, 6% in South America and 4% in Mexico (see figure IV.18A). Total GDP could fall by 7 percentage points in the Caribbean, while the effect is expected to be smaller in other parts of the region. The crisis will have a negative impact on employment in the sector. Without taking into account the effects of the mitigation measures that governments are implementing to protect businesses and jobs, total employment could fall by 9 percentage points in the Caribbean and by less than 2 percentage points in South America (see figure IV.18B).

Figure IV.18
Latin America and the Caribbean (selected countries and subregions): expected decline in exports, GDP and employment, 2020



Source: Economic Commission for Latin America and the Caribbean (ECLAC), "Recovery measures for the tourism sector in Latin America and the Caribbean present an opportunity to promote sustainability and resilience", *COVID-19 Reports*, Santiago, 2020.

Note: The Caribbean Community (CARICOM) excludes Montserrat; Central America excludes El Salvador and, in figure B, Panama; South America excludes the Bolivarian Republic of Venezuela.

3. Measures to mitigate the impact of the crisis and speed up recovery

Different measures have been taken in the countries of the region to mitigate the economic and social effects of the pandemic on tourism and to prepare the sector for recovery.

Some of these measures are intended to protect worker employment and incomes. In many countries, fiscal packages have been approved to temporarily support the incomes of workers and business owners in the formal sector and in some cases, such as Brazil, in the informal sector throughout the economy. This includes workers in the tourism sector. Measures have been introduced to prevent companies from dismissing workers for a fixed period (Argentina) or to allow employers and employees to reach agreements on reductions in working hours and pay to avoid layoffs (Costa Rica). The Governments of the Bahamas, Belize and Jamaica have introduced temporary unemployment benefits for self-employed workers in all sectors and cash transfers for workers in the tourism sector, most of whom are women. Recovery plans must be based on the principle of decent work for all and include standards covering labour and health rights.

Other measures aim to promote the survival of businesses, in particular MSMEs, throughout the tourism value chain. These measures include: temporary exemptions or extensions for the payment of corporation tax (Saint Kitts and Nevis) (*Saint Kitts & Nevis Observer*, 2020), value added tax (VAT) (Argentina and Colombia) and social security contributions (Chile, Colombia and Peru); reductions in the corporation tax rate; lines of credit (Ecuador) or subsidies (Guatemala) to provide working capital; and partial payment of wages (Bahamas, Brazil, Colombia and Costa Rica).

In addition to immediate support, it is important to prepare MSMEs in the tourism sector for the future, in particular by strengthening digital skills. Booking platforms and social media have reduced barriers to entry and enabled tourism service providers to interact directly with their customers and cut out intermediaries. Digital know-how also encompasses other innovative technologies, such as macrodata, for tracking consumer behaviour and forecasting demand, and artificial intelligence, for designing unique experiences.

Measures have also been taken to facilitate the recovery of the sector in the short term. While destinations may be objectively safe, many risk-averse travellers will avoid exposure to COVID-19 and choose not to travel, or to travel only short distances, so as to avoid flying. Different strategies can be implemented to restore these travellers' confidence. The most urgent is to take preventive measures to minimize the spread of the disease. In several countries, health and tourism ministries, technical standards institutions and the private sector are working together to develop new protocols to minimize the risk of infection. The collapse of international arrivals has highlighted the need for diversification and led several countries to promote domestic tourism to increase their resilience to shocks.

Some of these strategies can be more easily implemented if tourism enterprises operate in public-private clusters, i.e. geographical concentrations of interconnected enterprises, suppliers and other institutions that have a strategic agenda to improve their service and enhance its sophistication. Clustered businesses have advantages when it comes to meeting the immediate challenges of the pandemic and designing recovery programmes. In Colombia, for example, there are 18 tourism clusters in segments such as cultural, nature, business and health tourism.

Another aspect to be taken into account is regional cooperation. Governments in the region should step up collaboration to keep cross-border transport networks as open as possible, taking particular care to facilitate the transit and exchange of transport operators' cruise ship, airline and logistics crews. In addition, they should refrain from measures that restrict traffic in transit, except as necessary to safeguard public health.

Digital solutions that limit physical contact at borders and protect workers' health should be pursued. Some initiatives have been introduced, mainly in the Caribbean Community (CARICOM), to foster cooperation and coordination in order to confront the pandemic and its consequences (Morgan, 2020; CARICOM, 2020). Other subregional cooperation mechanisms, such as the Central American Tourism Integration Secretariat (SITCA), should be strengthened to deal with the pandemic. Other measures that could be coordinated at the regional or subregional level include the following:

- Set up multi-country and multi-stakeholder crisis coordination teams to step up the sharing of information on travel-related health and on other measures to limit the spread of the virus.
- Develop joint guidelines and protocols for restoring travel and tourism that cover physical distancing and hygiene restrictions, the use of protective equipment, and disinfection on board aircraft and within ports and airports.
- Encourage the sharing of good practices between countries to address the crisis, in particular those related to connectivity, coordination, national relief measures and support for the tourism sector.
- Create and implement a post-crisis recovery plan to: enhance national and regional tourism capacity; involve industry stakeholders to increase business and consumer confidence; use digital technologies to explore innovative solutions serving to stimulate the tourism sector; coordinate marketing efforts; improve tourism resilience; and promote sustainable and inclusive tourism.
- Assess the social, economic and environmental impact of cruise ship tourism and set regional standards for the future.

4. Promoting medium-term sustainability and resilience in the sector

The mitigation measures being implemented for the tourism sector in the context of the pandemic could be used to improve the environmental and social sustainability of the sector, which contributes approximately 5% of global GHG emissions. Almost three quarters of the sector's emissions come from transport, followed by accommodation, which accounts for a fifth. Tourism can cause substantial environmental damage. If the necessary measures are taken to make this sector greener, its environmental impact could be significantly reduced (OECD, 2018a). Costa Rica is an example of a country that has developed a strategy to promote ecotourism (see box IV.4).

To function, tourism depends on natural ecosystems such as water, energy, agriculture and the attractiveness of the landscape, but it also contributes to their depletion. It is therefore heavily affected by climate change and natural disasters.[55] Climate change issues and disaster risk management are part of a common agenda for building resilience. In addition to increasing collaboration and integration between sectors and institutions, an approach sensitive to climate and to environmental risk would improve financing and promote investments that made broader contributions to sustainable development. Comprehensive planning processes that consider both issues can be expected to lead to more efficient use of resources, provide far-reaching multisectoral social benefits, have greater sustainability and be more integrated with other sectors (water, energy, transport, public infrastructure, agriculture and planning, among others).

As the pandemic progresses, new disaster risk management challenges will arise. However, emphasis should be placed on the importance of dealing with some persistent threats, in particular physical exposure. Businesses that focus on natural attractions are often close to coasts, volcanoes and rivers. The demand for these activities is expected to continue as trends shift towards natural destinations and social distancing becomes part of the new normal. Disaster risk reduction measures must therefore be strengthened. Zoning plans need to be designed with provision for evacuation and other safety considerations for local inhabitants and tourists. Building codes should consider local hazards and environmental conditions to determine which building methods and materials are appropriate. Where infrastructure is already developed, hotel infrastructure should be adapted to withstand the effects of the most common natural hazards. Protective structures such as dykes should be accompanied by ecological solutions such as mangrove restoration and reforestation of riverbeds.[56]

[55] From 1970 to 2019, 39.5% of the disasters recorded in the world affected Asia and 16.6% Latin America. Within the region, South America was the worst-affected subregion (47.3%), followed by Central America (30.6%) and the Caribbean (22%) (CRED, 2019).

[56] Worthington and Spalding (2018) estimate that there is potential for mangrove restoration across an area of 2,788 km2 in nine Latin American and Caribbean countries, half of it in Mexico. Using data from that country's National Forestry Commission (CONAFOR), it can be estimated that 326 days of unskilled labour alone would be generated per hectare restored (CONAFOR, 2014).

Box IV.4
Costa Rica: ecotourism as an alternative development model

Three million tourists visited Costa Rica in 2018 (ICT, 2018); there were 2.1 million visits to protected wildlife areas, 54% of them by non-residents. Some 64% of the tourists who entered Costa Rica by air from 2016 to 2018 carried out ecotourism activities in 29 natural parks, 19 wildlife refuges and 8 biological reserves (SINAC, 2018).

Ecotourism centres around experiences based on encountering and observing outstanding features of nature and ecological, geological and suchlike processes, which involves activities such as watching birds, observing flora and fauna, visiting volcanoes and national parks, hiking and trail walking (Visit Costa Rica). Since 1985, the Costa Rican Tourism Board (ICT) has highlighted natural beauties in the country brand, and tourism development plans have centred on building an image of the country as a nature destination. There is also a National Sustainable Tourism Plan and differentiated destination management plans.

From 1960 to 1986, before this country brand was created, Costa Rica went through a period of frontal deforestation in which forest cover was reduced from 59.5% to 40.8%. Also during this time, changes occurred in the country's production system, social movements were formed to demand socioenvironmental well-being, and the global environmental movement grew. It was in this context that regulations were enacted to protect and preserve the environment, and from 1986 to 2010 there was a forest recovery that brought wooded cover back up to 51% (Sánchez, 2015). This work received a great boost in the 1970s when 14 protected wilderness areas were established, helping to shift the provision of tourist services away from the central valley. Today, such areas cover about 26% of the country's territory.

This fast-moving effort to position the country as a world leader in ecotourism innovation has been made possible by the convergence of the public, private, non-governmental and academic sectors, as well as a cross-cutting environmental sustainability strategy. Apart from the country's global positioning as a tourism destination, this wide-ranging vision of sustainability has led to pioneering innovations, such as the environmental service payment mechanism and its contributions to the Reducing Emissions from Deforestation and Forest Degradation (REDD) strategy, and the joint management of protected areas in pursuit of community empowerment and the development of ecotourism destinations. There are also environmental sustainability certifications, such as the ICT certificate and the Ecological Blue Flag, awarded to more than 15 different types of organizations and activities dedicated to environmental improvement.

The growth of ecotourism has also produced strains, and challenges are being encountered, particularly with regard to the planning of host communities or tourist destinations. The main challenges are spatial planning, management of protected wilderness areas, waste management, water resource management and marine conservation. Despite this, ecotourism and rural tourism have proved to be triply sustainable local development alternatives (Peralta and Solano, 2009). At their heart is the empowerment of host communities and a new appreciation of natural or cultural assets as the driving force behind tourism.

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Costa Rican Institute of Tourism, *Anuario Estadístico de Turismo 2018,* San José, 2018; "Principales actividades realizadas por los turistas" San José, 2019; Visit Costa Rica [online] https://www.visitcostarica.com/en; L. Peralta and M. Solano, "Turismo rural comunitario como enfoque alternativo de desarrollo", *Revista Centroamericana de Ciencias Sociales*, vol. 6, No. 2, San José, Latin American Faculty of Social Sciences (FLACSO), 2009; A. Sánchez, "Análisis de la cobertura forestal de Costa Rica entre 1960 y 2013", *Ambientico*, No. 253, Heredia, Ambientico Ediciones, 2015; National System of Conservation Areas (SINAC), *Informe anual estadísticas SEMEC 2018: SINAC en números*, San José, 2018.

Tourism can also help to modernize the agricultural sector, lengthen value chains and improve the living and working conditions of local populations. Tourism often has lasting effects on local food, as the availability of products changes because of visitors' expectations and the emergence of new products (OECD, 2018a). Possible actions in this regard include fostering a new or renewed appreciation of local diets and products, seeking to match agricultural cycles and gastronomic offerings, promoting agrotourism, identifying gastronomic tourism niches, strengthening MSMEs in order to improve the quality and availability of local products, and making food producers aware of tourist expectations.

All this work should be coupled with policies to increase linkages with local economies and reduce large chains' strong tendency to import. In other words, the logic of the enclave economy must be overcome.

H. Conclusions

The analyses of industrial organization presented in this chapter highlight some central features of the production structure of Latin American and Caribbean countries.

First, the chapter shows that the countries of the region have advanced to differing degrees with some industries or services that are crucial to the three dimensions of sustainability. While there are sectors where production activities are fully established and growing very strongly, such as non-conventional renewable energy sources and the digital economy, there are others where progress is incipient, such as electromobility, the circular economy and sustainable tourism. For this reason, the corresponding sections stress the need to develop these sectors rapidly in order to take advantage of their potential.

Second, the chapter highlights the importance of accumulated capabilities when it comes to responding to the new conditions arising from technological change and, in the shorter term, from the COVID-19 pandemic. As shown in the analysis of the health-care manufacturing industry, the fastest and most effective responses were those that arose from business capabilities built up over time, in some cases starting in the decades when the import substitution industrialization strategy was dominant. In other cases, such as digitization, capacities likewise crucial to the effectiveness of the response were built up in a shorter time frame, but one also measurable in decades.

Third, the success stories analysed combined business strategies with public policy decisions. Government action, under the name of industrial policy, competitiveness policy or some other term, was essential for the establishment of regulatory and, in many cases, incentive systems that made investment and human and corporate capacity-building processes viable. In industries such as carmaking, current capabilities would be sufficient for effective progress towards new technological patterns, such as electromobility, if they were combined with appropriate public policies, several of which should be adopted not only at the national level, but also at the local or municipal level. In some cases, such as the production of electric vehicles, the scope of action should be extended to the regional level to take advantage of economies of scale and synergies between countries.

Fourth, the capabilities developed in companies, private and public universities and sectoral government agencies —i.e. in the crucial components of national innovation systems— played an important role in knowledge transfer and even innovation, as can be seen in the technological dynamics of low-emissions agriculture and other activities linked to the bioeconomy, one of the areas where most progress has been made in innovation.

Lastly, for the purposes of policy design and implementation, it is important to bear in mind that there are strong interrelations and synergies between the sectors analysed, e.g. between digitization, the move towards non-conventional renewable energy sources and the promotion of electromobility to replace public and private urban transport powered by fossil fuels. The relevant policies should take into account the need to go beyond the traditional sectoral definitions, which have become increasingly vague, to encompass broader production systems, which are strongly determined by their technological dimension.

In summary, the message is clear: cooperation and the creation of synergies between State policies, the strategies of firms in the private or public sector and social and community initiatives must be at the heart of any production development capable of bringing about progressive structural change likely to narrow the external, environmental and social gaps. All this requires enabling strategies and policies to ensure an environment of high output growth, productivity and employment, as well as progress on income distribution and equality, which are discussed in the next chapter.

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CHAPTER

V

Policies for transformative recovery: growth, equality and sustainability

A. Policies for a change of era

The pandemic caused by coronavirus disease (COVID-19) has turned a spotlight on structural problems that the Latin America and the Caribbean region has been facing for decades: sluggish growth, a heterogeneous and poorly diversified production structure, high levels of informality and lack of protection, social inequalities and global asymmetries. It has also highlighted the unsustainability of a development pattern that is based on ever deeper inequalities, increasingly precarious social reproduction, environmental destruction and the weakening of multilateralism and international cooperation. The region is on the cusp of a change of era that will involve uncertain, lengthy, and complex processes of structural change that will revolutionize the technological base and ways of producing, distributing, inhabiting, consuming, accumulating, thinking and living together. Like all epochal changes, setbacks and continuities combine with innovations and ruptures that entail the modification and replacement of power structures and social and political coalitions. At the same time, paradigms, theories and ways of knowing and interpreting reality also change. For all these reasons, the pandemic should not be treated as a parenthesis but as a turning point, a genuine transformative crossroads.

The current change of era is not a repeat of earlier ones. The world is facing far-reaching changes in every domain: technological, social, cultural, economic, political, values, scientific, religious, and ideological. First, there is the speed and intensity of technological change in the biological and molecular spheres, combined with the digital revolution, which affects communication and the interconnectedness of economies and societies. Second, there is a growing understanding that environmental frontiers and constraints are being breached and the destruction of biodiversity and the risk of zoonosis are on the rise. In addition to the need to understand and define the economic domain in new terms, two additional dimensions of the ideal are emerging in the mind of the public: the environmental and the social. It is therefore time to discuss the foundations of a new development pattern —a different welfare and social protection regime, a new global environmental accord and a global governance capable of rising to the challenges facing humanity and the planet.

Following decades of economic orthodoxy, there is a growing recognition of the potential for heterodox policies, based mainly on a number of lessons learned from the rise of emerging economies such as those of East Asia, which was driven largely by non-conventional policy approaches that combined market forces with State leadership. The shift in development style towards one targeting sustainability requires investments with participation by the public and private sectors in terms of both amount and function. Yet the incentives existing in the current structure of returns do not point in that direction; so public policy action is needed to induce and nurture structural change.

This policy approach is needed because, under the current development model, markets do not provide the signals (profitability, incentives, prices) that foster progressive structural change —a change that allows for increased productivity together with social inclusion, equality, and growing environmental sustainability. On the contrary, these signals often tend to amplify inequalities and sacrifice social and environmental issues in favour of a form of economic growth that is based on a culture of privilege and spurious competitiveness. Furthermore, regulations and incentives sometimes serve as barriers or send signals that run counter to sustainable development.

The market also has coordination problems when the viability of a given investment depends on other complementary investments also being made; and no investor will take the risk without being certain of this happening. Moreover, investments that could generate positive externalities in terms of knowledge and capacities, as well as linkages with other investments, either do not materialize or are insufficient because, in the short term, they are less profitable than other alternatives since the externalities cannot be internalized. Hence the proposal for a big push for sustainability which will make it possible to link up policies and coordinate investments, based on social, sectoral and environmental objectives, policies and targets.

In restructuring the economy towards sustainability, many lessons learned in the application of public policies in past decades need to be taken into account. Linking competitiveness with the fostering of equality and environmental protection can generate a better-quality and more dynamic development process, and support alignment with other goals that are essential for achieving environmental objectives. All the foregoing

requires an active State that coordinates, guides, and induces change in production and consumption patterns, while discouraging unsustainable forms of behaviour —a State that represents and brings together a wide range of social stakeholders rather than just minority interest groups.

Facilitating public and private sector experimentation with new technologies and concentrating on the competitive allocation of funds, monitoring and evaluation, systematic learning, joint design of instruments, and co-financing with the private and social sectors are criteria recognized as necessary in industrial policies (Altenburg and Lütkenhorst, 2015). All this means going beyond traditional industrial policy to embark on a strategy for a big push for sustainability.

Because the policies needed for this big push depend on national contexts, and the applicable instruments need to be calibrated to each country's economic and social conditions and institutional capacities, the political process must be able to deal with uncertainty, dilemmas and synergies between targets and outcomes and interactions among stakeholders. In contexts of major uncertainty, marginal institutional modifications are insufficient; instead, it is necessary to "invent and develop institutions which are 'learning systems', that is to say, systems capable of bringing about their own continuing transformation" (Schön, 1973, p. 28).

In this framework, the predominance of the emergency, the current conditions and the tendency for inequality and poverty to become naturalized as unavoidable phenomena make it hard to build a long-term vision. Instead of progressing towards equality and sustainability, growth today is prioritized over a strategy for the future; and spurious competitiveness based on negative externalities affecting the environment and health is increasingly protected.

The region has already tested many policies and instruments; the task now is to turn them into a coherent set, give them a new direction and implement them effectively. The challenge is to harmonize policies aimed at closing the external, social and environmental gaps with a view to forging a new development pattern and fulfilling the 2030 Agenda for Sustainable Development. The basic criteria that should guide this action are as follows:

- Incentives for structural transformation based on promoting dynamic, inclusive sectors with a small environmental footprint for capacity-building, sustainability, production diversification, increased productivity and job creation.
- Social and environmental justice, with a preventive approach that strengthens physical, economic and social resilience.
- Coordinated and consistent action among stakeholders to reduce inequality, prioritizing the protection and improvement of living conditions.
- Protection of the environment and people against environmental degradation, with measures that foster economic recovery with less poverty and inequality.
- Green taxation and financing, and payment for ecosystem services arising from nature-based solutions.
- Consideration of each country's conditions and the social context in which the policies will be implemented, to ensure a fair transition towards delivery of results.

As shown in chapter I, the vision of change that informs this document's proposal is based on the growing evidence of three overlapping crises that necessitate a shift towards sustainability. This shift will only be achieved if public policies are implemented to increase the relative returns on investment in the sectors analysed in chapter IV. Social and sectoral policy targets should contribute to simultaneously closing the three gaps discussed in chapter II because, as shown in chapter III, virtuous policy combinations can be achieved to foster growth, employment, equality and sustainability. While chapter IV described policies to promote seven sectors that are crucial to the three dimensions of sustainability, this chapter sets out the framework conditions and cross-cutting policies that not only underpin these sectoral actions, but also provide in-depth coverage of other areas that are fundamental to achieving sustainable development.

B. Responses to the economic and social emergency generated by the pandemic

A bridge needs to be built between economic recovery in the short term and the structural shift towards sustainability and equality. The recession caused by the COVID-19 pandemic has rekindled the tension between what is urgent and what is important; between a reactivation anchored in the risky sustainability path that prevailed before the pandemic, or, conversely, one based on sectoral and cross-cutting policies that nurture the transition towards a more sustainable and egalitarian form of development.[1]

In its collection series of *COVID-19 Special Reports*, the Economic Commission for Latin America and the Caribbean (ECLAC) has made proposals for mitigating the effects of the pandemic and for response during the recession. These include an emergency basic income, an anti-hunger grant, co-financing of firms' payrolls, investments to universalize broadband internet access and increased investment in health and its infrastructure.[2] However, there are additional bridges between the short- and medium-term approaches that should be included among the public-spending priorities for economic recovery.

Lockdown has highlighted the shortcomings of connectivity and the affordability of digital technologies, the insufficient coverage of basic services such as drinking water and sanitation, financial vulnerability and lack of infrastructure for public transport and active mobility, as well as the need to reduce overcrowding in housing to meet the minimum conditions for implementing quarantine and social-distancing measures. Consequently, and unlike in the global financial crisis of 2008–2009, the inevitable public spending needed to overcome the recession should prioritize works that improve health care, allow lockdown to be lifted safely, or restore nature, because they are job-intensive, low in imported inputs and emissions, relatively low-cost, and compatible with closing the three gaps and contributing to the big push for sustainability.

In that universe, the key issues are Internet access; water and sanitation infrastructure; upgrading of neighbourhoods, homes and buildings; renovation of infrastructure for public transport and active mobility; and emerging employment programmes for the restoration of natural systems. In particular, it is essential to review the financing model for public transport systems that are under pressure from social distancing, and to broaden their financing base. Measures of this type can pave the way to a medium-term approach and a change in the development path.

Along with investment for recovery, there is also an opportunity to move forward in gaining regulatory approval for sectoral production alternatives to replace products that have high carbon emissions and a large environmental and social footprint, stimulate private investment and provide spaces to expand the social and solidarity-based economy,[3] under a rationale of densification and democratization of the production fabric. This package of regulatory measures would make it easier to finance new products by reducing the risk involved in bringing them to market; and it should be complemented by energy-efficiency standards in buildings, production processes and vehicles. These actions are generally low in cost and facilitate the emergence of products and services capable of replacing high-emissions sectors.[4]

Activities in the social and solidarity-based economy, which are often insufficiently visible in national accounts,[5] can provide a major boost to sustainability. Examples include local electric-power generation based

1 As of the time of writing (September 2020), few countries in the region had included green recovery measures in their recovery programmes, and none had made this category the pillar of their recovery policy.

2 See the *COVID-19 Special Reports* published since April 2020.

3 The social and solidarity-based economy includes producers, enablers and consumers, such as cooperatives, consumer associations, fair-trade networks, social banking, "ecoins", agro-ecological projects, self-managed initiatives, rural producer unions, *ejido* unions, and communities.

4 Regulations to allow the circulation of vehicles that have been converted from internal combustion to electricity; the replacement of boilers in industries, buildings and homes; the legal use of natural materials in construction, the tendering of electric transmission lines (which revives investment in the energy sector); the regulation of ride hire services, and domestic geothermal energy to control temperatures are a few examples.

5 Mexico's National Institute of Statistics and Geography (INEGI) has established a good practice, which consists of producing a satellite account of the economy's social sector, to make this sector visible and quantify its contribution to the national economy and its significant potential for expansion.

on renewable energies, local irrigation or health infrastructures, agro-sylvo-pastoral production, agro-ecology, the circular economy, and community or eco-tourism.[6]

Inflexible approaches towards fiscal balance and austerity that could compromise the recovery need to be avoided; and green bonds should be issued for infrastructure development. Tax-related measures that would otherwise be less viable need to be considered, such as the reduction of tax expenditures and environmentally harmful subsidies, the taxation of under-taxed sources (such as capital-market operations or certain types of transactions, or recovering the increase in land values facilitated by public investment). Although these proposals require difficult decisions to be made, they can yield quick results, their capacity demands are low, they are adapted to care and social-distancing needs, and they require few imports.

C. Policies for the medium and long terms

1. Taxation and financing

(a) Diversify and strengthen tax revenues

Changing the development path in Latin America and the Caribbean through an active fiscal policy requires bolstering tax collection and changing the historic situation whereby tax revenues have been insufficient to finance the level of public spending needed for sustainable development. How revenue is collected is just as important as its amount: the tax system must nurture a fairer, more egalitarian and sustainable society and economy, through taxes that redistribute income and wealth while also altering consumption and production patterns.

The region's tax burden is generally light even compared to those of other countries of similar development levels around the world. Nonetheless, there is a wide diversity of tax realities in the region (ECLAC, 2020). In some countries, central government tax revenue is close to or even above the average levels prevailing in the countries of the Organization for Economic Cooperation and Development (OECD) (34.3% of gross domestic product (GDP) in 2018). Examples include Barbados (33.1%), Brazil (33.1%) and Cuba (42.3%). In other countries tax burdens are much lighter: for example, Guatemala (12.1% of GDP), Mexico (16.1%), Panama (14.6%), Paraguay (14.0%) and the Dominican Republic (13.2%).

Whereas taxes levied on the consumption of goods and services, which are fundamentally regressive, generate 50% of total tax revenue in the region, compared to 32% in OECD, revenue from direct taxation is low, particularly in the case of personal income tax. The low yield of this tax diminishes its redistributive power: its revenue reduces the Gini coefficient by just 2.0% compared to 12.5% in the countries of the European Union (ECLAC, 2017a).

Reliance on revenues from taxes levied on the exploitation of non-renewable natural resources slows structural change and reinforces lock-in in economic dynamics. Although oil revenues have declined in recent years owing to the fall in international oil prices, they still represent more than 15% of total revenues in the Bolivarian Republic of Venezuela, Ecuador, Mexico, the Plurinational State of Bolivia, and Trinidad and Tobago (Hanni, Jiménez and Ruelas, 2018). The share of revenue obtained from the mining sector tends to be smaller owing to tax arrangements that aim to encourage investment by multinational firms. Reliance on this type of income makes the fiscal accounts in these countries highly sensitive to exogenous factors (such as variations in prices or in international demand) which limits the scope for maintaining an active countercyclical fiscal policy.

Given the inadequacies of the tax systems to finance development and reduce inequalities, it is essential to establish an agenda of reforms that will underpin the active fiscal policies needed for sustainable development.

[6] Many of the region's countries have had successful experiences in the area of cooperatives and self-management projects to promote technologies for capturing rainwater, building and installing biodigesters based on waste, making compost based on organic garbage, soil retention works, using polyethylene terephthalate (PET) containers for building walls or even houses, as well as garbage containers. There are also good experiences in the use of discarded cactus fibres to produce construction materials, in the reuse of tyres in works to mitigate landslide-risk, and the use of waste to produce paper and organic textiles.

This agenda should end opportunities for tax evasion and avoidance since, in some countries, tax systems collect less than half the amount that theoretically ought to be generated by personal and corporate income taxes.[7] At the same time, another drain on resources arises from illicit financial flows resulting from misinvoicing in international goods trade, which suggests potential abuses of the transfer-pricing rules that lie at the heart of international income taxation (ECLAC, 2020; 2016a). An egregious form of such tax non-compliance is evasion and avoidance perpetrated through tax havens by multinational firms and high-net-worth individuals that sap national revenues (ECLAC, 2017b; Zucman, 2015). It is therefore necessary to strengthen the tax and customs administrations to enable them to perform their inspection tasks more effectively.

To make the tax system more progressive it is essential to consolidate personal and corporate income tax, while reviewing the use of fiscal incentives and tax expenditures and retargeting those that do not serve development objectives (ECLAC/Oxfam, 2019). The scope of capital and property taxes as tools to mobilize resources and reduce inequality also needs to be expanded. As economic activities become increasingly formalized, the scope of social contributions can be expanded to make health-care and pension systems more sustainable.

National authorities should also seek ways to exploit alternative tax bases. Corrective taxes, such as those relating to the environment, which are discussed below, and those related to public health, are important not only for changing behaviour and consumption patterns but also for mobilizing funds. Moreover, as noted in chapter IV, in recent years several of the region's countries have taken steps to tax the digital economy, mainly through indirect taxes. This process needs to be complemented with a new international tax governance for firms that operate digital platforms in one country but file their tax returns in another. The debate on this issue has been gaining traction around the world, but taxes of this type are difficult to implement owing to the business model of the firms in question and the fact that they are concentrated among the world's major economic powers.

In a situation like the present, implementing a heterodox fiscal policy involving deficit spending, low interest rates and a higher ratio of public debt is unavoidable. Within this framework, for highly indebted middle-income economies or those with increasingly burdensome debt services, such as those of the small island developing States of the Caribbean and other countries in the region, it is essential to reduce the burden of foreign debt, since servicing it absorbs a large part of their fiscal income, aggravates the external constraint and impedes progressive structural change. The lack of diversification among the Caribbean economies, the weakness of their public finances and the constant destruction of infrastructure owing to their vulnerability to extreme climate phenomena form a vicious circle that needs to be broken and then transformed. To this end, ECLAC reiterates the need to implement its Debt for Climate Adaptation Swap Initiative.[8]

(b) Expand green financing

Promoting sustainable development requires drawing on public funding sources to mobilize private financing, particularly through multilateral or national development banks, to complement the mobilization of national public resources. In this connection, multilateral development banks need to play a key role in financing the transformation of production; and they should be mandated to channel a percentage of their lending into investments that promote green growth and climate-change resilience. Regional and subregional development banks need to be strengthened and expanded to enable them to serve as a powerful and stable tool with a medium- and long-term focus on the big push for sustainability.

The financial sector is the key to shifting relative returns in favour of sustainable investments, which could be achieved through two approaches (Bárcena and others, 2020). One approach argues that there is a shortage of sufficiently profitable projects that are structured in such a way that the financial system can support them;

7 ECLAC (2020) estimates that the evasion of income tax and value added tax generated a revenue loss of US$ 325 billion in 2018, equivalent to 6.1% of the region's GDP.

8 The debt-relief approach proposed by ECLAC has two dimensions. In countries with high levels of debt owed to official creditors, funds interested in building resilience and adaptation would be prevailed upon to purchase multilateral and bilateral debt at negotiated discount rates. In countries with large debts owed to private creditors, debt buyback or swap mechanisms could be applied. The repayment of Caribbean country debt would be deposited in a climate-change-resilience fund to finance investments in green industries, clearly targeted on adaptation and mitigation projects, according to the countries' own priorities.

in other words, the functioning of the financial system is neutral and its procedures do not have to be adapted to the climate emergency —it is up to project managers to find ways to make them profitable.[9] The other approach holds that the financial system does not account for damages or risks unless they have a market price, nor does it recognize the contributions and risk reduction produced by lower carbon investments. From this standpoint, it is the financial system that must adjust to the reality of climate change. This is the approach advocated in this document.

Developing the approach that leads to improvements in financial sector operations and capacities reveals the possibilities for internalizing climate risk, applying a social price to carbon, using different discount rates, diversifying guarantees for this type of project, and establishing technological or minimum floors and operating techniques for certain types of projects in terms of emissions; and excluding investments with high carbon emissions even if they are profitable. In this way, financiers and the projects could be brought together, and the financial sector would be a protagonist in changing relative profitability.

In this universe, where the leading actors are national and international development banks and multilateral climate funds, the private commercial banks and the bond market must increase their contributions. In contrast to the few private banks that invest their own funds for these purposes and whose lines of financing represent, in most cases, the on-lending of funds obtained from multilateral or national development banks, the issue of green or environmental bonds covers a growing proportion of climate financing in the region (Samaniego and Schneider, 2019).

These bonds are sovereign, corporate or bank-issued fixed-income securities that raise private funds for investment in projects or activities with environmental sustainability objectives. They are structured in a similar way to standard bonds in terms of seniority, rating, compliance with conditions and pricing. As there is no legal definition of what a green bond actually is and it has been left to the issuers to decide whether their bonds meet green environmental criteria, they lack homogeneity and have no globally accepted rating. In the absence of these, a number of general principles and voluntary certification programmes have been established:

- The use of the funds in eligible green project categories, such as renewable energies, energy efficiency (including efficient buildings, solar and wind power, and low-carbon buildings), sustainable waste management, sustainable land use (including sustainable forestry and agriculture), biodiversity conservation, clean transport, sustainable water management and adaptation to climate change.
- Transparent processes of project evaluation and selection, specification of environmental sustainability objectives, monitoring of revenue use and allocation to a specific portfolio, and audit or third-party reporting.

The Climate Bonds Standard (CBS) which involves voluntary certification in line with these principles, enabling investors to examine a bond for its environmental impact and have it certified by a third party is a complementary instrument. The Climate Bonds Standard has both pre-issue and post-issue requirements. Climate bond certification can only be maintained if the standard is met one year after the bond is issued (World Bank/IFC, 2016; ECLAC, 2017c).

(c) Improve environmental risk management in the financial sector

The transition to sustainability entails developing robust environmental- and climate-risk management in the financial system and among central banks, avoiding overexposure to those risks, and encouraging sustainable investments. To this end, it is possible to apply similar criteria to those used for the methodological adaptation of public investments (differentiated discount rate and social cost of pollutants and other damages), with some specific add-ons. One of these is to make climate risk exposure transparent in its three dimensions:

- The risk of losses stemming from the physical effects of climate change, as in the case of investments in the agriculture sector or investments exposed to sea level rise.

[9] According to this approach, small-scale climate funds have been created which, with fiscal resources from developed countries, help to make otherwise unprofitable projects viable. These funds are mainly managed by the World Bank, based on the model established by the Global Environment Facility (GEF).

- The risk that technological change will turn an asset into a liability, such as investment in fleets of internal combustion vehicles and in hydrocarbon assets, which may cease to operate owing to regulatory changes or competition from cleaner alternatives.
- The reputational risks of maintaining certain levels of investment in alternatives that have higher carbon emissions than are acceptable to, or desired by, the management and other investors related to the financial institution.

Although some of these risks (for example the physical ones) can be transferred to the insurance system, provided cover is available, others are harder to transfer, and their behaviour needs to be monitored appropriately. A precautionary measure adopted in the international financial system has been to set green- or climate-finance targets.

Central banks can play an important role by setting reserve requirements for the private banking system and development banks, based on the environmental or carbon footprints of their respective portfolios. This would create a coordination mechanism for change in the financial system, and an incentive for the latter to gradually move away from environmentally unsustainable investments and avoid exposure to the risks in question. The financial system itself has created markers for more sustainable operations in the capital market through special indices and the issuance of environmental bonds, as mentioned above.

2. Internalization of environmental externalities

The shift in relative returns towards investments for sustainability requires the gradual elimination of illegitimate advantages or savings in the production system, which are harmful to nature or health.[10] This can be done by regulating polluting discharges with a view to their minimization or elimination, or by taxing environmental and health hazards. In addition to reducing non-internalized external effects, this would also support the production of sectors that are more supportive of sustainable development. The following paragraphs describe a number of policy instruments that contribute to this objective:

(a) Introduce environmental taxes or increase existing ones

To alter relative returns and change corporate behaviour, and also to gain additional fiscal space, environmental taxes need to be introduced or existing ones increased. The internalization of negative externalities imposes costs on those that generate them: for example, when the cost of polluting is increased or when investments in assets, such as fossil fuels, lose value. These additional costs generate resistance to reform by powerful actors in the economy and in society.

Environmental taxes shift the profitability of production and consumption patterns towards alternatives with a smaller environmental footprint (by sending signals to society) and they increase the efficiency of resource use. Environmental pollution, air-quality deterioration and global warming can be reduced by taxing the consumption of goods such as gasoline, automobiles and the associated services. Furthermore, as noted in chapters III and IV, these measures should be accompanied by investments in renewable energy sources and alternative mobility solutions, such as the modernization and expansion of public transportation, which are socially sustainable and do not generate inequalities or accentuate those that already exist.

Carbon taxes on fossil fuels, for example, are a signal to reduce their use and also have positive revenue effects. To include the costs of the externalities involved and act as a deterrent, they need to be in the range of at least US$ 40 to US$ 100 per ton, although other estimates indicate higher figures (World Bank, 2017). The use of taxation as a tool to internalize and alter the relative profitability of an investment is complementary

[10] The orthodox microeconomics literature views negative externalities as market failures that can be corrected by State intervention. In reality, they are advantages obtained from costs that are avoided by off-loading them onto third parties, enabled by historical and social processes. The counterpart of this tolerance is higher profitability for the economic activities that benefit from it. Key examples include pollutant emissions, the use of toxic or carcinogenic inputs, and the degradation of ecosystems.

to other systems for correcting externalities, such as the regulation of emissions and the mandating of energy-efficiency requirements. Taxes can be accompanied by complementary institutional infrastructures, such as systems of tradable emission permits, which achieve the same objectives but emphasize different aspects. Thus, the levels of taxes needed to achieve environmental objectives may vary, depending on the adoption of complementary regulatory measures, such as the definition of emission standards in industry or the mandatory blending of biofuels in transport, as analysed in chapter III.

The lessons learned from their application in Latin America and the Caribbean show that taxes on carbon and other negative externalities should not be designed as one-off changes, but instead they should rise progressively through time. This would enable them to send a more powerful signal of direction with less political friction. Among other international experiences, the province of Quebec (Canada) and Sweden decided to combine a carbon tax with environmental objectives with a policy of fiscal neutrality; in other words, other taxes were reduced to compensate for the additional environmental tax burden.

One problem with tax systems that tax "bads" (environmental damage, for example) rather than goods (investment, income and consumption) is that their very effectiveness in changing behaviour entails a reduction in the revenue base. Nonetheless, these processes tend to be slow and can be compensated by higher levels of activity in the sectors most compatible with sustainable development, which are being promoted and form a new tax base. Fiscal policy should then earmark the extra revenue obtained temporarily to help new activities take off until they are able to make up for the diminishing revenues obtained as unsustainable sectors decline.

(b) Eliminate perverse subsidies

Another mechanism for changing the relative returns on investment involves gradually eliminating unjustified tax incentives and perverse subsidies, especially inefficient and socially regressive subsidies on fossil fuels, given their magnitude and relevance.

Subsidies on fossil fuel consumption reached US$ 318 billion worldwide in 2012, and production subsidies added another US$ 24 billion per year (IEA, 2019a). This means that, for every dollar invested in renewable technologies, six dollars are spent subsidizing fossil fuels (Dobbs and others, 2011). These subsidies represented between 0.2% and 2.8% of GDP in the region in 2019; and, in the Bolivarian Republic of Venezuela, they ran as high as 16.7%.[11] A fraction of this fiscal expenditure would be sufficient to eliminate extreme poverty and significantly reduce total poverty, as shown in chapter II; or to promote the big push for sustainability, as discussed in chapter III.

Fossil fuel subsidies benefit high- and middle-income sectors and power groups, such as those in energy-intensive industries and their distributors. Thus, they have distorted markets to the detriment of renewable energies and energy efficiency and more sustainable development. Despite the growing conviction that these subsidies are an obstacle to the transition to sustainability (Beaton and others, 2013; Clements and others, 2013), reducing them has proven extremely difficult.

Reducing fossil fuel subsidies depends on complex interactions in society, because vested interests among stakeholders and even in governments unleash multifaceted political economy dynamics. In many countries around the world and in the region that continue to subsidize fossil fuels, arguments are made for this support in terms of equity and competitiveness. To counter this rationale, the elimination of these subsidies should be complemented by compensation for individuals in low-income sectors insofar as they are directly or indirectly affected. Actions should be calibrated according to national and local characteristics and be accompanied by other measures, such as transfers and compensatory allowances, ensuring transparency in the destination of resources. The timing of measures is also important: in particular, compensations should be implemented at the same time as the taxes are applied, to avoid political reactions that render environmentally-friendly policies unviable.

[11] The International Energy Agency (2019a) reports fossil fuel subsidies as a percentage of GDP in some countries of the region: Argentina, 1%; the Bolivarian Republic of Venezuela, 16.7%; Colombia, 0.2%; Ecuador 2.8%, El Salvador, 1.2%; Mexico, 0.3%; the Plurinational State of Bolivia, 1.7%; and Trinidad and Tobago, 2.1%. Based on a different methodology that includes the value of negative externalities, the International Monetary Fund (IMF) estimates the value of fossil fuel subsidies worldwide at US$ 43 trillion, or 6.5% of GDP in 2017 (Coady and others, 2019).

(c) Include sustainability in the evaluation of investment

Another instrument that has been trialled in some of the region's countries to alter relative returns is the use of methodologies for investment evaluation that recognize environmental advantages, particularly in the case of public investment (Bárcena and others, 2020). These include the following:

- The use of lower and differentiated discount rates to benefit projects that have environmental advantages, which tend to have longer maturity periods and yield their social benefits over a lengthier period, thereby enabling them to compete with projects that have a higher rate of return but also larger negative externalities.
- The introduction of a social value for carbon and other environmental and health damages in systems for evaluating public investment.[12] The effect of this, unlike tax measures, is to shift profitability in favour of projects with fewer negative externalities by distributing the differential cost or benefit over the lifetime of the project.
- Specification of individual environmental footprints in the technical specifications for public works executed both directly and indirectly. Unlike the two measures mentioned above, this one does not transform the environmental footprints into monetary values, and it gives the government the opportunity to favour investments with a smaller environmental footprint by including this in the evaluation criteria through a scoring system, for example.
- Amendment of public procurement standards and practices to favour products with a smaller environmental footprint. In the case of green procurement, the usual practice is to list products whose process is considered more desirable; but this can give an advantage to large firms that have the capacity to develop advanced processes and even advocate for their products to be officially listed. In contrast, choosing the smallest environmental footprint gives all types of suppliers the possibility of adjusting their procurement, production and distribution processes to reduce their environmental footprints. This increases the number of suppliers with the capacity to respond to innovative changes that have positive effects on the production profile. This can favour actors in the social sector, as well as other producers who maintain production patterns with a smaller environmental footprint.
- Amendment of procurement standards or practices so that procurement by tender is based on life-cycle approaches (especially in the case of systems, such as transportation) and not exclusively on the cost of equipment purchase. The proposal here is to assess the overall equipment and operating costs (capital expenditure + operational expenditure), and not just the value of the equipment (capital expenditure). This reform is particularly relevant for housing production systems and the transition to electric-powered mobility systems.

(d) Promote regulatory innovation

The internalization of externalities through regulation can shift the relative returns of declining production patterns towards emerging sectors. Accordingly, regulatory frameworks need to be designed that support production in the new activities,[13] a gradual increase in the requirements for domestic components in emerging value chains, tenders that allow producers to gain access to financing, and certainty in the demand for alternative production. The more competitive market mechanisms and private- and social-sector initiatives that can be incorporated into policies, the less incentive there will be to capture rents by abusing market power. This involves innovations such as the following:

- Auction support or subsidies on a best-bid basis.
- Require product labelling that makes carbon, water, environmental and social footprints and other avoidable "bads" more transparent to consumers.

[12] This measure has already been introduced by the Ministry of Social Development and Family of Chile and is also being studied in several Central American countries.

[13] The new activities include, for example, the conversion of internal combustion vehicles reconditioned to run on electricity or hydrogen, the replacement of fossil fuel combustion boilers with electric or hydrogen alternatives, the use of biomaterials in construction, and regulation of the use of recycled materials.

- Allow regional clusters to compete for incentives to promote technologies.
- Experiment with new sustainable technologies within schemes of cost-sharing between the public and private sectors.
- Combine proposals from the private and social sectors for voluntary standards or agreements with performance standards and binding deadlines determined by public policy (UNIDO, 2011a).
- Promote new standards in environmental accounting and management, as is done by the International Organization for Standardization ISO (UNIDO, 2011b).
- Take the most energy-efficient private sector and social sector product as a benchmark for standards, and set deadlines for the rest of the industry to achieve them.[14]
- Apply standards based on voluntary private- and social-sector standards (such as pollutant emission and transfer registers) that become mandatory once producers and consumers have had time to adapt.
- Tighten requirements in terms of efficiency, the taxation of externalities, or the removal of subsidies for products whose consumption it is desired to reduce.

(e) Measuring development and well-being, not just market transactions

Despite its well-known shortcomings and the fact that it is not a good instrument for measuring the shift of the current growth model towards more sustainable development with equality, still less for a change of era, GDP continues to be used as a central measure of progress.[15] Transaction growth is a monotonic metric that does not reflect increased well-being, nor the ecological value of protecting biodiversity, and in which prices subsume all other values.[16]

The use of GDP has two negative implications for the sustainability of development. It does not reflect the state of nature or human health and well-being; nor does it take account of non-market satisfiers, or all forms of work that are important to people's well-being. Moreover, some market operations that may be harmful to well-being, health and nature, can appear with a positive sign in the GDP account. Something similar happens with certain operations to protect against "bads" caused by economic activity itself, such as combating pollution or recovery of the health impaired by the production, commercialization and consumption of toxic, dangerous and polluting substances. Faced with this situation, it is necessary to:

- Adopt a better criterion to measure national and international well-being, such as ecological net national domestic product. Although this indicator shares some of the defects of GDP, it does take account of the depreciation of produced capital and the degradation and depletion of nature.
- Include the contributions of the care economy and all forms of unpaid work whose omission underestimates the economic contribution made by women.
- Discount market-priced activities that decrease well-being but currently have a positive sign, and include measures of inequality and carbon footprint.
- Incorporate the contribution to GDP made by the provision of public goods and services as a value-building process, beyond their recording as public expenditure.
- Introduce the magnitude and evolution of social inequalities as a factor constituting a new metric, not a complementary or additional one.

[14] For example, Japan with its "Top-Runner" programme according to BMU (2008), the Energy Star programme in the United States, or the system for adopting efficiency standards in household appliances in India.

[15] Although the calculations in earlier chapters were made relative to the GDP (inevitable as long as GDP is the central reference metric) this does not diminish the strength of the argument made in this section.

[16] An even more fundamental issue is the use of "price" as synonymous with "value" when producing the national accounts. This is the fundamental reason for the exclusion of clearly valuable and valued activities (and persons), such as domestic care or the provision of free public goods and services which, because they are unpriced, are simply invisible or not quantified in economic terms.

These changes would enable clearer recognition of inequalities and society's relationship with nature; the distinction of goods from "bads"; and support for progress towards measuring comprehensive fulfilment of the 2030 Agenda for Sustainable Development. Although there are experimental national initiatives and international indicators such as the Human Development Index (HDI) published by the United Nations Development Programme (UNDP), progress is needed in developing common definitions. In this connection, it is time for the United Nations, as the world's statistical authority, to establish a methodology and set an effective date for moving from the current metric to a better official criterion, and adapt regular reports to reflect this change. This task would be undertaken in cooperation with other broad-scope statistical offices, such as the Statistical Office of the European Union (Eurostat) and the national statistical offices and institutes of the region, with the coordination of the Statistical Conference of the Americas.

3. Industrial policies for sustainable development

(a) Objectives, instruments and timing

Industrial policies should aim to undertake public investments and support private investments, along with social and solidarity-based ones, in the sectors that drive progressive structural change. The possibility of moving towards inclusive and sustainable economies depends largely on the opportunities associated with disruptive changes in the new technological cycle, in areas such as new advanced manufacturing (sometimes referred to as Industry 4.0), transport and logistics, energy efficiency, digital services and social innovation. The absence of industrial policies in a context of the accelerating fourth industrial revolution and post-globalization will increase the production and technological gaps with the consequent negative effects on the external gap (Cimoli and others, 2017).

The economic impacts of the COVID-19 pandemic have highlighted the need for governments to implement industrial-policy measures. There is no longer any questioning of actions to subsidize or rescue firms, to generate new production capacities, or to work together in the search for novel solutions, without waiting for market forces. The new situation thus opens spaces for mission-oriented policies aimed at industrial transformation and productive resilience.

Unlike competitiveness policies, which promote sectors that are very close to the goods that countries already export and are based on very similar factor and technology endowments, industrial and technology policies should be targeted on building new endogenous capacities. This requires actions that deliberately foster certain production and service sectors and value chains, modifying market signals with a view to altering the economy's specialization pattern. These actions need to be translated into collaborative and competition-based instruments that operate in a coordinated manner, since it is necessary to act on a very broad set of variables in the spheres of multiple sectoral ministries.

As shown in chapter III, industrial policies for financing non-conventional renewable energies, based on the regulation and withdrawal of subsidies to fossil sources, or the taxation of carbon emissions, can generate results that increase GDP, boost employment and improve the trade balance, while reducing emissions in accordance with the commitments assumed by the region in its nationally determined contributions (NDCs). The effects on income distribution and gender equality are also positive when these policies are implemented in the context of a global environmental agreement and a fair environmental transition, and when the fiscal space created by the withdrawal of subsidies or additional tax revenue helps finance social policies. For example, investment in domestic capacities for innovation and the production of capital goods for the renewable energy sectors can play a key role in expanding this type of energy source in total energy consumption, while reducing foreign-exchange constraints and promoting productivity growth.

The transformation of production requires interventions not only in terms of investment policies, foreign trade, science, technology and innovation, training and skill development, and micro-, small and medium-sized enterprises (MSMEs), but also in infrastructure, transport and energy policies, in both urban and rural areas.[17] In the region, policy

[17] Padilla (2017) highlights the importance of rural industrial policy, understood as the implementation of instruments aimed at strengthening production activities in rural areas to achieve structural change through manufacturing and service activities; and to achieve integration and complementarity with more dynamic and knowledge-intensive activities, markets and sectors. These actions should harness the production aptitudes of the localities in question, scale them up and complement them with secondary activities (for example, agribusiness and crafts) and tertiary activities (such as rural tourism, nature-based solutions and professional services). Rural industrial policy is predominantly vertical in nature, benefiting a particular sector or geographic space.

should focus primarily on the seven sectors of the environmental big push analysed in chapter IV: non-conventional renewable energies, electromobility, the digital transformation, the health-care-related manufacturing industries, the bioeconomy, the circular economy and tourism. Given the characteristics of these sectors and their value chains, it is necessary to advance initially in activities that can trigger learning and innovation processes that have greater potential to generate and disseminate technological externalities and make production more resilient.

Implementing these change processes takes time. Creating stable and effective institutions, promoting capacities in the firms and the production fabric and coordinating policies and initiatives among the areas involved (public, private, social, territorial, scientific) are complex tasks that can be tackled in medium-term scenarios. This chronology may not be compatible with the urgent need to solve problems relating to weak growth and external constraints, particularly in the current international context. Industrial policies must therefore combine the medium-term commitment to an economy that builds in greater knowledge, innovation capacity and sustainability, with the implementation of initiatives to support leveraging of the potential of certain production chains, services and technological platforms in the short run.

(b) The indispensable development of MSMEs

Formal micro, small and medium-sized enterprises, both private firms and those in the social sector, are major job-creators, but they face serious problems of productivity and competitiveness.[18] Although more than 40% of these firms (the vast majority of which are microenterprises) are concentrated in commerce, they also generate 49% of formal employment in manufacturing industry (Dini and Stumpo, 2019). Therefore, a large proportion of MSMEs need to be supported through industrial policies focused on innovation, dissemination of new knowledge and production linkaging, by integrating them into value chains, consolidating partnering networks and strengthening clusters.

These policies should form part of general industrial development strategies, which, in turn, should incorporate measures consistent with the needs of private and social sector MSMEs, through:

- Competition policies that punish abuses of dominant position in supplier relationships, access to distribution channels, digital platforms and basic inputs (water rights and concessions for the use of natural resources, among others).
- Plans and programmes for innovation and human-resource training that take their specific requirements into account.
- Scalable and reproducible tools and programmes to flatten learning curves and modernize a significant percentage of MSMEs.
- Sufficient access to public and private financing under adequate conditions.
- Public procurement policies that prioritize procurement sourced from MSMEs.

In their implementation, these policies must overcome operational failures that would compromise their effectiveness. This requires clear targets, solid institutions and a selective approach to priority chains and territories. Setting clear and measurable goals should guide the strategies of support institutions and ensure convergence in their training, innovation, export, management and financing policies. This requires an entity in charge with adequate human and financial resources and a clear political mandate. Horizontal approaches (which do not discriminate by agent, sector or territory and which have predominated in policy formulation thus far) should focus on general-interest enabling measures and be supplemented by specific measures to build capacities in priority production chains and territories.

Lastly, the governance of these policies needs to have a local dimension and, at the same time, guarantee a space for regional action. The local dimension relates to the need for strategies and support measures to take into account the territorial specifics of production systems, to be based on flexibly designed development initiatives which nurture management capacities in the localities concerned. On the other hand, the scale

[18] As many as 99.5% of the firms in the region are MSMEs; they generate 61% of employment, but only 24.6% of production.

of many challenges related to the transformation of the region's production systems requires coordinated action among the countries to formulate a cooperation agenda that recognizes the importance and potential of MSMEs, speeds up the dissemination of good practices, generates joint actions for the development of initiatives that require major investments (for example, specialized centres for technology development and transfer), and facilitates regional integration.

(c) Correcting implementation failures[19]

The experiences of Latin American and Caribbean countries highlight the progress and shortcomings of industrial policies in the region. Despite the changes in policy approaches and the fact that, as discussed in chapter II, the region's countries are not tending towards closing the three gaps, they have, nonetheless, made progress in the following aspects of industrial policy:

- An appropriate policymaking process involving all stakeholders is more effective than trying to copy best practices from developed countries and regions.
- Policy formulation and implementation are learning processes. There are no predetermined paths; experimentation and trial-and-error processes are at the heart of effective dynamics.
- Policies and programmes should have a small set of explicit, measurable objectives (quantitative goals).
- The learning period is much longer than most policies envisage, and certainly longer than a government's four-to-six year term of office.
- A policy is only real if its implementation is backed by financial and human resources. Economic actors interpret the lack or inadequacy of financial commitments as a sign that policy actions are merely public relations; so they do not collaborate in those initiatives.

Despite these conceptual advances, some of the usual problems that bedevil the implementation of industrial development policies persist:

- The failure to rank objectives, which are presented as list of priorities without clear trade-offs between them, which hinders policy implementation.
- The weakness of the institutions responsible for implementation and their separation from the entities that formulate the plans result in a dilution of responsibilities.
- Evaluation of policy impacts is not a common practice and, when it is done, its recommendations are seldom used to reformulate policy design and management.

In conclusion, industrial policies work best when they have clear priorities, engage in constructive public-private-social sector dialogues, and mobilize coordinated packages of investments in sectors such as those analysed in chapter IV. Given that institutions co-evolve with the challenges they face and the policies they implement, weak institutional capacities should not be an excuse for weak State action. Institutional strengthening needs to form part of the industrial policy itself because it is essential for policy implementation.

4. A new welfare and social protection regime

Social policies should not be envisaged as compensatory mechanisms. The main objective of social policy is to achieve the greatest possible well-being among individuals and communities, along with its respective benefits in terms of productivity, capabilities and resilience. The development of a rights-based welfare state is the great pending task facing the region's countries. In Latin America and the Caribbean, central-government social spending increased in 2000–2018 from 8.5% to 11.3% of GDP (ECLAC, 2019b), but it still lags far behind social spending in OECD countries, both relatively and in absolute terms. Along with other factors,

[19] This subsection is based on the analyses and conclusions reported in Peres and Primi (2019).

this means that welfare regimes in the region are insufficiently redistributive, and that very high levels of inequality persist. The Gini coefficient after taxes and transfers is only 4% lower than the labour market Gini coefficient.[20] By comparison, in the most universalist welfare regimes, such as those of the Nordic countries, the post-tax-and-transfer Gini coefficient is 32% lower than the market coefficient (Filgueira and Rossel, 2017).

(a) Combat the normalization of inequality and the culture of privilege

In a context of poverty and short-term perspectives, it is difficult to gain the space needed to internalize the costs of spurious behaviours or negative externalities by adopting measures that reduce competitiveness in the short term (Giglio and others, 2020). Poverty and inequality should not be accepted fatalistically as immutable realities. On the contrary, as shown in chapter II, a correct combination of industrial, social and fiscal policies would make it possible to significantly reduce inequality and achieve poverty-free societies over the course of a decade. In short, the idea that inequality and poverty, and the culture of privilege that sustains them, are normal phenomena needs to be resisted.

A non-negotiable stance against inequality and poverty is essential for making government measures more redistributive, particularly with regard to public finances, while supporting a shift towards more inclusive structural change. This also implies reporting on inequality in society, both before and after fiscal effects, and denouncing the negative distributive effects of tax privileges, the orientation of investment and, particularly public spending. It also means combating all forms of discrimination, especially those based on gender or ethno-racial status, in order to move from a culture of privilege to one of equality and efficiency.

(b) Universalize social protection

To strengthen, renew and expand the welfare state and ease the transition towards a new development pattern, universal social policies are needed that are based on rights rather than on participation in formal employment; and labour rights must be upheld. This is because the goal is to change the economic and social structure through affirmative actions in favour of individuals and groups that suffer various types of inequality, discrimination and exclusion, as proposed in the Regional Agenda for Inclusive Social Development adopted at the third session of the Regional Conference on Social Development in Latin America and the Caribbean, held in October 2019 (ECLAC, 2019c).

An important means of universalization consists in extending the payment of direct cash transfers to the population, especially in the extreme phases of the life cycle (early childhood and old age), and to move towards providing a universal basic income as an additional pillar of the welfare regime and the social protection system, in keeping with the characteristics of each country. As early as 2010, in *Time for Equality: Closing Gaps, Opening Trails,* ECLAC proposed moving towards a system of redistributive citizen income transfers that would help reduce inequality and the infantilization of poverty, protect against unemployment, increase people's autonomy and address precariousness in old age. Moreover, *The Inefficiency of Inequality* (ECLAC, 2018a) proposed the gradual, progressive and long-term implementation of a basic citizen income, understood as a universal monetary transfer that is unconditional and regular over time, and which complements and strengthen social protection systems.

The crisis unleashed by the COVID-19 pandemic underscores the importance of ensuring social security for all and guaranteeing both access to, and the quality of, public services such as digital connectivity, drinking water, transportation, air quality and health. Universal social protection must redistribute and ensure universal access to education and health care, and guarantee incomes for those who lose their jobs in the process of the green or digital transition. It can also have a multiplier effect in terms of increasing aggregate demand. It also helps to address the impacts of disasters, before, during and after their occurrence, in which the poorest and most vulnerable populations are the worst affected. Welfare regimes and social protection systems need

[20] This figure complements the data presented in the section on taxation, which compares the effect of regressive indirect taxes and progressive direct taxes on redistribution through the tax structure. The figure considered in this paragraph measures the impact of taxes and spending on the Gini coefficient; spending consisting mainly of pensions and transfers.

to be adapted to the challenge posed by the intensification of human mobility (regular and irregular migrations, displaced persons, refugees and asylum-seekers) and the need to build a social protection framework that is consistent with this reality from the human-rights and human-security perspective. Universal access, non-discrimination by migratory status, and the portability of rights are among the crucial dimensions to be resolved.

The pension system is a central component of social protection. In past decades, it underwent parametric or structural reforms that now reveal its shortcomings and fragilities. In general, contributory pensions still have limited coverage and low replacement rates and, consequently, the amounts they pay are insufficient to provide the social recognition and economic security which they were originally designed to guarantee. Pension systems are also one of the key sources of social concern and conflict in several of the region's countries. The right to a pension is not guaranteed by the system of individual capitalization accounts that most nations in the region have chosen. The increase in pensions financed from (non-contributory) general taxes has been important and significant; but this alone cannot resolve the weaknesses and shortcomings of the contributory system.

There have been various pension reform initiatives in the region, ranging from a reversal of the system of individual accounts, through the formation of mixed systems, to parametric modifications to the individual-account system. These initiatives testify to an unresolved problem and, therefore, the need to re-examine pension systems, comprehensively and structurally, with the aim of guaranteeing a dignified old age by adopting the policy measures needed to ensure their sustainability.

(c) Provide social protection against disasters and climate change

Social protection policies increase the population's resilience to disasters associated with natural phenomena, especially hydrometeorological, climatological and health-biological ones; and they should be included in climate-change mitigation and adaptation and disaster-risk management strategies.

In addition to hindering growth, inequality and social exclusion hinder environmental stewardship, and they compound the adverse effects of disasters. For example, poverty, informality, precarious conditions and shortages have impeded strict compliance with lockdown and physical distancing recommendations, which are essential for slowing the spread of the pandemic. By contrast, as has been shown during the pandemic, social protection policies against disaster risk can prevent economic setbacks by meeting basic needs and sustaining the consumption of households that are unable to generate income. They also facilitate the implementation of climate change adaptation and mitigation actions and safeguard the well-being of population groups, especially those in most vulnerable or precarious conditions. An example of this would be to support relocation planning and improve access to housing and water, fostering the restructuring of production through labour market inclusion and formalization programmes, and promoting access to education and health services. In addition, the negative impacts and livelihood loss that follow in the wake of extreme events could be mitigated through income transfers delivered in a predictable manner or through microcredits to make it possible to replace productive assets that have been lost.

All these actions are essential to support sectors that suffer from what ECLAC has referred to as a dual asymmetry, since the populations in question contribute minimally to global warming while suffering severe damage from the cumulative effect of emissions from more developed nations and higher-income sectors in their own countries.

(d) Universalize, improve quality and de-commercialize access to health care and education

The pandemic has further highlighted the shortcomings and inequalities that pervade the population's exercise of the right to health. The construction of a health system that guarantees this right is, without doubt, one of the most urgent tasks. To this end, it is essential to eliminate the barriers to universal access to health, with actions including the following:

- Reposition public health as a human right and a public good (as understood in the domain of international cooperation and the human rights system), de-commercialize access, resolve its fragmentation and stratification, and move towards integrated, public and universal systems.
- Raise public spending on health to at least 6% of GDP and keep it at that level, in other words, nearly double the 3.7% of GDP recorded in 2015 (ECLAC/PAHO, 2020). This level of financing would make it possible to reduce inequities and provide the services in a framework of universal access and coverage, sufficiency, quality, equity, efficiency and sustainability.
- Shift the inefficient care model currently prevailing in Latin America and the Caribbean (centred on hospitals, curative care and medical specialization) towards a policy based on primary health care, by strengthening the primary care level and the link with the social protection system (PAHO, 2019).

As is true of health, quality education increases a person's ability to contribute to the production process, because, by aiding cognitive development and learning capacity, as well as the ability to learn and to acquire new skills, it has a positive impact on productivity (ECLAC, 2018a). In terms of guaranteeing the right to education, the following are proposed:

- Guarantee access to quality services and reduce exclusion and segmentation in the education system in the various dimensions of the inequality matrix (ECLAC, 2016b; Mercadante, 2019).
- Improve investment in early childhood education, since this lays the foundation for a person's future development.
- Ensure that all young people complete secondary education at least, which is considered the minimum level of schooling to be able to enter the labour market productively (currently, only 60% of those aged 20–29 in the region achieve this).
- Close gender gaps, by fostering greater participation by women in scientific disciplines and, in particular, physics and mathematics. It is crucial to eliminate gender inequalities and to promote a system of mathematics and science education that stimulates women's engagement in technological disciplines (ECLAC, 2017b and 2019c; Mercadante, 2019; Seville, 2017).
- Invest in the development of basic cognitive skills (reading, writing and mathematics) and complex skills (critical thinking, problem solving, innovation), learning to learn and learning to unlearn, enhancing ability to solve information management problems (such as searching, evaluating, synthesizing, analysing and representing information in the digital environment) and sharing and collaborating with others in the new work and socio-emotional environments (collaboration and bonding with others, open mind, emotions management and goal achievement).
- Adequately combine scientific and technical education with knowledge of the humanities and history, an appreciation of democracy and the responsibilities of life in society, the dissemination of philosophy, development of the arts and the promotion of artistic production aimed at a comprehensive, humanistic and emancipatory education that results in more informed, free and autonomous generations.
- Adjust curricula to promote environmental and digital skills for sustainable development. This means supporting education, vocational re-skilling and retraining of workers to enable them to be successful in the new jobs.

(e) Promote a comprehensive, public and defeminized care system

Substantive gender equality is a cross-cutting issue in all policies and initiatives that pursue development with equality. Care work, which is performed above all by women, is essential to all activities in any society. As discussed previously, when this work is done in the home, it is invisible to economic indicators. Counting the time invested in care work and recognizing its value at market prices would make it possible to measure both its direct contribution to economic growth and the importance of these tasks —as is being done in several countries that maintain satellite accounts, which report figures of between 18% and 23% of GDP.

Along with its positive effects on economic growth and in reducing inequality, the care economy can be compatible with greater sustainability, while being labour-intensive and low in imports. It therefore contributes to closing all three gaps. Investing in the care economy contributes to diversification of the production structure without transgressing the ecological frontiers for the reproduction of life, which in turn alleviates the pressure on the natural heritage and ensures the sustainability of life (ECLAC 2019a). The demographic transition requires development and formalization of the care economy, with its relatively low environmental footprint, since it is fundamentally about offering highly inclusive and dynamic services in response to growing demand. It is a matter of moving towards a defeminized public care system while guaranteeing labour rights and decent work to all persons involved in the care economy.

The COVID-19 health crisis has highlighted the unjust social organization of care activities in the region, where they are treated as an externality rather than a component of development. Responses to care needs must be viewed from a gender perspective since it is women who, whether paid or unpaid, bear the heaviest care burden, which generates a huge social subsidy that is not recognized by the national accounts.

The health crisis —like population ageing— demands that the care economy be viewed as a crucial component of a welfare state in the region. Expanding and formalizing the care economy and linking it to production development policies would consolidate it as a development engine for which the region offers favourable conditions. Caring for children means safeguarding the future; caring for older adults means protecting legacy; caring for the planet is indispensable. Care thus becomes a universal public good, and the role played by women in these tasks must be recognized and revalued.

(f) Foster a culture of substantive equality and sustainability

Fostering a culture of substantive equality, non-discrimination and sustainability entails developing active policies that value the implementation of new lifestyles —ranging from the individual to society as a whole (education policies, green and digital skills, communication campaigns and dissemination through social networks). The 2030 Agenda for Sustainable Development sets targets for social, territorial, and gender equality; and it aims to end poverty everywhere and in all its forms. These goals and targets need to be made highly visible; they must also have a deadline for national and subnational fulfilment, and monitoring and dissemination. This cultural change also requires information and documentation of processes and experiences, as well as adequate public policies and material conditions, in order to adapt lifestyles to the challenges of more sustainable development and to mainstream environmental sustainability into all public actions. Increasing societal knowledge and participation means that decisions need to take due account of the most vulnerable groups or those living in the most precarious situations, eliminate social and environmental inequalities, and ensure a safe and auspicious environment for those on the front line of environmental protection.[21]

Achieving these targets would narrow the three gaps discussed in chapter II and reduce the work to be done in the external sector and on the environmental frontier. Replacing the development model with one that is both dynamic and economically, socially, and environmentally sustainable requires a population endowed with a greater understanding of the social and environmental footprints of the current development style, and of the implications of major investment decisions, and their effects on climate change and biodiversity (see box 1). As noted above, epochal shifts entail transformations in thinking, values, and social subjectivity. This cannot happen without spaces for participation and the material conditions and incentives to underpin changes in lifestyles, resources, knowledge and willingness to change.

[21] Article 9 of the Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean (the Escazú Agreement) addresses the situation of human rights defenders in environmental matters, paying attention to prevention, guaranteeing their security and investigating attacks against them, so that they can carry out their work without fear or reprisals (ECLAC, 2018b). Coincidentally, at its fortieth session, the United Nations Human Rights Council adopted a resolution recognizing the contribution of environmental human rights defenders to the enjoyment of human rights, environmental protection and sustainable development (A/HRC/40/L.22/Rev.1) (United Nations, 2019).

Box 1

The Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean (Escazú Agreement): a Latin American and Caribbean compact for sustainable development

Human well-being is intrinsically linked to the constitution of peaceful, fair, inclusive and sustainable societies. A new welfare regime with these characteristics is built through the deepening of democracy, full respect for human rights, and participation by all in sociopolitical compacts for sustainability. Improving the economic system requires eradicating negative externalities and asymmetries of information and power among stakeholders, together with the implementation of transparent public policies and decisionmaker accountability. Strengthening the rule of law, including a justice system that ensures that everyone can exercise their rights, is an inherent element of sustainable development.

In the Rio Declaration on Environment and Development (1992), the world recognized that providing people with access to information, involving them in decision-making processes and giving them access to justice was the best way to address environmental issues. Nearly 30 years on, and in the midst of the COVID-19 pandemic, the relationship between human beings and their environment is becoming even more evident, as is the link between the human rights to life and to a healthy environment, which are recognized in national constitutions. Climate change shows that it is impossible to guarantee human rights and ensure future well-being by maintaining a business-as-usual approach. Growth cannot be obtained at the expense of the environment and people's well-being.

The changes needed can be achieved only through cooperation and multilateralism, which is the best route to address common problems and seek joint solutions. In a time of convulsion and major transformations, Latin America and the Caribbean has shown that such a path is possible. The Escazú Agreement, a regional accord on access to information, public participation and justice in environmental matters and the first environmental treaty to be signed in the region, shows the benefits of transparent and participatory regional endeavour, in both its negotiation and its content, as well as the benefits of collaboration among multiple social stakeholders: individuals, communities, firms and governments. By addressing fundamental rights and emphasizing democratic principles that are essential for achieving sustainable development, the region has an instrument for pursuing people-centred and nature-based solutions (United Nations, 2020) and for taking a further step towards making equality, economic growth, and sustainable development a reality for all.

Source: Economic Commission for Latin America and the Caribbean (ECLAC), "Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean" [online] https://www.cepal.org/en/escazuagreement; United Nations, *Policy Brief: The Impact of COVID-19 on Latin America and the Caribbean*, New York, 2020.

5. From the strengthening of regional integration to a renewed multilateralism

(a) The regional space for policy harmonization

The coordination and harmonization of policies in the regional space benefits national action by making it possible to learn about and evaluate good practices and innovative policies. This can expedite the transition towards sustainability in a framework of international cooperation, and avoid competition between sectoral investments that is based on exploiting advantages that are harmful to the environment, health or labour conditions (such as regulatory backsliding). It thus provides greater legitimacy and viability to delicate or conflictive measures, such as changes in fiscal and regulatory policy, while protecting the sustainability of development. Regional action also strengthens the values of global multilateralism that recognize the asymmetries existing between the developed and the developing countries, in order to strengthen international cooperation based on the principle of common but differentiated responsibilities.

Regional coordination would make it possible to achieve the scales of production and demand necessary to sustain virtuous linkages between consumption and production patterns in the region.[22] Procedural harmonization covers the acts of licensing and application of economic policy instruments (taxes, subsidies, mechanisms for evaluating public procurement and investments) and regulations. In this field, at the minimum, harmonization is needed in:

- Tax policy for transnational firms and digital platforms.
- Licensing; for example, in environmental impact assessment of coastlines to anticipate sea level rise and link it with foreign investment in tourism and infrastructure.
- Taxation of carbon and other polluting emissions.
- Energy-efficiency requirements for buildings, and vehicle and appliance efficiency and interoperability, so that the region has incentives at appropriate scales for investment in more sustainable production processes, with smaller environmental footprints, lower life cycle emissions and more resilient infrastructure.

Altering the relative returns on investment is more feasible if it is done at the regional level. Processes such as those mentioned above require regional institutional strengthening for the exchange of information and experiences, along with shared or comparable methodologies for evaluating impacts, and mechanisms for periodically reviewing agreements.

At the same time, the region is facing the challenge of agreeing on methodological and practical definitions that are important for sustainable development. This point has already been made in the framework of national policies; however, to ensure comparability, interoperability of systems and products, investment and reporting, these definitions need to be agreed upon and shared regionwide. To reach agreement on measurement and reporting methodologies, and on shared definitions (for example on issues such as green, or net sustainable, grey or polluting investments; net sustainable financing; and net sustainable public finance; pollution levels of different types of vehicles; levels of risk) it is necessary to create specific working groups with defined timelines and products. Today such entities operate only to limited extent among the governments of the region.

It is also necessary to gradually align the sustainability of the financial sector operating in the region with the priorities and methodologies for assessing investment and sustainability risk (shared definitions, reduction of environmental impact, increased positive social impact). It is important to promote joint investments in the region to develop appropriate production scales and distribution of benefits across the region in industries that support the big push. Steps should be taken to ensure that the benefits of aggregate demand of many countries can be shared by all, even though, in some activities, only a few producers would be able to operate on an efficient scale.

(b) International trade in a more sustainable world

The content of the most modern trade agreements increasingly recognizes the links that exist between environmental problems, international trade and foreign direct investment. Nonetheless, the rationale of most trade agreements remains at odds with the type of actions and instruments that are needed to address climate change and other environmental pressures with the requisite vigour and celerity. Progress must be made in implementing the climate change provisions in trade agreements, which, despite their greater dissemination thanks to the 2030 Agenda and the Paris Agreement, are still expressed only in terms of "best efforts".

It is significant that hardly any current trade agreement (multilateral, regional or bilateral) explicitly mentions the Paris Agreement. Nor does the Paris Agreement refer to trade, despite the latter's importance for climate change mitigation. Thus, greater consistency is needed between these two international regimes that address closely linked issues, but which have functioned in silos. Otherwise, there is a risk in the coming years that

[22] For example, for the development of the electric vehicle industry, value chains for renewable energies, digital technologies for the control of public utilities, and the production of large-scale ecosystem services, among others, as analysed in chapter IV.

disputes may be brought before the World Trade Organization (WTO) over measures to meet commitments under the Paris Agreement or to compensate producers for the cost of doing so. Although trade measures are scarce in the nationally determined contributions (NDCs) under the Paris Agreement, it is expected that the link with trade will become more prominent during the five-yearly update of NDCs following their first global stocktake. This could heighten the risk of conflict with WTO rules.

In this context, the proposal to establish a "climate waiver" that would exempt certain measures taken by governments to address climate change from being challenged at WTO should be negotiated regionally. While the original formulation of this proposal (Bacchus, 2017) refers specifically to carbon adjustments at the border, a future climate waiver could be extended to other measures, such as programmes to support renewable energies. Similarly, members of WTO and other trade agreements should consider reintroducing rules that make programmes to support adaptation to the new environmental requirements immune from legal challenge, as they existed until 1999; and they should be designed so as to prevent them from being abused for protectionist purposes (resulting from regulatory capture). Moreover, a future agreement, in WTO and in other trade agreements, to restrict harmful fishing subsidies would both contribute to the conservation of the oceans and their resources, and facilitate fulfilment the Paris Agreement NDCs.

A WTO climate waiver in the framework of North-South discussions would facilitate the implementation of environmental industrial policy within the margins allowed by trade agreements, such as fiscal stimuli and other forms of pro-sustainability support for industry, in the context of a growing "green" international trade in which the region is falling behind. The renewable energy promotion programmes of several countries, both developed and developing, have been argued to breach WTO agreements because they include local content requirements that can promote local production capabilities and create coalitions to drive policies addressing climate change. An environmental waiver would avoid disputes over the legality of applying carbon tariffs at the border (to discourage carbon leakage[23]), subject to strict conditions aimed at preventing protectionist abuses.

Many trade and investment agreements signed by the region's countries include an investor-State dispute settlement mechanism that allows multinational firms to seek recourse in ad hoc international tribunals if environmental regulatory measures in their host countries affect their profits or, in some cases, merely their expectations thereof. In post-2000 free trade agreements, this risk to the regulatory autonomy of States in environmental matters has been diminished to some extent by including reservations for environmental policies. Nonetheless, it is important to move towards new models for resolving investment disputes that better protect the right of States to regulate in the public interest, including the protection of the environment and health.

In this area, in January 2020, the European Commission reported that, as part of the European Green Deal, it is designing a carbon border adjustment mechanism for imports from countries that do not tax carbon or where the tax rate is lower than that of the importing country.[24] This initiative, which would support efforts to make the European Union carbon-neutral by 2050 (Khan, 2020), could give rise to environmental disputes in WTO.

(c) New global agreements for international governance

In the multilateral domain, a key issue is the financing for development agenda, which is pursuing a reform to achieve a better global financial architecture that channels resources committed to development cooperation —the commitment of 0.7% of GDP which very few countries fulfil, as well as the funds committed to ensure the proper functioning of the Paris Agreement. Intellectual property rights need to be made more flexible in some sectors, such as pharmaceuticals and digital and environmental technologies, the importance of which has been highlighted by the health emergency and the shift towards more sustainable production with a smaller environmental footprint.

[23] Carbon leakage consists of the migration of high-carbon output and exports that reduce the carbon footprint of the country of origin of the corresponding investments. A virtual carbon border tariff would avoid the carbon implicit in consumption.

[24] In 2009, draft laws were introduced in the United States and France that made it possible to impose border carbon adjustments on imports originating from countries that do not contribute as much to combating climate change as they could. These initiatives sought to induce the major developing economies to assume international commitments to reduce their greenhouse gas emissions, which was not the case under the Kyoto Protocol to the United Nations Framework Convention on Climate Change (Herreros, 2010).

The COVID-19 pandemic also revealed the shortcomings of international governance and the high cost of weakening multilateralism. The globalization of problems (economic crises, pandemics, global warming, irregular and unsafe migrations) requires inclusive, horizontal and effective multilateralism. There is growing evidence that there are no national or unilateral solutions to phenomena on this scale: solutions that are not multilateral will be no solution at all.

Latin America and the Caribbean must participate actively in discussions on the new international governance, as well as its design and the institutions comprising it, in order to promote the region's initiatives and defend its interests and aspirations in a framework of renewed international cooperation. To this end, it is essential to relaunch and substantially strengthen the processes of regional integration and the related institutional framework. Otherwise, it will be very difficult for the region to participate meaningfully in the incipient debate on a new global accord and global governance for the twenty-first century.

D. Public policies and social-consensus-building: the role of the State

State leadership towards a more sustainable development pattern does not mean a return to a State-led development model, but instead a more proactive and dynamic State as a factor of development. The big push for sustainability requires creativity and the expediting of technological and institutional innovation. Economic history shows the important role played by the private and social sectors in developing viable solutions to a wide range of problems, sometimes with substantial government support. The conventional debate tends to pit the State against the market and to generate stereotypes that oppose picking winners. The big push for sustainability provides an opportunity to build a new style of development based on a new equation between the State, market, society and the environment, which is, in essence, the key aspiration of the 2030 Agenda for Sustainable Development.

At present, government and private policies are not up to the task. The art of policymaking for progressive structural change consists in agreeing on the general direction of the desired social change, and then providing incentives to the private sector and the social and solidarity-based economy sector through stimuli and regulation to steer relative returns. It can be built upon private sector exploratory processes aimed at achieving efficiency and effectiveness, while recognizing the primacy of politics over economics and the public interest over the private. This should occur in the framework of societies in which most energy is obtained from renewable sources, thereby affording greater energy autonomy; the bioeconomy combines food security with nature-based solutions; cities have electrified public transport, and buildings are increasingly eco-efficient; high-quality digital connectivity is universal; the circular economy is a reality; tourism is becoming more sustainable; access to education, health and social protection is universal and decommercialized; and the population enjoys a guaranteed income.

Uncertainty is running high and so are the chances of error. Hence the importance of rationality, transparency, and both systematic and continuous learning about policies and corrective options. However, the greatest risk lies in a failure to act in the face of the potential environmental and social catastrophe predicted by climate scenarios and growing health risks.

At the same time, the transition towards sustainability provides opportunities and benefits in employment, competitiveness, ecosystem restoration, better health and access to safe energy. The change process can generate virtuous circles between new digital technologies, global knowledge networks, environmentally-aware consumers, and new technological options. In turn, scientific progress and successful ongoing changes can help build better options for sustainable development. Understanding this co-evolution is the basis for expediting the change towards sustainability. Be this as it may, the means for bringing about a change in the development pattern are specific and historically given, and require a high level of contextualization.

The big push for sustainability requires a basic level of social acceptance. Although the development of new industries, such as non-conventional renewable energy, has huge economic and political potential, top-down development, as seen in the Republic of Korea in the last century, is likely to rapidly encounter its

limits (Kim, 2010). Social acceptance for a major push to move the development pattern towards sustainability is critical to achieving distributional impacts, especially between declining "brown" industries and emerging greener ones. The same applies to the relationship between social groups that benefit in the process and those that lose out.

Although the debate on growth, inequality and environmental damage has been ongoing for decades, the debate on synergies and dilemmas between low-environmental-footprint development and social equality is more recent. There has not yet been sufficient empirical analysis of the relationships between the social and environmental pillars of sustainable development. Equality and sustainability can only be placed at the centre of the development pattern if social compacts are constructed to make this possible, because development is ultimately a political issue. The new social contract needed at the current crossroads requires the construction of far-reaching political agreements and consensuses, attuned to a new political economy of development and a different equation between State, market, society, and environment.

Politics must be restored as an instrument of change, as a mechanism to deliberate, dissent and agree, and to generate public goods and lasting compacts. A new social contract and a sustainable, egalitarian and equalling type of development will be viable and lasting if societies build the compacts that make them possible. Since 2014, with the publication of *Compacts for Equality: Towards a Sustainable Future,* ECLAC has highlighted the need for basic compacts that provide the backbone of a renewed perspective on development.[25] In the context of the pandemic and its effects, ECLAC reiterates the relevance and urgency of this proposal. For governments, there should be no dilemma, but rather synergy between explicit environmental policies, which tend to be reactive and have high associated costs, and industrial policies for sustainable development. This synergy could lead to more orderly processes with better prospects for improving quality of life for all.

The change in the development pattern resulting from the combination of enabling, cross-cutting, and sectoral policies proposed in this document may, in the medium term, enhance the relative importance of sectors that are pillars of the big push for sustainability. This would make it possible, by 2030, to achieve a sustained path towards closing external, environmental and social gaps; transform, densify and democratize the production fabric, gearing it towards knowledge- and innovation-intensive activities; reduce structural heterogeneity and deprimarize the economy; and guarantee decent work, eliminate poverty, and build egalitarian societies among social groups and between women and men, with the highest possible levels of well-being and free from discrimination.

Achieving all this requires a political and social compact based on a vigorous State with participation by all stakeholders, progressive taxation and a coordinated effort of public, private and social investment in an international context with fewer climate change and global financial architecture asymmetries. The means by which social compacts will be built and adopted will depend on each country's institutional culture, and on the values and practices that have guided and given meaning to the work of its citizens. Compacts should lay the foundations for constructing a welfare state which, among other objectives, ensures redistributive taxation, increased productivity, better provision of public goods and services, sustainable management of natural resources, and increased and more diversified investment. Compacts must have political leadership to convene the most wide-ranging and diverse participation of social actors —usually expressed through voting and participation in political and social organizations— while at the same time committing the effective action of democratic institutions, the government and parliaments. Achieving broad representation and social legitimacy will oblige actors to fulfil what has been agreed upon, facilitating subsequent coexistence, as well as the resolution of redistributive conflicts that will inevitably arise in the future. Ideally, broad social and political coalitions should coalesce around these social agreements. Young people, in particular, will need to play an important role, calling conventional wisdom into question and placing their demand for intergenerational justice, among other issues, on the table.

This is the type of society that epochal change demands and which, if coalitions are built and the necessary compacts are forged, is more than ever within reach. Responding to the civilizational crossroads in which the region finds itself is a shared and urgent task.

[25] Seven specific compacts were proposed in that document, namely: a fiscal compact for equality; a compact for investment, industrial policy and inclusive financing; a compact for equality in employment; a compact for social welfare and public services; a compact for environmental sustainability; a compact for natural resource governance; and a compact among the international community for development and cooperation beyond 2015 (ECLAC, 2014).

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This document argues that Latin America and the Caribbean is in a position to move towards a "big push for sustainability" through a combination of economic, industrial, social and environmental policies capable of driving a recovery with equality and sustainability and relaunching development in the region.

The document has five chapters. The first studies the three crises (slow growth, growing inequality and the environmental emergency) affecting economies and societies around the world and those of Latin America and the Caribbean. The second presents a framework for analysing these crises in an integrated manner and measuring their magnitude in the region. The third chapter examines the quantitative impacts on growth, emissions, income distribution and the external sector under different policy scenarios, highlighting the potential of various policy combinations to forge a more dynamic growth path, with lower emissions and greater equality. The fourth identifies seven sectors that can drive sustainable development and proposes policies to foster these sectors. The fifth chapter concludes with an analysis that links up macroeconomic, industrial, social and environmental policies and the role of the State in building consensus for their implementation.

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